CITY AND COUNTY OF DENVER

STATE OF COLORADO

DENVER®
THE MILE HIGH CITY

DEPARTMENT OF PUBLIC WORKS / ENGINEERING DIVISION

BID DOCUMENTS PACKAGE

Contract No. 201204517

WEST DENVER LIBRARY

February 1, 2012

DENVER
THE MILE HIGH CITY

Department of Public Works
Engineering Division

Capital Projects Management – Dept. 506
Right-of-Way Services – Dept. 507
Policy and Planning – Dept. Dept. 509
Traffic Engineering Services – Dept. 508

201 West Colfax Avenue
Denver, CO 80202
www.Work4Denver.com

NOTICE OF APPARENT LOW BIDDER

Ash & White Construction Co.
18 S. Wilcox St., Ste. 100
Castle Rock, CO 80104

The MANAGER OF PUBLIC WORKS has considered the Bids submitted on **March 1, 2012** for work to be done and materials to be furnished in and for:

CONTRACT NO 201204517 WEST DENVER LIBRARY

as set forth in detail in the Contract Documents for the City and County of Denver, Colorado. It appears that your Bid is fair, equitable, and to the best interest of the City and County; therefore, said Bid is hereby accepted at the bid price contained herein, subject to the approval and execution of the Contract Documents by the City in accordance with the Charter of the City and County of Denver, and to your furnishing the items specified below. The award is based on **Lump Sum Bid Amount plus Add Alternates No. 1, No. 2, No. 3a, No. 3b, No. 4 and No. 5**, the total estimated cost thereof being: **Five Million Six Hundred Fifty-Six Thousand Dollars and No Cents ($5,656,000.00).**

It will be necessary for you to appear forthwith at the office of the Department of Public Works, Contract Administration, 201 W. Colfax Ave., Dept 614, Denver, Colorado 80202, to receive the said Contract Documents, execute the same and return them to the Department of Public Works, Contract Administration within the time limit set forth in the Bid Proposal.

In accordance with the requirements set forth in the Contract Documents, you are required to furnish the following documents:

a. Insurance Certificates: General Liability and Automotive Liability, Workman's Compensation and Employer Liability;
b. One original plus two copies of the Power of Attorney relative to Performance and/or Payment Bond; and,

All construction Contracts made and entered into by the City and County of Denver are subject to Affirmative Action and Equal Opportunity Rules and Regulations, as adopted by the Manager of Public Works, and each contract requiring payment by the City of one-half million dollars ($500,000.00) or more shall first be approved by the City Council acting by ordinance and in accordance with Section B1.12.2 of the Charter of the City and County of Denver.

Prior to issuance of Notice to Proceed, all Equal Opportunity requirements must be completed. Additional information may be obtained by contacting the Director of Contract Compliance at (720-913-1700).

The Bid Security submitted with your Bid, will be returned upon execution of the Contract and furnishing of the Performance Bond. In the event you should fail to execute the Contract and to furnish the performance Bond within the time limit specified, said Bid Security will be retained by the City and County of Denver as liquidated damages, and not as a penalty for the delay and extra work caused thereby.

Dated at Denver, Colorado this 12th day of June 2012.

CITY AND COUNTY OF DENVER

By _____

Jose M. Cornejo, P.E.
Manager of Public Works

GD/tmg

cc: J. Valdez (CAO), Gallagher (AUD), Schellinger (Treasury/Tax Compliance), DSBO Inbox, M. Sheehan, Quentin Rockwell, Merritt (PW-Aud), File.

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
Engineering Division

BID FORM AND SUBMITTAL PACKAGE ACKNOWLEDGMENT

CONTRACT NO. 201204517

WEST DENVER LIBRARY

BIDDER: Ash & White Construction Co., d.b.a. White Construction Group, Ltd.

ADDRESS: 18 S Wilcox St., Ste. 100
PO Box 97
Castle Rock, CO 80104

The undersigned bidder states that the undersigned bidder has received and had an opportunity to fully and thoroughly examine a complete set of the Contract Documents for **Contract No. 201204517, WEST DENVER LIBRARY,** made available to the undersigned bidder pursuant to Notice of Invitation for Bids dated February 1, 2012.

The undersigned bidder acknowledges that a complete and final set of the Contract Documents for the referenced Project, the components of which are identified below, are bound and maintained as the record set of Contract Documents by the Contract Administration Division of the Department of Public Works and that this Record Set is available for examination by the undersigned bidder.

The undersigned bidder, having thoroughly examined each of the components identified below and contained in Contract Documents, HEREBY SUBMITS THIS BID FORM AND SUBMITTAL PACKAGE, fully understanding that the Contract Documents, as defined in Paragraph 1 of the contract, including this executed Bid Form and Submittal Package, constitute all of the terms, conditions and requirements upon which this submission is based and further understanding that, by submission of this Bid Form and Submittal Package, the City shall rely on the representations and commitments of the undersigned bidder contained herein.

The following completed documents comprising this Bid Form and Submittal Package will be included with and, by this reference, are expressly incorporated into the Contract Documents specified at Paragraph 1 of the Contract:

- Bid Form and Submittal Package Acknowledgment Form
- Bid Form
- List of Proposed Minority/Woman Owned Business Enterprise(s)
- Commitment to Minority/Woman Owned Business Enterprise Participation
- Minority/Woman Owned Business Enterprise(s) of Intent
- Joint Venture Affidavit (if applicable)
- Joint Venture Eligibility Form (if applicable)
- Bid Bond
- Bidder / Contractor / Vendor / Proposer Disclosure Form
- Certificate of Insurance

The following designated documents constitute that portion of the Contract Documents made available by the Notice of Invitation for Bids, but not included in the Bid Form and Submittal Package:

Notice of Invitation for Bids
Instructions to Bidders
Addenda (as applicable)
Equal Employment Opportunity Provisions (Appendix A and Appendix F)
Contract Form
General Contract Conditions
Special Contract Conditions
Performance and Payment Bond
Notice to Apparent Low Bidder
Notice to Proceed
Contractor's Certification of Payment Form
Final/Partial Lien Release Form
Final Receipt
Change Orders (as applicable)
Federal Requirements (as applicable)
Prevailing Wage Rate Schedule(s)
Technical Specifications
Contract Drawings
Accepted Shop Drawings

The undersigned bidder expressly assumes responsibility for the complete contents of these designated documents as bound together with the Bid Form and Submittal Package submitted herewith and designated the Contract Documents.

IN WITNESS WHEREOF, the undersigned bidder has signed personally or by duly authorized officer or agent and duly attested.

BIDDER: Ash & White Construction Co.,
Name: dba White Construction Group, Ltd.
By: Douglas E. Decker
Title: Vice President

ATTEST:
By:
[SEAL]

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
Engineering Division

BID FORM

CONTRACT NO. 201204517
WEST DENVER LIBRARY

BIDDER Ash & White Construction Group,
dba White Construction Group, Ltd.

TO: The Manager of Public Works
City and County of Denver
c/o Contract Administration
201 West Colfax, Dept. 614
Denver, Colorado 80202

The Undersigned Bidder, having examined the plans, technical specifications, and remainder of the proposed Contract Documents as designated and enumerated in the General and Special Contract Conditions and any and all addenda thereto; having investigated the location of and conditions affecting the proposed Work; and being acquainted with and fully understanding the extent and character of the Work covered by this bid, and all factors and conditions affecting or which may be affected by Work, HEREBY SUBMITS THIS BID, pursuant to an advertisement of a Notice of Invitation for Bids as published on **February 1, 2012**, to furnish all required materials, tools, appliances, equipment and plant; to perform all necessary labor and to undertake and complete: **CONTRACT NO. 201204517, WEST DENVER LIBRARY,** in Denver, Colorado, in full accordance with and conformity to the Plans, Technical Specifications, and Contract Documents hereto attached or by reference made a part hereof, at and for the following price(s) set forth on this Bid Form.

The following documents, which taken as a whole constitute the Contract Documents for this Project, and which are incorporated herein, by reference, were made available to the Bidder as provided in the Advertisement of Notice of Invitation for Bids, were received by the bidder, and form the basis for this bid:

Advertisement of Notice of Invitation for Bids
Instructions to Bidders
Commitment to M/WBE Participation
Article III, Divisions 1 and 3 of Chapter 28, D.R.M.C.
Bid Bond
Addenda (as applicable)
Equal Employment Opportunity Provisions (Appendix A and Appendix F)
Bid Form
Contract Form
General Contract Conditions
Special Contract Conditions
Performance and Payment Bond
Notice to Apparent Low Bidder
Notice to Proceed
Contractor's Certification of Payment Form
Final/Partial Lien Release Form
Final Receipt
Change Orders (as applicable)
Federal Requirements (as applicable)
Prevailing Wage Rate Schedule(s)
Technical Specifications
Contract Drawing
Accepted Shop Drawings
Certificate of Insurance

Unit Price Disclosure

Please provide unit pricing in accordance with Specification 012200 and Drawings and include these amounts in the Total Lump Sum Bid Amount:

Provide Optic Window Assembly and Roller Shades.

a. **Provide a unit price of (1) Optic Window Assembly:** Two Thousand **Dollars ($** 2,000 **)**

b. **Provide a unit price of (1) Electrically Powered, Blackout Roller shade individually controlled.** Two thousand Five hundred **Dollars ($** 2500.00 **)**

Total Lump Sum Bid Amount of: Five Million, Five hundred Seventy Eight Thousand Dollars **Dollars ($** 5,578,000.00 **)**

Prioritized Add Alternates (Specification Section 012300):

Alternate No. 1: Full dimming with lighting control panels Ten Thousand Four hundred **Dollars ($** 10,400 **)**

Alternate No. 2: Higher quality glazing Five hundred dollars **Dollars ($** 500.00 **)**

Alternate No. 3a: Snowmelt system – East Side Thirty two thousand Twenty Seven Thousand **Dollars ($** 27,000 **)**

Alternate No. 3b: Snowmelt system – Northwest Corner Ten Thousand **Dollars ($** 10,000 **)**

Alternate No. 4: Add twelve (12) more Solatubes Twenty Six thousand **Dollars ($** 26,000.00 **)**

Alternate No. 5: Hold Area Lighting Four thousand One hundred **Dollars ($** 4,100.00 **)**

Alternate No. 6: Windows in Children's area Three Thousand **Dollars ($** 3,000.00 **)**

Alternate No. 7: Acoustical treatments in the "Studio" two thousand Four hundred **Dollars ($** 2,400.00 **)**

If the Manager mails a written Notice of Apparent Low Bidder, addressed to the Bidder's business address stated on this Bid Form, the Undersigned Bidder shall, in accordance with the Contract Documents, be ready to, and shall, within five (5) days after the date of the Notice: (i) execute the attached form of Contract in conformity with this bid; (ii) furnish the required proofs of insurance; and (iii) furnish the required bond or bonds in the sum of the full amount of this bid, executed by a surety company acceptable to the Manager.

The Arch Insurance Co, a corporation of the State of Missouri, is hereby offered as Surety on said bond. If such surety is not approved by the Manager, another and satisfactory surety company shall be furnished.

Enclosed with this bid is a bid guarantee, as defined in the attached Instructions to Bidders, in the amount of 5%. The Undersigned Bidder agrees that the entire amount of this bid guarantee is to be paid to and become the property of the City as liquidated damages, and not as a penalty, if: (i) the bid is considered to be the best by the City; (ii) the City notifies the Undersigned Bidder that it is the Apparent Low Bidder; and (iii) the Undersigned Bidder fails to execute the Contract in the form prescribed or to furnish the required bond and proofs of insurance, within five (5) days after the date of such notification.

The following persons, firms or corporations are interested with the Undersigned Bidder in this bid:

Name: _____ Name: _____

Address: _____ Address: _____

If there are no such persons, firms, or corporations, please so state in the following space: None

The Undersigned Bidder proposes to subcontract the following Work in accordance with General Contract Conditions, Title 5, SUBCONTRACTS, and represents that, to the greatest degree practical, all subcontractors known at the time of bid submittal have been identified.

Item of Work	Percent (%) of Total; Work	Proposed Subcontractor and Address
Earthwork	1.7	Lighting Ventures Denver, Co Larkspur
Concrete	4.18	Plaza Construction Denver, Co
Storefront & Glazing	4.117	Colorado Window Systems Denver, Co
Structural Steel	13.113	Steel Star
Millwork	1.2	JK Concepts
Roofing	1.9	Douglas Colony
Gypsum Board	5.72	Rock one Drywall
Electrical	7.235	Crest View
Mechanical	19.541	N M Industrial

(Copy this page if additional room is required.)

DENVER
THE MILE HIGH CITY

List of Proposed MWBE or DBE Bidders, Subcontractors, Suppliers (Manufacturers) or Brokers

Office of Economic Development
Division of Small Business Opportunity
Compliance Unit
201 West Colfax Avenue, Dept. 907
Denver, CO 80202
Phone: 720-913-1999
Fax: 720-913-1803
DSBO@denvergov.org

City and County of Denver Contract No. 201204517

The undersigned Bidder proposes to utilize the following MWBE or DBE for the project. All listed firms are **CURRENTLY** certified by the City and County of Denver. Only the level of MWBE or DBE participation listed at the bid opening will count toward satisfaction of the project goal. Only bona fide commisions may be counted for Brokers. MWBE or DBE prime bidders must detail their bid information below. Please copy and attaach this page to list additional MWBE or DBE. Ashe White Construction Co., dba White Construction Group, Ltd.

Address: PO Box 97, Castle Rock, CO 80104	Contact Person: Doug Decker	
Type of Service:	Dollar Amount: $:	Percent of Project:

MWBE or DBE Prime Bidder

Business Name: Plaza		
Address:	Contact Person:	
Type of Service:	Dollar Amount: $:	Percent of Project:

Subcontractors, Suppliers Manufacturers or Brokers (check one box)

[X] Subcontractor (√)	[ ] Supplier (√)	[ ] Manufacturer (√)	[ ] Broker (√)
Business Name: Plaza Construction Inc			
Address: 845 Dicatur St.	Type of Service: Concrete		
Contact Person: Juan Alvariz	Dollar Amount: $: $233,157.00	Percent of Project: 14.180	

[√] Subcontractor (√)	[ ] Supplier (√)	[ ] Manufacturer (√)	[ ] Broker (√)
Business Name: Colorado Window Systems			
Address: 1065 E. 58th	Type of Service: Storefront Entrances.		
Contact Person: Heidi Skinner	Dollar Amount: $: $232,431.00	Percent of Project: 14.137	

[ ] Subcontractor (√)	[ ] Supplier (√)	[ ] Manufacturer (√)	[ ] Broker (√)
Business Name: American Industrial Services			
Address: 975. E. 58th Denver	Type of Service: Elec. Supplies		
Contact Person: Veronica Ledvex	Dollar Amount: $: 47,000	Percent of Project: 2.144	

Subcontractors, Suppliers Manufacturers or Brokers (check one box)			
X Subcontractor (√)	Supplier (√)	Manufacturer (√)	Broker (√)
Business Name: Linkmont Technologies			
Address: 550 W. 53rd Pl.		Type of Service: Telecom	
Contact Person: Sergio Gutierrez		Dollar Amount: $: $81,000	Percent of Project: 1.58
X Subcontractor (√)	Supplier (√)	Manufacturer (√)	Broker (√)
Business Name: NM Industrial			
Address: 1004 W. 42nd Ave		Type of Service: Mech/Plumbing	
Contact Person: Nathen Martinez		Dollar Amount: $: $ 1,090,000	Percent of Project: 19.51
Subcontractor (√)	Supplier (√)	Manufacturer (√)	Broker (√)
Business Name:			
Address:		Type of Service:	
Contact Person:		Dollar Amount: $:	Percent of Project:
Subcontractor (√)	Supplier (√)	Manufacturer (√)	Broker (√)
Business Name:			
Address:		Type of Service:	
Contact Person:		Dollar Amount: $:	Percent of Project:
Subcontractor (√)	Supplier (√)	Manufacturer (√)	Broker (√)
Business Name:			
Address:		Type of Service:	
Contact Person:		Dollar Amount: $:	Percent of Project:
Subcontractor (√)	Supplier (√)	Manufacturer (√)	Broker (√)
Business Name:			
Address:		Type of Service:	
Contact Person:		Dollar Amount: $:	Percent of Project:
Subcontractor (√)	Supplier (√)	Manufacturer (√)	Broker (√)
Business Name:			
Address:		Type of Service:	
Contact Person:		Dollar Amount: $:	Percent of Project:

Bid Form & Submittal Package, Participation Page 1/07-dm

The undersigned Bidder hereby certifies that the aforementioned subcontractors and suppliers have full knowledge that their names have been offered as subcontractors and suppliers for the work, and the Bidder further certifies that the dollar amount of work to be performed by the aforementioned M/WBE(s) was furnished to the Bidder prior to the bid opening. The undersigned Bidder agrees that after the bid opening, it shall submit to the City an executed and completed W/MBE "Letter of Intent" in three working days (3) on each of its M/WBE subcontractors. The "Letter of Intent" form is contained in the Contract Documents.

The undersigned Bidder acknowledges the right of the City to reject any or all bids submitted, to waive informalities in bids and to re-advertise this Project for bids.

The undersigned certifies that it has carefully checked all works and figures and all statements made in these Bid Forms.

This bid is submitted upon the declaration that neither, I (we), nor, to the best of my (our) knowledge, none of the members of my (our) firm or company have either directly or indirectly entered into any agreement, participated in any collusion or otherwise taken any action in restraint of free competitive bidding in connection with this bid.

Business Address of Bidder: PO Box 97

City, State, Zip Code: Castle Rock, CO 80104

Telephone Number of Bidder: 303.688.6924 Fax No. 303.688.6265

Social Security or Federal Employer ID Number of Bidder: 84-0991003

Name and location of the last work of this kind herein contemplated upon which the Bidder was engaged:
Anythink Commerce City Library

For information relative thereto, please refer to:

Name: Wember INC., Justin Sager

Title: Owners Rep 720.384.8733

Address: 7525 S. Jasmine Ct., Centennial, CO 80112

The undersigned acknowledges receipt, understanding, and full consideration of the following addenda to the Contract Documents:

Addenda Number 1 Date 2.16.2012

Addenda Number 2 Date 2.23.2012

Addenda Number _____ Date _____

Dated this 1st day of March, 2012.

Signature of Bidder:

If an Individual: _____ doing business as _____.

If a Partnership: _____

by: _____ General Partner.

If a Corporation: Ash & White Construction Co., dba White Construction Group, Ltd

a Colorado Corporation,

by: _____, its Vice President.
Douglas E. Decker

Attest:

Secretary (Corporate Seal)
Courtney A. White

If a Joint Venture, signature of all Joint Venture participants.

Firm: _____

Corporation ( ), Partnership ( ) or ( ) Limited Liability Company

By: _____ (If a Corporation) Attest:

Title: _____ Secretary (Corporate Seal)

Firm: _____

Corporation ( ), Partnership ( ) or ( ) Limited Liability Company

By: _____ (If a Corporation) Attest:

Title: _____ Secretary (Corporate Seal)

Firm: _____

Corporation ( ), Partnership ( ) or ( ) Limited Liability Company

By: _____ (If a Corporation) Attest:

Title: _____ Secretary (Corporate Seal)

DENVER
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COMMITMENT TO MWBE OR SBE PARTICIPATION

Office of Economic Development
Division of Small Business Opportunity
Compliance Unit
201 West Colfax Avenue, Dept. 907
Denver, CO 80202
Phone: 720-913-1999
Fax: 720-913-1803
DSBO@denvergov.org

The undersigned has satisfied the MWBE or SBE participant requirements in the following manner (Please check the appropriate box):

☑ The Bidder/Proposer is committed to a minimum of 30 % **MWBE or SBE** utilization on the project, and will submit Letters of Intent (LOI) for each subcontractor/subconsultant listed in the Bid Forms as follows:
Hard Bids: Three (3) business days after the bid opening
Request for Proposals: With the proposal when due

☐ The Bidder/Proposer is unable to meet the project goal of _____% **MWBE or SBE**, but is committed to a minimum of _____% **MWBE or SBE** utilization on the project. The Bidder/Proposer understands that they must submit a detailed statement of their good faith effort in accordance with DRMC Section 28-62 and 28-67 of Ordinance 760 and must submit Letters of Intent for each **MWBE or SBE** listed in the Bid Forms, within three (3) business days after the bid opening or at time proposal is submitted.

☐ The Bidder/Proposer is a certified **MWBE or SBE** in good standing with the City and is committed to self-perform a minimum of _____% of the work on the contract.

Bidder/Proposer (Name of Firm):	Ash & White Construction Co., dba' White Construction Group, Ltd.		
Firm's Representative (Please print):	Douglas E Decker		
Signature (Firm's Representative):			
Title:	Vice President		
Address:	PO Box 97		
City: Castle Rock		State: CO	Zip: 80104
Phone: 303.688.6924	Fax: 303.688.6265	Email:	ddecker@whitecg.com

A copy of the MWBE or SBE Certification must be attached.

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
DEPARTMENT OF PUBLIC WORK

CONTRACT NO. 201204517
PROJECT NAME: WEST DENVER LIBRARY

ADDENDUM NO. 1 TO CONTRACT DOCUMENTS

Bidders are hereby instructed that the drawings, specifications, and other contract documents are modified, corrected, supplemented and/or superseded for the above mentioned project as hereinafter described in the following attachments:

BID FORM AND SUBMITTAL PACKAGE

None

BID DOCUMENT PACKAGE

None

CLARIFICATIONS

The question deadline has been extended to Friday, February 17, 2012 due by or before 5:00 p.m., local time. Due to the upcoming City closures on Friday for furlough and in observance of the holiday on Monday please submit your questions to both the Project Manager, Quentin Rockwell @ qrockwell@wemberinc.com and Toni Green @ toni.green@denvergov.org.

Product substitutions will not be accepted prior to the Bid Opening on March 1, 2012. Any and all substitution requests will be evaluated and accepted and/or denied after the bid opening, and as per the process dictated by the contract documents.

QUESTIONS AND ANSWERS

1) QUESTION: The ITB states that this building is LEED Silver Certified. Does the GC need to be LEED certified?

   CITY RESPONSE: The City & County of Denver has required that this project be a minimum of LEED Silver Certified. There is no requirement that any of the contractors or their staff working on this project be LEED Accredited. The contractor should follow all LEED requirements and responsibilities as outlined in the plans and specifications in order to comply with the USGBC LEED process.

2) QUESTION: I do not see a hardware group for the following doors. Door #101C, #233 and #301. Any information on this hardware would be appreciated.

   CITY RESPONSE: Information forthcoming in Addendum 02

3) QUESTION: Will a fulltime/onsite Quality Control Manager be required and will the Daily QC reports per the specifications be required?

CITY RESPONSE: The contractor should designate an individual on their staff at the site as the person in charge of overall project quality and notify the City of who that person is. Daily QC reporting is not required per Spec Section 01400, Item C., however the contractor should maintain daily job reports, and will be asked to regularly provide them to the City for monitoring and record keeping purposes. Per the specifications, the contractor should submit their QC plan for the project within 20 working days of the Notice to Proceed for City review. Also, the project team should review quality issues on an on-going basis, and review the contractor's QC reports/logs at the weekly project meetings. The City expects the contractor to provide on-going quality control of the work at the site, and for the contractor to provide regular tracking of and reporting on issues involving quality of the work, and corrective actions that need to be taken if workmanship or constructability issues are identified by the project team.

4) QUESTION: Please confirm that 6 parking spots are required for the project manager/design team at the field office – from the pre-bid meeting conversation it sounds like this may be an issue. With this can the owner give us an ideal trailer location and potential temp power access?

   CITY RESPONSE: It is not required that the contractor provides the 6 parking spaces. Regarding the location of the contractor's trailer and temp power access, please refer to the plans and specifications regarding site layout and staging.

5) QUESTION: Please confirm night security lighting is desired.

   CITY RESPONSE: The contractor should determine the level of night security lighting at the site based on a review of the site and the surrounding area, as the contractor is responsible for controlling and maintaining the safety of the site.

6) QUESTION: Please confirm two telephones are required in the job site office. If so are mobile cell phones acceptable – along with this are WIFI required.

   CITY RESPONSE: The City expects the contractor will provide a fully operable site office that includes phone and internet connectivity, as well as sufficient areas for the project team to conduct meetings at the site throughout the duration of the project.

7) QUESTION: Please confirm what is expected for over excavation beneath the building SOG and foundations as well as site paving.

- The soils report recommends a three foot over excavation and replacement of natural soils with imported structural fill and a 4-6" layer of gravel below the slab. The earthwork specifications state that the soils report is not part of the contract documents and we have not found any other recommendations in the plans/specs for building prep.

  CITY RESPONSE: Refer to Civil drawing C-103 for subgrade elevations and Architectural Wall Sections for supplemental information

8) QUESTION: Please clarify whether or not the "Sub-fill drainage layer" w/PVC drainage system per item 10 on page 17 of the Geotech investigation is required.

CITY RESPONSE: Refer to Civil drawing C-103 and Architectural Wall Sections, note "Perimeter Drain, RE, Civil for Elevations".

9) QUESTION: The soils report suggests to over excavate, moisture treat and compact to a depth of 1 foot below pavements. The specifications state 8". Please confirm what depth will be required under all site pavements.

CITY RESPONSE: Geotechnical report is not part of the construction documents, it is provided for information only. Eight inches is required as specified.

10) QUESTION: Please confirm that the paving of the four parking spaces on the south side of the building are in this contract.

CITY RESPONSE: Yes, all paving at the four parking spaces at the south side of the Library are a part of this contract, along with the curb and gutter at the locations noted on the plans.

11) QUESTION: Is the parking lot to the East of the library part of our construction scope? This is displayed differently on a few of the pages, with one showing the limits of construction dividing the parking lot in half.

CITY RESPONSE: The parking lot to the east of the Library is not a part of this scope. However, installation of the curb and gutter east of the Library will require asphalt patching and restriping at the saw cut areas to provide curb and gutter as indicated on C-101 that is part of the Work to be included in the scope. Work related to irrigation, landscaping, and lighting in the east parking lot is defined on AS001.

12) QUESTION: Section 08800. This spec is not clear. It states 50% coverage and then says 60% coverage. It can't be both. The performances are different and we can't figure them out with the information provided. Also, we are unsure what the S-54 is."

CITY RESPONSE: Refer to Addendum 1 narrative for revisions to Specification Section 08800.

13) QUESTION: As I read through the specs it mentions that the contractor will be required to have it owns quality control. Will the city be handling all of the testing or will there be a QC and QA component to the project?

CITY RESPONSE: Regarding contractor responsibilities for QC and QA, please refer to Spec Section 01400 and 01402. Regarding material testing, the City and County of Denver will contract with an independent materials testing firm for these services. The City expects that the GC will actively coordinate with the project team and the City's materials testing firm regarding the schedule of tests that need to take place.

SPECIFICATIONS / DRAWINGS

A. 081113 CUSTOM HOLLOW METAL DOORS AND FRAMES

1. 1.04, E. 1 **REVISE** to "Not Used"
2. 1.04 E **ADD** item 3 and 4 as listed below:

"3. Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation). "

"4. Include information on Material Tracking Worksheets."

3. 1.04, E1: **DELETE** "Regional Materials (MRc5)"
   a. Submit product data or other published information verifying the location of manufacturing facility including name, address, and distance between manufacturing facility and the project site. Provide manufacturer's documentation indicating location where the base materials were extracted, mined, quarried, harvested, etc. and the distance between this location and the project site. Also include material costs (excluding costs of installation).
   b. Include information on Material Tracking Worksheets.
4. 2.01, A, 1 **REVISE** to "Not Used"
5. **ADD** items 1 and 2 as listed below to the following sections:
   a. 2.03, A
   b. 2.03, B
   c. 2.03, C

"1. Building materials in this section must have post- and/or pre-consumer recycled content by weight of total product."

"2. Minimum 50% recycled content total."

B. 084113 ALUMINUM –FRAMED ENTRANCES AND STOREFRONTS

1. **ADD** Paragraph 2.1.B as follows:

   B. Optical Window Assembly System Basis-of-Design Product: Subject to compliance with requirements, provide "Encore" 3-9/16" system by Kawneer North America; an Alcoa company, or comparable product by one of the following:
      i. Arcadia, Inc.
      ii. EFCO Corporation.
      iii. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.
      iv. YKK AP America Inc.

C. 086300 METAL-FRAMED SKYLIGHTS
1. **ADD** New Section, attached.

D. 088000 GLAZING
1. **REVISE** Article 2.9 to read as follows:

2.9 GLASS TYPES

A. Glass Type A: Gray-tinted low E insulating glass.
   1. Overall Unit Thickness: 1 inch.
   2. Thickness of Each Glass Lite: 6.0 mm.
   3. Outdoor Lite: Gray-tinted float glass.
      a. Basis of Design Product: VE3-2M by Viracon.
         1) Low E Coating: Sputtered on second surface.
   4. Interspace Content: Air.
   5. Indoor Lite: Clear float glass.
   6. Winter Nighttime U-Factor: 0.29 maximum.
   7. Summer Daytime U-Factor: 0.26 maximum.
   8. Visible Light Transmittance: 35 percent minimum.
   9. Solar Heat Gain Coefficient: 0.24 maximum.
   10. Provide labeled safety glazing at "Hazardous Locations" as outlined in Chapter 24 of the International Building Code and as indicated on Drawings.

B. Glass Type B: Clear low E insulating glass.
   1. Overall Unit Thickness: 1 inch.
   2. Thickness of Each Glass Lite: 6.0 mm.
   3. Outdoor Lite: Clear float glass.
      a. Basis of Design Product: VUE1-40 by Viracon.
         1) Low E Coating: Sputtered on second surface.
   4. Interspace Content: Air.
   5. Indoor Lite: Clear float glass.
   6. Winter Nighttime U-Factor: 0.29 maximum.
   7. Summer Daytime U-Factor: 0.26 maximum.
   8. Visible Light Transmittance: 40 percent minimum.
   9. Solar Heat Gain Coefficient: 0.22 maximum.
   10. Provide labeled safety glazing at "Hazardous Locations" as outlined in Chapter 24 of the International Building Code and as indicated on Drawings.

C. Glass Type C: Clear low E insulating glass.
   1. Overall Unit Thickness: 1 inch.
   2. Thickness of Each Glass Lite: 6.0 mm.
   3. Outdoor Lite: Clear: float glass.
      a. Basis of Design Product: VE1-2M by Viracon.
         1) Low E Coating: Sputtered on second surface.
   4. Interspace Content: Air.
   5. Indoor Lite: Clear float glass.
   6. Winter Nighttime U-Factor: 0.29 maximum.
   7. Summer Daytime U-Factor: 0.26 maximum.
   8. Visible Light Transmittance: 70 percent minimum.
   9. Solar Heat Gain Coefficient: 0.38 maximum.
   10. Provide labeled safety glazing at "Hazardous Locations" as outlined in Chapter 24 of the International Building Code and as indicated on Drawings.

D. Glass Type D: Translucent clear low E insulating glass.
   1. Overall Unit Thickness: 1 inch.
   2. Thickness of Each Glass Lite: 6.0 mm.
   3. Outdoor Lite: Clear float glass.
      a. Basis of Design Product: VE1-2M by Viracon.
         1) Low E Coating: Sputtered on second surface.

4. Interspace Content: Air.
5. Indoor Lite: Clear float glass.
   a. Basis of Design Product: V1086 by Viracon.
      1) Silk-Screen Coating: #3058 on third surface.
         a) Color: Subdued Gray.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.26 maximum.
8. Visible Light Transmittance: 44 percent minimum.
9. Solar Heat Gain Coefficient: 0.34 maximum.
10. Provide labeled safety glazing at "Hazardous Locations" as outlined in Chapter 24 of the International Building Code and as indicated on Drawings.

E. Glass Type E: Clear low E insulating glass (Additive Alternate No. 2).
1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Clear float glass.
   a. Basis of Design Product: VE1-2M by Viracon.
      1) Low E Coating: Sputtered on second surface.
4. Interspace Content: Air.
5. Indoor Lite: Clear float glass.
   a. Low E Coating: Pyrolytic on fourth surface.
6. Winter Nighttime U-Factor: 0.23 maximum.
7. Summer Daytime U-Factor: 0.20 maximum.
8. Visible Light Transmittance: 65 percent minimum.
9. Solar Heat Gain Coefficient: 0.36 maximum.
10. Provide labeled safety glazing at "Hazardous Locations" as outlined in Chapter 24 of the International Building Code and as indicated on Drawings.

F. Glass Type F: As specified in Division 05 Section "Architectural Railings."

G. Glass Type G: Clear low E insulating glass.
1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Clear float glass.
   a. Basis of Design Product: VNE1-63 by Viracon.
      1) Low E Coating: Sputtered on second surface.
4. Interspace Content: Air.
5. Indoor Lite: Clear float glass.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.26 maximum.
8. Visible Light Transmittance: 62 percent minimum.
9. Solar Heat Gain Coefficient: 0.29 maximum.
10. Provide labeled safety glazing at "Hazardous Locations" as outlined in Chapter 24 of the International Building Code and as indicated on Drawings.

H. Glass Type H: Tinted, silk-screen low E insulating skylight glass.
1. Overall Unit Thickness: 1 3/16 inches.
2. Outdoor Lite: Tinted float glass.
   a. Thickness: 6.0 mm.
   b. Basis of Design Product: VUE3-40 by Viracon.
      1) Low E Coating: Sputtered on second surface.
3. Interspace Content: Air.
4. Indoor Lite: Clear laminated float glass.

a. Outer Layer: 5.0 mm clear float glass.
b. Interlayer Thickness: 0.060.
c. Inner Layer: 5.0 mm clear float glass.
d. Silk-Screen Coating: #5023 on third surface.
1) Color: Subdued Gray.

I. Glass Type 1: Monolithic clear float glass.
1. Thickness: 6.0 mm.
2. Provide labeled safety glazing at "Hazardous Locations" as outlined in Chapter 24 of the International Building Code and as indicated on Drawings.

J. Glass Type 2: Clear insulating glass.
1. Overall Unit Thickness: 1 1/16 inch.
2. Outdoor Lite: Clear float glass.
a. Thickness: 8.0 mm.
3. Interspace Content: Air.
4. Indoor Lite: Clear float glass.
a. Thickness: 6.0 mm.
5. Provide labeled safety glazing at "Hazardous Locations" as outlined in Chapter 24 of the International Building Code and as indicated on Drawings.

2. **ADD** Article 2.10 as follows:

2.10 INSULATED INFILL PANELS

3. Insulated Infill Panels: Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.
a. Overall Panel Thickness: 1 inch.
b. Exterior Skin: Aluminum.
c. Thickness: Manufacturer's standard for finish and texture indicated.
d. Finish: Matching framing system.
e. Texture: Smooth.
f. Backing Sheet: 0.125-inch- thick, corrugated, high-density polyethylene.
g. Color : to be selected by Architect from Manufacturer's full range of standard options.
c. Interior Skin: Aluminum.
c. Thickness: Manufacturer's standard for finish and texture indicated.
d. Finish: Matching framing system.
e. Texture: Smooth.
f. Backing Sheet: 0.125-inch- thick, corrugated, high-density polyethylene.
g. Color : to be selected by Architect from Manufacturer's full range of standard options.
d. Thermal Insulation Core: Manufacturer's standard rigid, closed-cell, polyisocyanurate board.
e. Surface-Burning Characteristics: For exposed interior surfaces of panels, when tested according to ASTM E 84 "Standard Test Method for Surface Burning Characteristics of Building Materials," as follows:
c. Flame-Spread Index: 25 or less.
d. Smoke-Developed Index: 450 or less.

E. 092900 GYPSUM BOARD
1. 2.2, A **REVISE** from "Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 5%" to "Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 95%"

F. 096513 RESILIANT BASES AND ACCESSORIES 1.03B

1. 1.03, B **ADD** the following:

"D. Recycled Content (MRc4):"

1. Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).
2. Include information on Material Tracking Worksheets."

2. 2.02 **ADD** the following:

1. "I. Recycled Content (MRc4):

1. Building materials in this section must have post- and/or pre-consumer recycled content by weight of total product."

Drawings:

A. A-100 FOUNDATION PLAN

1. As a point of clarification, **DELETE** note near gridlines 3 and J that states "UNDERSLAB VENT RE: EV"

B. A-130 LEVEL 1 RCP

1. Detail 1, LEVEL 1 RCP
   a. **ADD** View Tag "MIR 9/A521" on Grid Z between Grid 3 and Grid 4, perpendicular to Grid Z
   b. **DELETE** View Tag "1/A503" on Grid Z
   c. **ADD** View Tag "15/A521" on Grid 5 and Grid C
   d. **As a point of clarification**, revise graphics between gridines Y/Z and 3/4 to match louver layout on M-102.

C. A-131 LEVEL 2 RCP

1. Detail 1, LEVEL 2 RCP.
   a. **As a point of clarification,** revise graphics between gridlines Y/Z and 3/4 to match louver layout on M-103.

D. A-131 LEVEL 2 RCP & Sheet A-130 LEVEL 1 RCP

1. KEYNOTES , 12.12, 12.15
   a. **DELETE** "PROVIDED BY OWNER INSTALLED BY CONTRACTOR"

E. A-404 INTERIOR ELEVATIONS WONDER WALL

1. Detail 1, INT ELEV – WONDER WALL NORTH
   a. **ADD** Note "EXTRUDED ALUMINUM REVEAL REGLET "F" REVEAL" to the joints between the walls on either side of the "OPEN TO BEYOND" and the area above the "OPEN TO BEYOND"
   b. **ADD** Note showing "GWB" either side of the "OPEN TO BEYOND" and "POLYCARB" above the "OPEN TO BEYOND"

2. Detail 2, INT ELEV – WONDER WALL SOUTH
   a. **ADD** Note "EXTRUDED ALUMINUM REVEAL REGLET "F" REVEAL" to the joint above the "OPEN TO BELOW" parallel to the line of the east side of the "OPEN TO BELOW"

F. A-503 EXTERIOR DETAILS
   1. **DELETE** Detail 1, DIFFUESER @ POLYCARB

G. A-512 OPTIC WINDOW ASSEMBLY DETAILS
   2. **ADD** Full size Sheet 512, Detail 1-4. Attached

H. A-513 OPTIC WINDOW ASSEMBLY DETAILS
   1. **ADD** Full size Sheet 513, Detail 1-8. Attached

I. A-521 INTERIOR DETAILS
   1. **ADD** Full size Sheet 521, Detail 1-14. Attached

J. A-603 FINISH SCHEDULE
   1. FINISH SCHEDULE, RM 130 CLP, NORTH WALL
      a. **DELETE** "30%"
   2. FINISH SCHEDULE, RM 130 CLP, SOUTH WALL
      b. **DELETE** "30%"
   3. FINISH SCHEDULE, RM 130 CLP, WEST WALL
      c. **DELETE** "30%"
   4. FINISH SCHEDULE, RM 130 CLP, CEILING FINISH
      d. **DELETE** "25%"
   5. FINISH SCHEDULE, RM 130 CLP, COMMENTS
      e. **DELETE** "AP2 = ADD ALT 10"
   6. FINISH SCHEDULE, RM 130 CLP, COMMENTS
      f. **ADD** "FOR AP"
   7. LEGEND - FINISHES
      g. **ADD** "AP –ACOUSTICAL PANELS"

K. M-001 Mechanical Schedules
   1. REVISE Note 7 of Rooftop Unit with Energy Recovery Schedule to read "17,500 CFM".

L. M-002 Mechanical Schedules
   1. REVISE Cabinet Unit Heater, CUH-3 to be Model J 02, Arrangement "B", Discharge "C"; floor mounted, with slope top.

M. M-102 Level 1 Mechanical Plan
   3. DELETE thermostat tagged for RTU-1 located near gridlines 4 & C.2.
   4. DELETE thermostat tagged for RTU-1 located near gridlines 3/4 & E/F.
   5. DELETE thermostat tagged for RTU-2 located near gridlines 4 & E.

N. M-103 Level 2 Under Floor Mechanical Plan
   1. REVISE controls for Study Rooms 222, 223, 224, 225, 226 and Meeting Room 220: see attached sketch MX-01.
   2. REVISE leak detection cable, LD, routed north/south between gridlines E/F to be west of Stair B, not inside the west wall of Stair B.

O. M-104 Level 2 Mechanical Plan
   1. DELETE thermostat tagged for RTU-1 located near gridlines 3 & C.
   2. DELETE thermostat tagged for RTU-1 located near gridlines 3 & E/F.
   3. DELETE thermostat tagged for RTU-2 located near gridlines 4/5 & E/F.
   4. DELETE thermostat inside of Wonderwall located between gridlines 3/4.

P. M-105 Roof Level Mechanical Plan

2. ADD General Note #3 to read "SEAL ALL DUCTWORK PENETRATING THE WONDERWALL. COORDINATE WITH ARCHITECT FOR SEALANT TO PROVIDE AND INSTALL PER MANUFACTURER'S RECOMMENDATIONS FOR PENETRATIONS AT WONDERWALL."

Q. M-301 Mechanical Control Diagrams
1. REVISE B-1 flow switch control point tag number from 22 to 24; control point tag number 22 is not used.

R. M-302 Mechanical Control Diagrams
1. REVISED Control Diagrams: see attached, REVISED sheet, M-302.

S. M-303 Mechanical Control Diagrams
1. REVISED Control Diagrams: see attached, REVISED sheet, M-303.

T. M-304 Mechanical Control Diagrams
1. REVISED Control Diagrams: see attached, REVISED sheet, M-304.

U. E-101 Level 1 Lighting Plan
1. CHANGE (1) luminaire type F8 in Lobby 100 to type F9. Refer to attached sketch EX-1.
2. CHANGE (1) luminaire type F9 in Lobby 100 to type F10. Refer to attached sketch EX-1.

V. E-103 Level 1 Power Plan
1. CHANGE connection location and connection requirements for Book Sorter. Refer to attached sketch EX-2.
2. REVISE work note #9. Refer to attached sketch EX-2.

W. E-301 Electrical Panel Schedules
1. CHANGE AIC rating of panel "LPL" to 42,000A.
2. CHANGE AIC rating of panel "LPP" to 42,000A.

X. E-302 Electrical Panel Schedules
1. CHANGE AIC rating of panel "LPM" to 42,000A.

Y. TC101
1. DELETE data outlet located on the diagonal north wall of Sorting 120. Outlet is located behind book sorter.

Attachments

Spec. Sections:	1	086300 METAL-FRAMED SKYLIGHTS
Drawings		
Full Sheet:	6	A-512, A-513, A-532, M-302, M-303, M-304
Sketches:	3	Mx-01, EX-01, EX-02

This **ADDENDUM** shall be attached to, become a part of, and be returned with the Bid Proposal.

Lesley B. Thomas
City Engineer

2.16.12
Date

The undersigned bidder acknowledges receipt of this Addendum. The Proposal submitted herewith is in accordance with the stipulations set forth herein.

_____
Contractor

ADDENDUM NO. 1 DATE: _____

SECTION 086300 - METAL-FRAMED SKYLIGHTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes:
   1. Aluminum-framed skylights with the following characteristics:
      a. Glazing is glass.
      b. Glazing is retained by field-installed pressure caps on four sides .

B. Related Sections:
   1. Division 01 Section "Sustainable Design Requirements" for additional LEED requirements.
   2. Division 07 Section "Thermal Insulation" for insulation materials field-installed with metal-framed skylights.
   3. Division 07 Section "Sheet Metal Flashing and Trim" for metal flashings installed at perimeters of assemblies.
   4. Division 07 Section "Joint Sealants" for sealants installed at perimeters of metal-framed skylights.
   5. Division 08 Section "Tubular Skylights" for standard, factory-assembled skylight units.
   6. Division 08 Section "Glazing" for glass units installed in metal-framed skylights.

1.03 PERFORMANCE REQUIREMENTS

A. Provide metal-framed skylights, including anchorage, capable of withstanding, without failure, the effects of the following:
   1. Structural loads.
   2. Thermal movements.
   3. Movements of supporting structure.
   4. Dimensional tolerances of building frame and other adjacent construction.

B. Failure includes the following:
   1. Deflection exceeding specified limits.
   2. Water leakage.
   3. Thermal stresses transferred to building structure.
   4. Noise or vibration created by wind and thermal and structural movements.
   5. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
   6. Loosening or weakening of fasteners, attachments, and other components.
   7. Sealant failure.

C. Structural Loads:
   1. Wind Loads: As indicated on Drawings.
   2. Snow Loads: As indicated on Drawings.
   3. Concentrated Live Loads: 250 lbf applied to framing members at locations that will produce greatest stress or deflection.
   4. Load Combinations: Calculate according to requirements of applicable Code.

D. Deflection of Framing Members:
   1. Deflection Normal to Glazing Plane:
      a. Spans Up to 20 Feet: Limited to 1/175 of clear span or 1 inch, whichever is smaller.
      b. Spans Exceeding 20 Feet: Limited to 1/240 of clear span.

c. Glass Edge Deflection: Limit edge deflection of individual glass lites to 3/4 inch.

2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller .

E. Lateral Bracing of Framing Members: Compression flanges of flexural members are laterally braced by cross members with minimum depth equal to 50 percent of flexural member that is braced. Glazing does not provide lateral support.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.04 PERFORMANCE TESTING

A. Provide metal-framed skylights that comply with test-performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard assemblies by a qualified independent testing agency.

B. Structural-Performance Test: ASTM International ASTM E 330 "Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference."
1. Performance at Design Load: When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. Performance at Maximum Test Load: When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main supporting members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity but not less than 10 seconds.

C. Air-Infiltration Test: ASTM E 283 "Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen."
1. Minimum Static-Air-Pressure Difference: 6.24 lbf/sq. ft.
2. Maximum Air Leakage: 0.06 cfm/sq. ft.

D. Test for Water Penetration under Static Pressure: ASTM E 331 "Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference."
1. Minimum Static-Air-Pressure Difference: 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
2. Water Leakage: None.

E. Test for Water Penetration under Dynamic Pressure: American Architectural Manufacturers Association (AAMA) 501.1 "Standard Test Method for Exterior Windows, Curtain Walls and Doors for Water Penetration Using Dynamic Pressure."
1. Dynamic Pressure: 20 percent of positive wind-load design pressure, but not less than 12 lbf/sq. ft..
2. Water Leakage: No uncontrolled water penetrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained to exterior and cannot damage adjacent materials or finishes is not considered water leakage.

1.05 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for metal-framed skylights.

B. Shop Drawings: For metal-framed skylights. Include plans, elevations, sections, details, and attachments to other work.
   1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples: For each type of exposed finish required, in manufacturer's standard sizes.

D. Sustainability Submittal:
   1. Product Data: For adhesives and sealants used inside of the weatherproofing system, including printed statement of VOC content.
   2. Recycled Content (MRc4):
      a. Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).
      b. Include information on Material Tracking Worksheets.

E. Field quality-control test and inspection reports.

F. Maintenance Data: For metal-framed skylights to include in maintenance manuals.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Entity capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 699 "Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components," for testing indicated.

C. Product Options: Information on Drawings and in Specifications establishes requirements for skylights' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including testing conducted by an independent testing agency and in-service performance.
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.07 PROJECT CONDITIONS

A. Field Measurements: Indicate measurements on Shop Drawings.

1.08 WARRANTY

A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal-framed skylights that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration caused by thermal movements.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. Adhesive or cohesive sealant failures.
      e. Water leakage.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide products by one of the following:
1. A. I. A. Industries, Inc.
2. Kawneer.
3. Naturalite Skylight Systems; Vistawall Group (The).
4. O'Keeffe's Inc.
5. Super Sky Products Inc.
6. TRACO.

2.02 FRAMING SYSTEMS

A. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B 209 "Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 "Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes."
3. Extruded Structural Pipe and Tubes: ASTM B 429 "Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube."

B. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
1. Include snap-on aluminum trim that conceals fasteners.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.

D. Anchors, Fasteners, and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding; compatible with adjacent materials.
1. At pressure caps, use ASTM A 193 "Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications," 300 series stainless-steel screws.
2. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
3. Exposed Fasteners:
   a. Use exposed fasteners with countersunk Phillips screw heads.
   b. Finish exposed portions to match framing system.
4. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.

E. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products," or ASTM A 153 "Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware," requirements.

F. Anchor Bolts: ASTM A 307 "Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength," Grade A, hot-dip zinc coating, ASTM A 153, Class C.

G. Concealed Flashing: Manufacturer's standard, corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

H. Exposed Flashing and Closures: Manufacturer's standard aluminum components not less than 0.040 inch thick.

I. Framing Gaskets: Manufacturer's standard.

J. Framing Sealants: As recommended in writing by manufacturer.

2.03 GLAZING SYSTEMS

A. Glazing: As specified in Division 08 Section "Glazing."

B. Spacers, Setting Blocks, and Gaskets: Manufacturer's standard elastomeric types.

C. Glazing Sealants: As recommended in writing by manufacturer.

2.04 ACCESSORY MATERIALS

A. Insulating Materials: Specified in Division 07 Section "Thermal Insulation."

B. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.05 FABRICATION

A. Fabricate aluminum components before finishing.

B. Fabricate aluminum components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Internal guttering systems or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within skylight to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.

C. Fabricate aluminum sill closures with weep holes and for installation as continuous component.

D. Reinforce aluminum components as required to receive fastener threads.

E. Weld aluminum components in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.06 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
7. Seal joints watertight, unless otherwise indicated.

B. Metal Protection: Where aluminum will contact dissimilar materials, protect against galvanic action by painting contact surfaces with bituminous paint or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.

C. Install continuous aluminum sill closure with weatherproof expansion joints and locked and sealed or welded corners. Locate weep holes at rafters.

D. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within skylight to exterior.

E. Install components plumb and true in alignment with established lines and elevations.

F. Install glazing as specified in Division 08 Section "Glazing."

G. Install insulation materials as specified in Division 07 Section "Thermal Insulation."

H. Erection Tolerances: Install metal-framed skylights to comply with the following maximum tolerances:
1. Alignment: Limit offset from true alignment to 1/32 inch where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches; otherwise, limit offset to 1/8 inch.
2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet but no greater than 1/2 inch over total length.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test and inspection reports.

B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed skylights with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
1. Water-Spray Test: Before installation of interior finishes has begun, skylights shall be tested according to AAMA 501.2 "Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage," and shall not evidence water penetration.

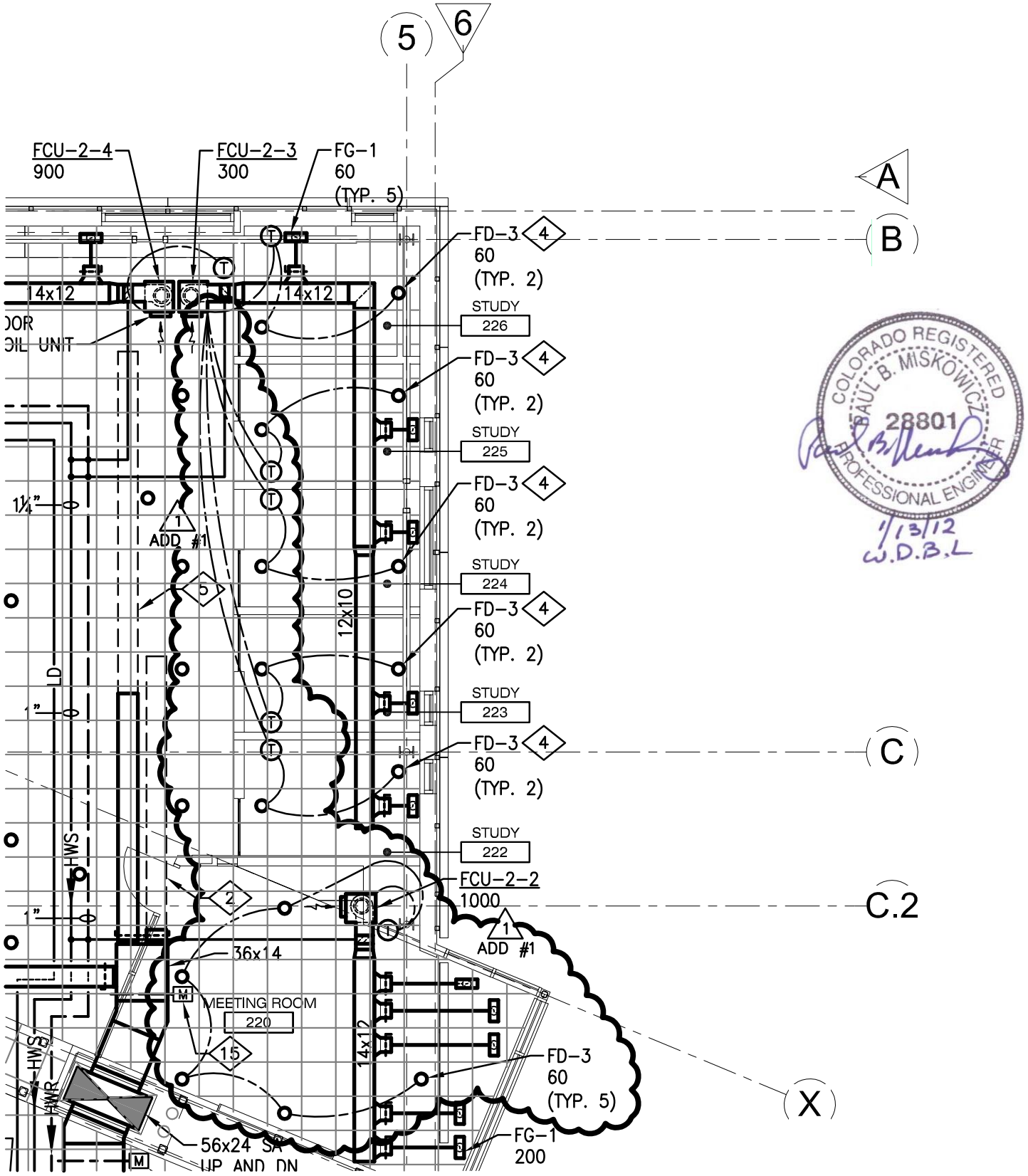
C. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.04 CONSTRUCTION WASTE MANAGEMENT

A. Manage construction waste in accordance with provisions of Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION



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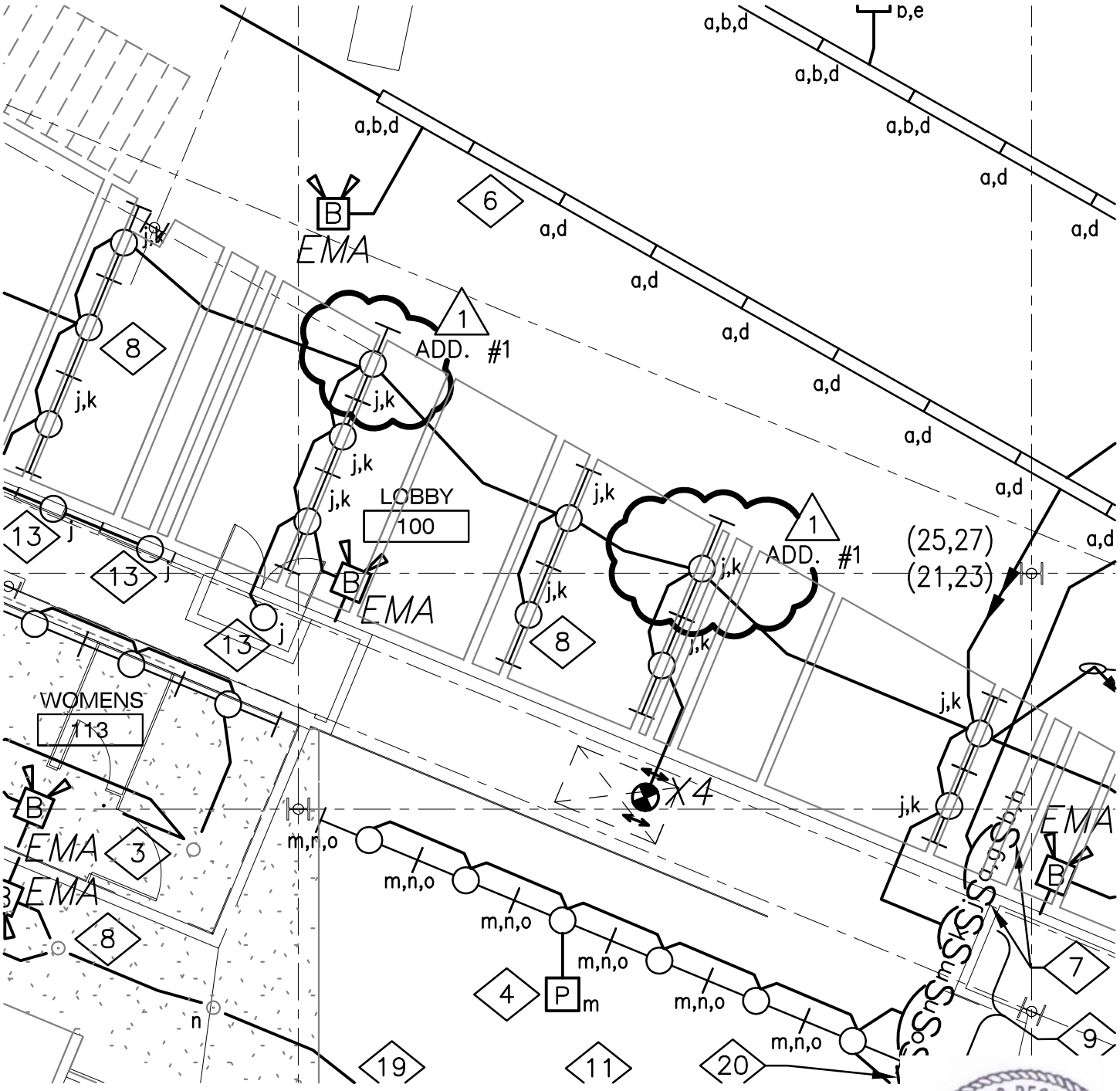
JOB NAME: WEST DENVER BRANCH LIBRARY			
SHEET TITLE: UNDER FLOOR MECHANICAL PLAN			
DRAWN BY: RLI	ISSUE: ADDENDUM #1	REV. NO.: 1	
CHECKED BY: RLI	DATE: 2/2/2012	MX-01	
PROJ. NO.: 43810006	REF. DRAWING: M-103		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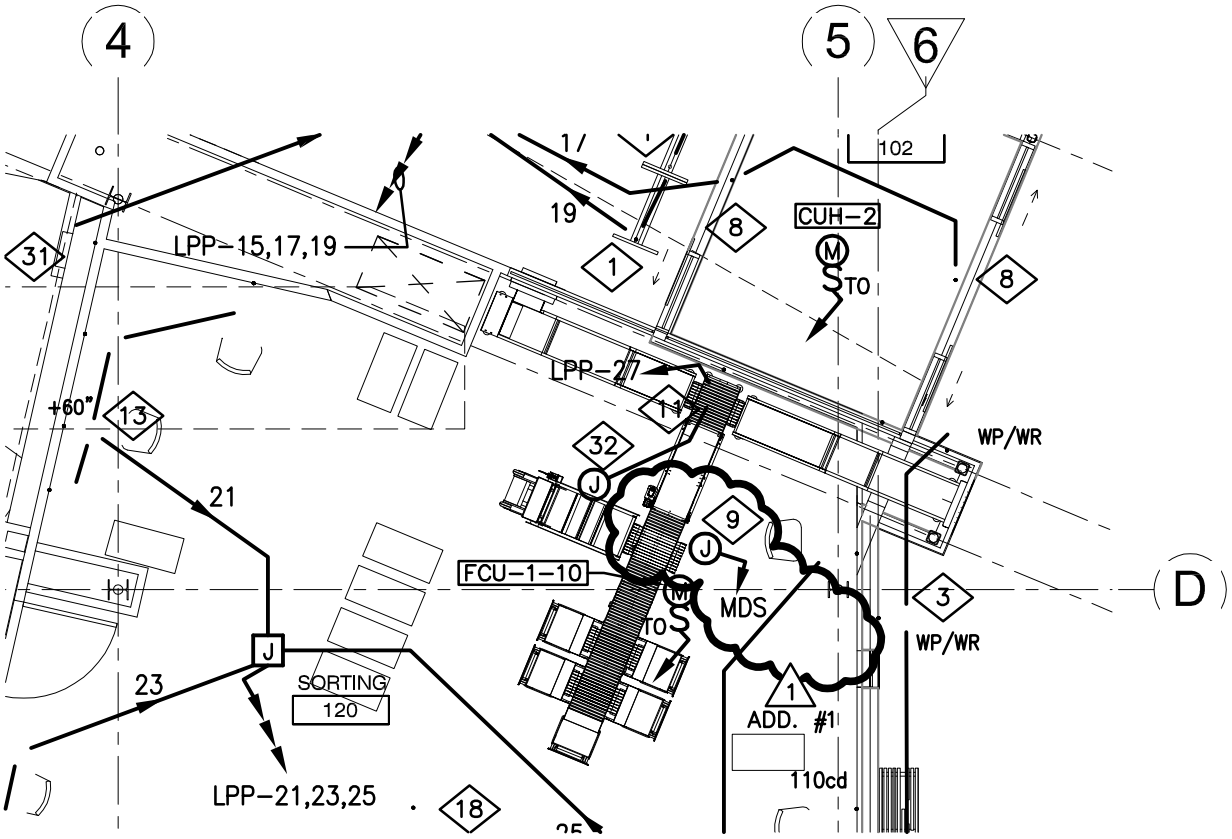

WORK NOTES:

9 PROVIDE CONNECTION TO BOOK SORTER CONTROL PANEL. CONTRACTOR SHALL PROVIDE ALL REQUIRED ELECTRICAL CONNECTIONS, BETWEEN THE BOOK SORTER CONTROL PANEL AND THE BOOK SORTER MOTORS. COORDINATE LOCATIONS OF ALL ELECTRICAL CONNECTIONS FOR BOOK SORTER WITH VENDOR PRIOR TO START OF WORK. REFER TO ELECTRICAL ONE-LINE DIAGRAM ON SHEET E-201 FOR FEEDER INFORMATION.

1 ADD. #1

Plan North

0 4' 8' 16'

SCALE: 1/8" = 1'-0"

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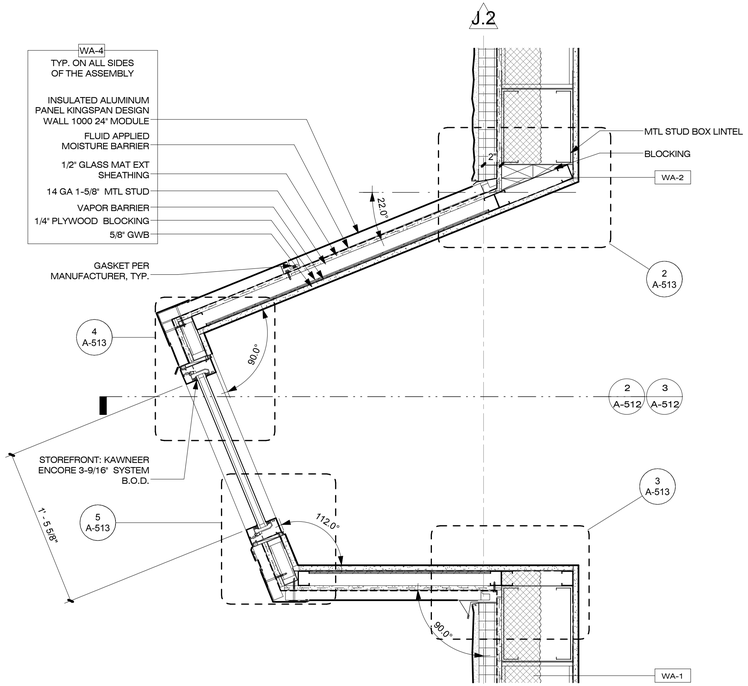
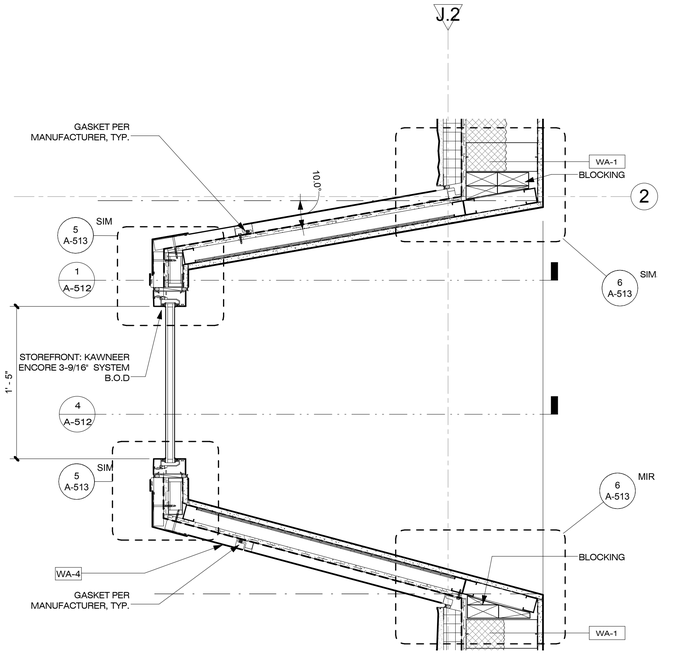
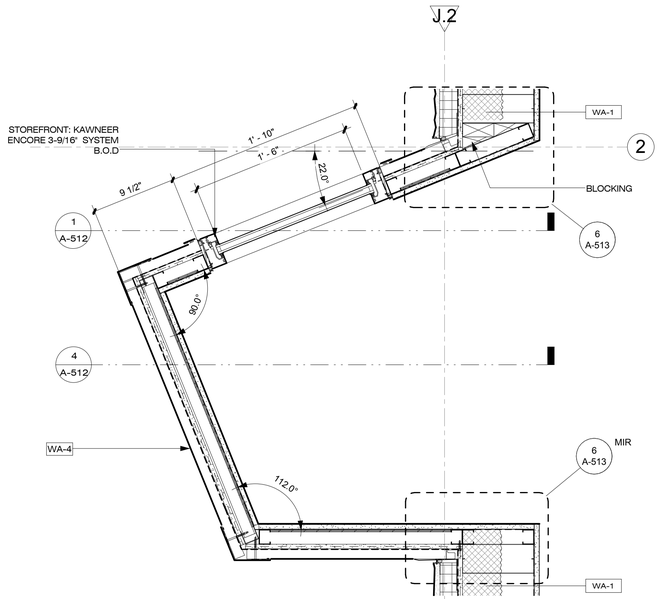
JOB NAME: WEST DENVER BRANCH LIBRARY			
SHEET TITLE: LEVEL 1 POWER PLAN			
DRAWN BY: MVM	ISSUE: ADDENDUM #1	REV. NO.: 1	
CHECKED BY: MVM	DATE: 2/2/2012	EX-02	
PROJ. NO.: 43810006	REF. DRAWING: E-103		



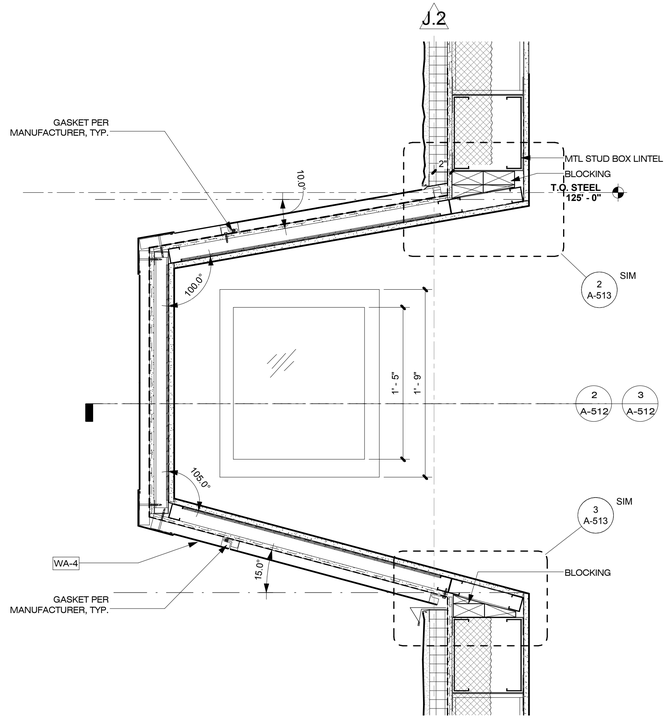
4 A-512 SEC - DTL OPTIC WINDOW ASSEMBLY FRONT GLAZING (OPTION 1)
1 1/2" = 1'-0"



3 A-512 PLAN - DTL OPTIC WINDOW ASSEMBLY (OPTION 1)
1 1/2" = 1'-0"



2 A-512 PLAN - DTL OPTIC WINDOW ASSEMBLY SIDE LENS (OPTION 2 AND OPTION 3 MIRROR)
1 1/2" = 1'-0"



1 A-512 SEC - DTL OPTIC WINDOW ASSEMBLY SIDE GLAZING (OPTION 2 AND OPTION 3 MIRROR)
1 1/2" = 1'-0"

NOTES - OPTIC WINDOW ASSEMBLY

1. THE GENERAL ASSEMBLY HAS ONE SHAPE THAT VARIES BASED ON THE LOCATION OF THE GLAZING OR OPTIC UNIT, AND HOW IT IS ORIENTED TO THE EXTERIOR WALL FACE.

2. THE ASSEMBLY UNITS ARE ATTACHED TO THE WALLS OF THE "STORY TIME TOWER" ALONG GRID LINE "1" AND GRID LINE "J.2"

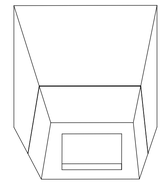
3. THE ASSEMBLY UNITS ROTATE ABOUT THE FACE OF THE WALL WITH THE FLAT FACE OF THE UNIT, THE FACE THAT IS PERPINDICULAR TO THE WALL, EITHER FACING DOWN OR TO ONE OF THE TWO SIDES.

4. THE GLAZING IN THE UNITS IS IN ONE OF TWO LOCATIONS ON THE ASSEMBLY, EITHER ON THE OUTER FACE LOOKING AWAY FROM THE BUILDING OR ON THE FACE THAT IS AT 22 DEGREE ANGLE TO A PERPENDICULAR LIND FROM THE FACE OF THE WALL OF THE BUILDING.

5. WHEN THE GLAZING IS ON THE 22 DEGREE FACE AND THE UNIT IS ORIENTED WITH THE 22 DEGREE FACE POINTED UP, THE GLAZING WILL BE THE SKYLIGHT FRAMING.

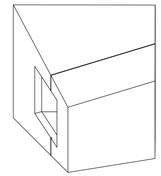
OPTION - 1

GLAZING ON OUTSIDE FACE, 22 DEGREE ANGLE SIDE FACING UP



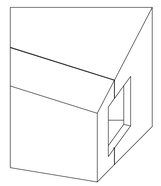
OPTION - 2

GLAZING ON THE 22 DEGREE ANGLED FACE, 22 DEGREE ANGLE SIDE FACING LEFT RELATIVE TO THE FACE OF THE WALL



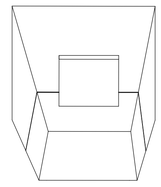
OPTION - 3

GLAZING ON THE 22 DEGREE ANGLED FACE, 22 DEGREE ANGLE SIDE FACING RIGHT RELATIVE TO THE FACE OF THE WALL



SKYLIGHT

GLAZING ON THE 22 DEGREE ANGLED FACE, 22 DEGREE ANGLE SIDE FACING UP RELATIVE TO THE FACE OF THE WALL



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CCOD PROJECT NO: CE 02089

ISSUE DATE: 02-02-2012
PHASE: ADDENDA 1

1

OPTIC WINDOW ASSEMBLY DETAILS

A-512

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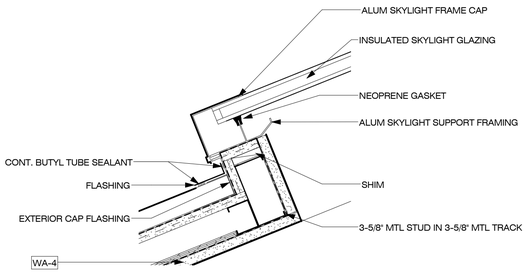
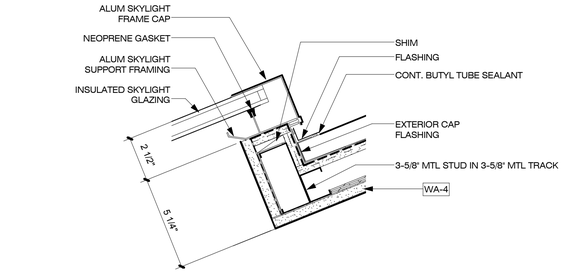
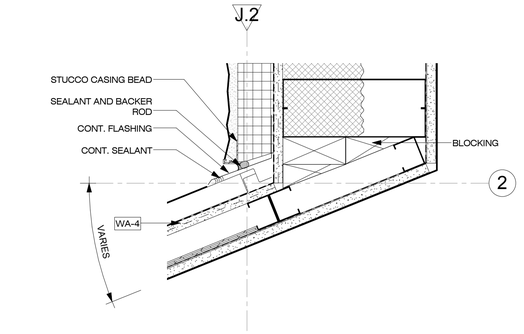


8 A-513 SEC - DTL SKYLIGHT LOWER
3" = 1'-0"



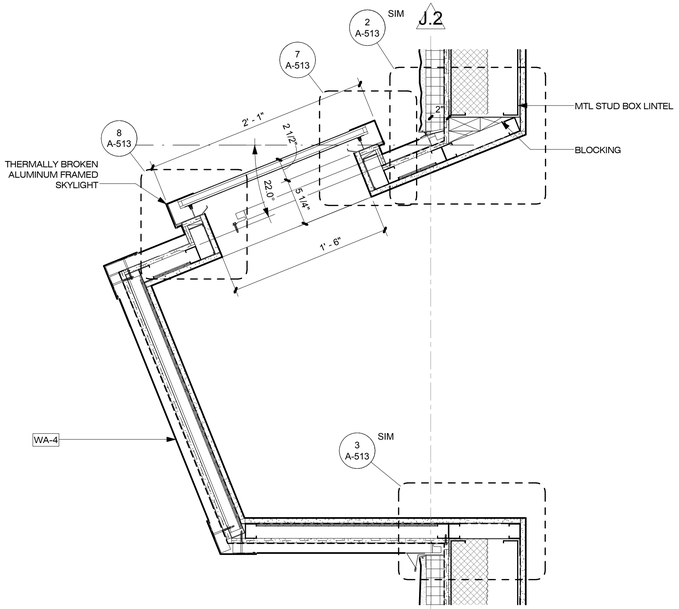
7 A-513 SEC - DTL SKYLIGHT UPPER
3" = 1'-0"



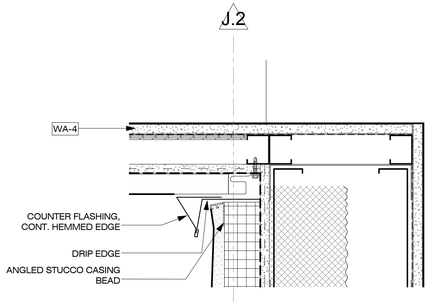
6 A-513 PLAN - DTL OPTIC @ WALL
3" = 1'-0"

5 A-513 SEC -DTL OPTIC WINDOW SILL
3" = 1'-0"

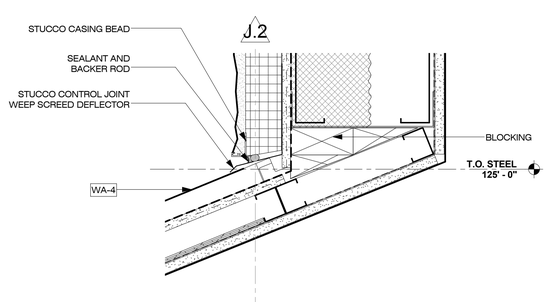
4 A-513 SEC - DTL OPTIC WINDOW HEAD
3" = 1'-0"



1 A-513 SEC - DTL OPTIC WINDOW ASSEMBLY TOP WINDOW
1 1/2" = 1'-0"



3 A-513 SEC - DTL OPTIC @ WALL SILL
3" = 1'-0"



2 A-513 SEC - DTL OPTIC @ WALL HEAD
3" = 1'-0"

NOTES - OPTIC WINDOW ASSEMBLY

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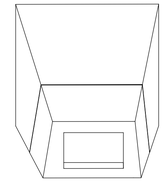
5. WHEN THE GLAZING IS ON THE 22 DEGREE FACE AND THE UNIT IS ORIENTED WITH THE 22 DEGREE FACE POINTED UP, THE GLAZING WILL BE THE SKYLIGHT FRAMING.

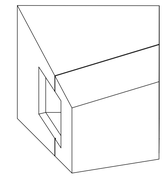
OPTION - 1

GLAZING ON OUTSIDE FACE, 22 DEGREE ANGLE SIDE FACING UP



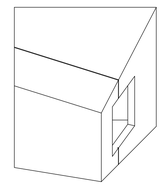
OPTION - 2

GLAZING ON THE 22 DEGREE ANGLED FACE, 22 DEGREE ANGLE SIDE FACING LEFT RELATIVE TO THE FACE OF THE WALL



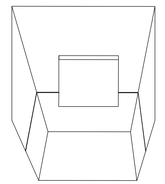
OPTION - 3

GLAZING ON THE 22 DEGREE ANGLED FACE, 22 DEGREE ANGLE SIDE FACING RIGHT RELATIVE TO THE FACE OF THE WALL



SKYLIGHT

GLAZING ON THE 22 DEGREE ANGLED FACE, 22 DEGREE ANGLE SIDE FACING UP RELATIVE TO THE FACE OF THE WALL



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ADDENDA 1

OPTIC WINDOW ASSEMBLY DETAILS

A-513

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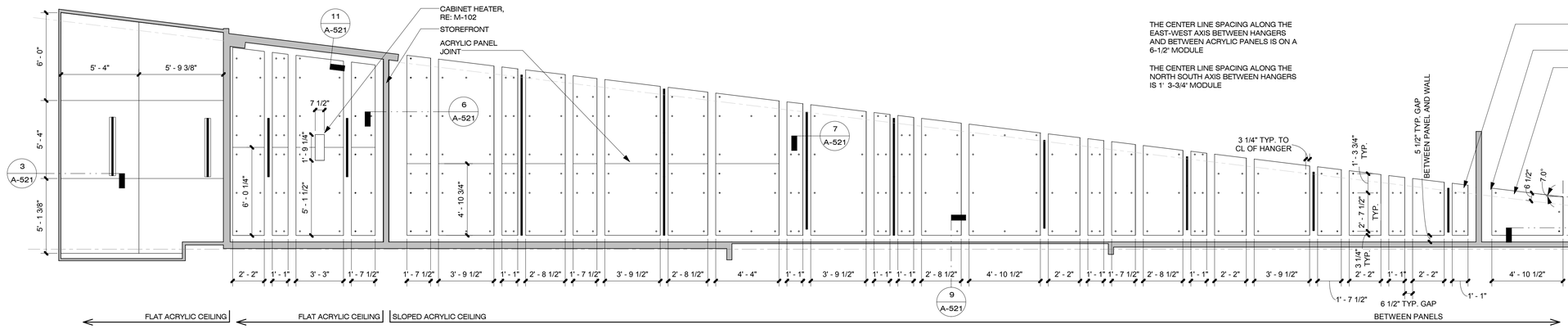
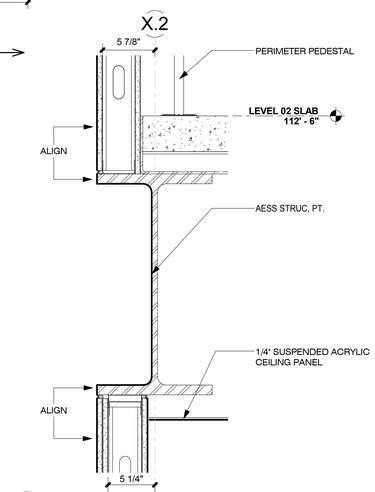
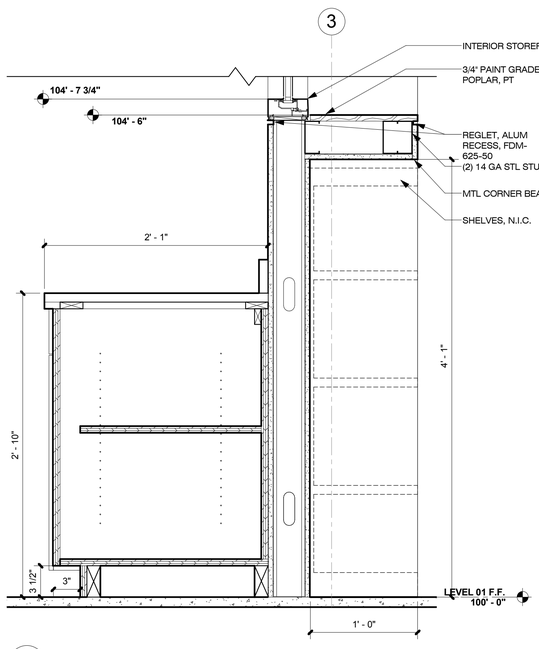


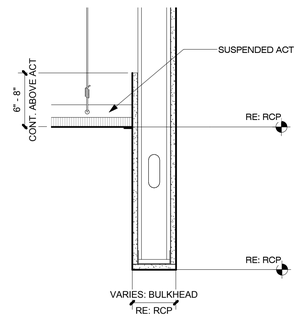
13 A-521 ENLARGED ACRYLIC CEILING PLAN -LOBBY 100, VESTIBULE 101 AND VESTIBULE 102
1/4" = 1'-0"



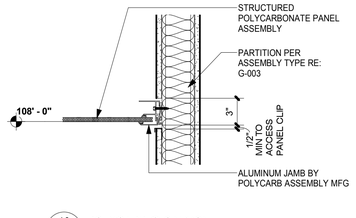
11 A-521 ACRYLIC CEILING @ VESTIBULE 3
1 1/2" = 1'-0"



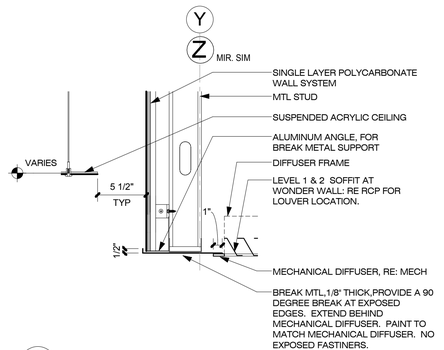
14 A-521 SEC - INT ART & CRAFT
1 1/2" = 1'-0"



12 A-521 ACT @ BULKHEAD, TYP
1 1/2" = 1'-0"



10 A-521 POLYCARB @ CANYON
1 1/2" = 1'-0"



9 A-521 DIFFUSER @ POLYCARB 2
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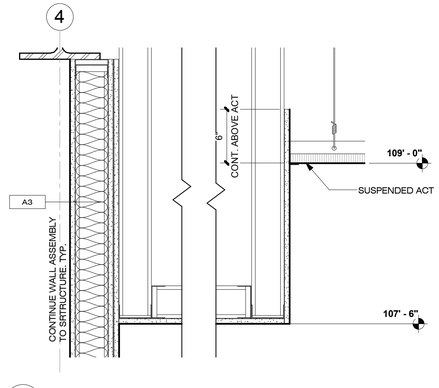
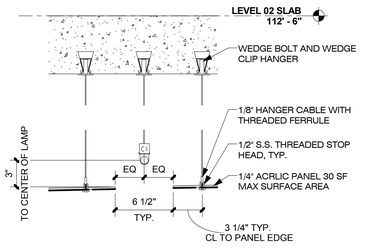
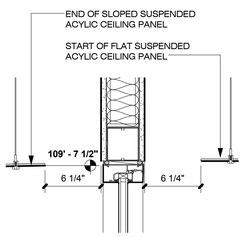


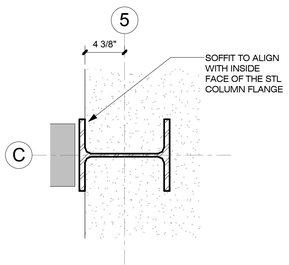
8 A-521 SEC - DTL SOFFIT STORAGE 122
1 1/2" = 1'-0"



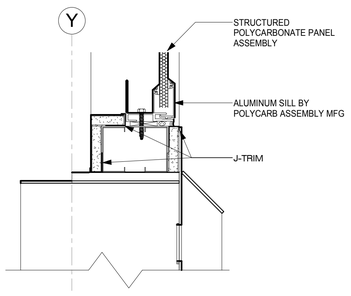
7 A-521 LIGHT IN ACRYLIC CEILING
1 1/2" = 1'-0"



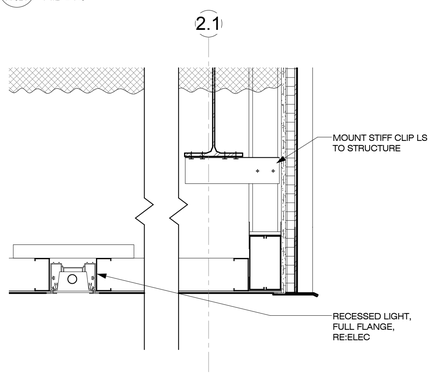
6 A-521 ACRYLIC CEILING @ VESTIBULE
1 1/2" = 1'-0"



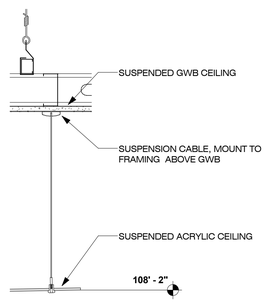
5 A-521 RCP - DETAIL SOFFIT
1 1/2" = 1'-0"



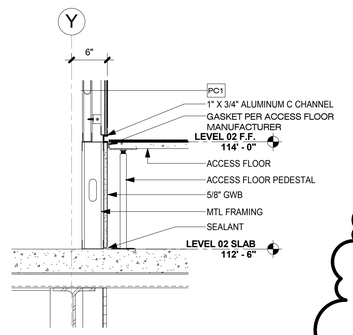
4 A-521 SECTION DTL - INTIRIOR BOOK DROP
3" = 1'-0"



3 A-521 SEC - DTL RECESSED LIGHT @ VESTIBULE
1 1/2" = 1'-0"



2 A-521 DTL - SEC HANGER THRU GWB
1 1/2" = 1'-0"



1 A-521 SECTION DTL - POLYCARB @ COMP
1" = 1'-0"

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SAN ENGINEERING
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P. 303.953.9014
F. 303.953.9016
www.sanengineeringllc.com

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MUNDUS BISHOP
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P. 303.278.1532
F. 303.278.8533
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ENVIROMENTAL
PINYON ENVIROMENTAL
14925 Camp Robber Ct.
Black Forest, CO 80908
P. 303.980.5200
F. 303.980.0089
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PROJECT:
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DENVER, COLORADO 80204

STATE OF COLORADO · REGISTERED ARCHITECT · JOHN M. LEWIS · 01.12.12 · LICENSED

sDC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02089

ISSUE DATE	PHASE
01-12-2012	100% CD
02-02-2012	ADDENDA 1

INTERIOR DETAILS

A-521

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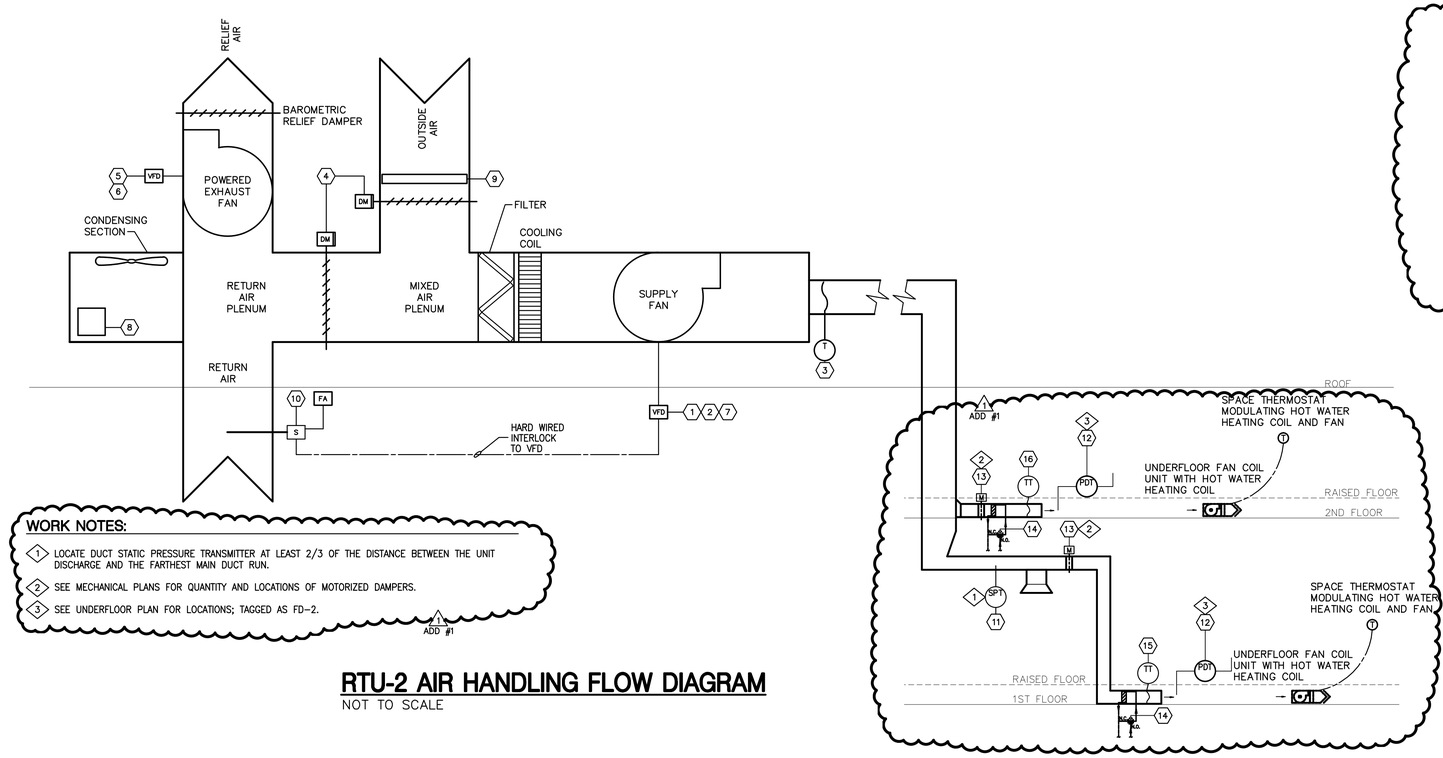


WORK NOTES:

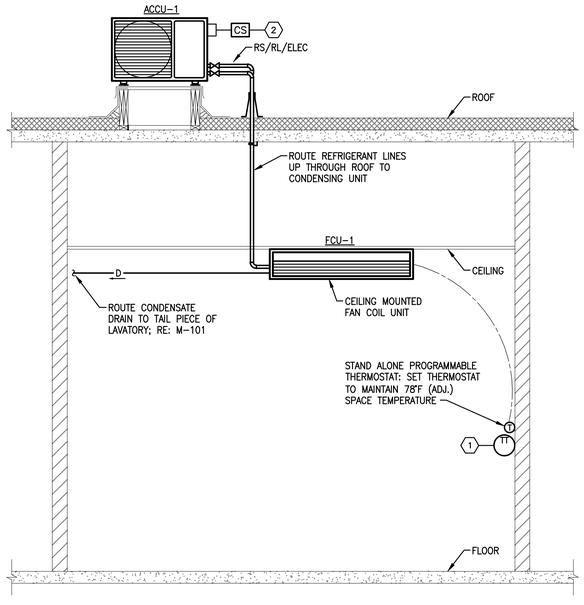
1. LOCATE DUCT STATIC PRESSURE TRANSMITTER AT LEAST 2/3 OF THE DISTANCE BETWEEN THE UNIT DISCHARGE AND THE FARTHEST MAIN DUCT RUN.
2. SEE MECHANICAL PLANS FOR QUANTITY AND LOCATIONS OF MOTORIZED DAMPERS.
3. SEE UNDERFLOOR PLAN FOR LOCATIONS; TAGGED AS FD-2.

ADD #1

RTU-2 AIR HANDLING FLOW DIAGRAM

NOT TO SCALE

RTU-2 POINTS LIST		
TAG	DESCRIPTION	TYPE
1	RTU START/STOP	BO
2	RTU STATUS/GENERAL ALARM	BI
3	SUPPLY AIR TEMPERATURE/LOW LIMIT	AI
4	ECONOMIZER DAMPER (OA & RA)	AO
5	RELIEF FAN START/STOP	BO
6	RELIEF FAN VFD SPEED	AO
7	SUPPLY FAN VFD SPEED	AO
8	COOLING ENABLE/DISABLE	BO
9	OSA FLOW MONITOR	AI
10	DUCT SMOKE DETECTOR	BI
11	DUCT STATIC PRESSURE	AI
12	UNDER FLOOR DIFFERENTIAL PRESSURE SENSOR (2)	AI
13	UNDER FLOOR MOTORIZED DAMPER (2)	AO
14	HOT WATER HEATING COIL (2)	AO
15	DUCT TEMPERATURE SENSOR LEVEL 1 (ADD #1)	AI
16	DUCT TEMPERATURE SENSOR LEVEL 2	AI



IT ROOM AND ELEVATOR MACHINE ROOM CONTROL DIAGRAM (AC-1/ACCU-1 & AC-2/ACCU-2)

NOT TO SCALE

TELE/COM POINTS LIST		
TAG	DESCRIPTION	TYPE
1	SPACE TEMPERATURE SENSOR	AI
2	CONDENSING UNIT STATUS	BI

SEQUENCE OF OPERATION:

FAN COIL AND CONDENSING UNIT SHALL OPERATE IN CONJUNCTION TO MAINTAIN 78°F (ADJ) SPACE TEMPERATURE COOLING SETPOINT. THE SPACE TEMPERATURE SETPOINT SHALL NOT RESET OR HAVE A SETBACK FOR UNOCCUPIED MODE. THE FAN COIL AND CONDENSING UNIT SHALL BE ENABLED 24HRS A DAY, 7 DAYS A WEEK. A SECONDARY TEMPERATURE SENSOR INDEPENDENT OF THE SPLIT SYSTEM PACKAGED CONTROLS SHALL BE PROVIDED AND INTEGRATED INTO THE BUILDING AUTOMATION SYSTEM. THE BAS SHALL GENERATE AN ALARM IF THE TEMPERATURE IN THE ROOM RISES ABOVE 90°F (ADJ).

ADD #1

BUILDING AUTOMATION SYSTEM (BAS) GENERAL REQUIREMENTS:

ACCEPTED STANDARDS
THE BAS INSTALLATION SHALL CONFORM TO ALL GENERALLY ACCEPTED HARDWARE AND PERFORMANCE STANDARDS, AS ADOPTED BY THE CITY AND COUNTY OF DENVER FOR LIBRARIES.

REFER TO THE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

ALL SETPOINTS IN ALL OF THE SYSTEM SEQUENCES SHALL BE ADJUSTABLE.

FRONT END AND GRAPHICAL INTERFACE
THE PRIMARY BAS USER INTERFACE SHALL RESIDE ON A LOCAL COMPUTER WORKSTATION WHICH IS SHARED WITH SECURITY SOFTWARE AND SECURITY FUNCTIONS. THE BAS SHALL ALSO INTERFACE WITH THE CITY OF DENVER PUBLIC LIBRARY, CENTRAL LIBRARY INTERFACE, VIA EXTERNAL NETWORK COMMUNICATIONS.

SOFTWARE PACKAGES
TWO SEPARATE CONTINUM SOFTWARE PACKAGES SHALL BE REQUIED. ONE SHALL BE PROVIDED ON THE PRIMARY BAS USER INTERFACE WORKSTATION REFERENCED ABOVE, AND SHALL INCLUDE ALL SYSTEM GRAPHICS, ALARMING, AND TRENDING FUNCTIONS IDENTIFIED IN THE CONSTRUCTION DOCUMENTS, OR AS REQUIRED BY THE CITY OF DENVER.

THE SECOND SOFTWARE PACKAGE SHALL BE INSTALLED ON A REMOTE INTEGRATED PC/TV VIDEO DISPLAY (LOCATED ON LEVEL 1) WHICH SHALL BE USED FOR THE PURPOSE OF DISPLAYING REAL TIME ENERGY USAGE, AND HISTORICAL ENERGY INFORMATION TO THE PUBLIC. THE DETAILS OF THIS REAL TIME DISPLAY SHALL BE DEVELOPED BETWEEN THE BAS CONTRACTOR AND THE CITY OF DENVER.

SEQUENCE OF OPERATION (RTU-2):

GENERAL

TC INSTALLER SHALL PROVIDE A UNIT CONTROLLER AND FIELD DEVICES, INSTALL FACTORY FURNISHED FIELD DEVICES, AND PROVIDE WIRING TO ACCOMPLISH THE SEQUENCE OF OPERATION. AN ECONOMIZER SECTION WILL ALSO BE PROVIDED WITH THE RTU WITH DAMPER MOTOR AND RELIEF FAN VFD TO BE WIRED BY TC INSTALLER.

THE BUILDING AUTOMATION SYSTEM (BAS) SHALL ENABLE/DISABLE THE UNIT AND PERFORM ALL CONTROL FUNCTIONS IDENTIFIED BELOW.

WHEN THE UNIT IS OFF, THE RETURN AIR DAMPER SHALL BE OPEN AND THE OUTSIDE AIR DAMPERS SHALL BE CLOSED.

SAFETIES AND OVERRIDES

A SMOKE DETECTOR IN THE RETURN AIR DUCT SHALL SHUTDOWN THE UNIT. THE DETECTOR SHALL BE HARDWIRED TO THE SUPPLY AND RELIEF FAN VFD ENABLE TERMINALS, WITH DIRECT OUTPUT TO THE FIRE ALARM SYSTEM.

FREEZE PROTECTION SHALL BE ACCOMPLISHED THROUGH BAS. A TEMPERATURE SENSOR MOUNTED IN THE SUPPLY DUCT SHALL SERVE AS A LOW LIMIT TEMPERATURE SENSOR AND TO MONITOR SUPPLY AIR TEMPERATURE. WHEN THE SUPPLY AIR TEMPERATURE FALLS BELOW 40 DEG F FOR 30 SEC, THE UNIT SHALL SHUTDOWN. IF THE SUPPLY AIR TEMPERATURE WARMS ABOVE 45 DEG F, THE UNIT SHALL RETURN TO ITS CURRENT MODE. SUPPLY AIR TEMPERATURE RESET SHALL BE ACCOMPLISHED THROUGH SOFTWARE.

OCCUPIED MODE

WHEN THE UNIT IS IN OCCUPIED MODE AS DETERMINED BY THE BAS, THE SUPPLY FAN SHALL BE ENABLED AND RUN CONTINUOUSLY. THE OUTSIDE AIR DAMPER SHALL BE INITIALLY SET TO MINIMUM POSITION. THE DAMPER AND RELIEF FAN SHALL BE CONTROLLED BY THE BAS.

SUPPLY FAN CONTROL

ENABLE AND MODULATE THE SUPPLY VFD TO MAINTAIN DUCT STATIC PRESSURE SETPOINT OF 0.65"W.C. (ADJ.).

RELIEF FAN CONTROL

ENABLE AND MODULATE THE RELIEF FAN VFD BASED ON A VARIABLE OUTPUT IN PROPORTION TO THE MONITORED OUTSIDE AIR QUANTITY. THE NET EFFECT TO MAINTAIN SLIGHTLY MORE AIR DELIVERED INTO BUILDING, THAN EXHAUSTED.

SUPPLY AIR TEMPERATURE RESET

THE BAS SHALL RESET THE SUPPLY AIR TEMPERATURE BASED UPON OUTSIDE AIR TEMPERATURE. AT OUTSIDE AIR TEMPERATURES ABOVE 50°F, THE SUPPLY AIR TEMPERATURE SHALL BE 55°F. AT OUTSIDE AIR TEMPERATURES BELOW 47°F, THE SUPPLY AIR TEMPERATURE SHALL BE 60°F.

THE BAS SHALL MODULATE THE ECONOMIZER DAMPERS AND COOLING STAGES IN SEQUENCE TO MAINTAIN THE CURRENT SUPPLY AIR TEMPERATURE SETPOINT.

OUTSIDE AIR VENTILATION RATE CONTROL:

A DEMAND CONTROLLED VENTILATION STRATEGY SHALL BE APPLIED WITH CO2 SENSORS LOCATED IN THE FOLLOWING ROOMS; 252 CONFERENCE AND 253 STAFF LOUNGE.

THE RATE OF OUTSIDE AIR VENTILATION SHALL BE CONTINUOUSLY MONITORED BY THE OUTSIDE AIR FLOW MONITORING STATION. DURING OCCUPIED HOURS, THE RATE OF OUTSIDE AIR SHALL BE ADJUSTED BETWEEN APP. 400 CFM AND 900 CFM AS INDICATED BELOW.

CONTINUOUSLY MONITOR THE CO2 LEVELS AT EACH OF THE SPACES LISTED ABOVE AND MODULATE THE MINIMUM OUTSIDE AIR DAMPER IN ORDER TO MAINTAIN A CO2 LEVEL OF NO HIGHER THAN 800 PPM (400 PPM AMBIENT + 400 PPM DIFFERENTIAL) IN THE MOST DEMANDING ZONE. NOTE: THIS SETPOINT MAY BE LOWERED AS OPERATIONAL SITUATIONS REQUIRE, BUT DO NOT INCREASE!

AS OCCUPANCY AND CO2 LEVELS INCREASE, INCREASE THE AMOUNT OF OUTSIDE AIR IN ORDER TO MAINTAIN THE CRITICAL SPACE CO2 LEVEL SETPOINT, OR UNTIL THE MAXIMUM VENTILATION RATE IS REACHED.

AS OCCUPANCY AND CO2 LEVELS DECREASE BELOW 600 PPM (ADJ) IN THE MOST DEMANDING ZONE, DECREASE THE AMOUNT OF OUTSIDE AIR IN ORDER TO MAINTAIN THE CRITICAL SPACE CO2 LEVEL SETPOINT, OR UNTIL THE MINIMUM VENTILATION RATE IS REACHED.

CONTINUOUSLY MONITOR AND TREND RETURN AIR CO2, AND SPACE CO2 LEVELS FOR ALL SENSORS.

ISSUE A VISUAL ALARM THROUGH THE BAS WORKSTATION IF ANY OF THE FOLLOWING CONDITIONS ARE PRESENT:
- MONITORED RETURN AIR CO2 LEVEL IS MORE THAN 1000 PPM.
- OUTSIDE AIR VENTILATION RATE IS LESS THAN THE MINIMUM CFM QUANTITY.
- ANY SPACE CO2 LEVELS EXCEED 880 PPM (10% ABOVE SETPOINT).

MAINTAIN DATA HISTORY OF CO2 LEVELS AND OUTSIDE AIR VENTILATION RATES TAKEN AT REGULAR INTERVALS, NOT LESS THAN EVERY 15 MINUTES.

UNOCCUPIED MODE

WHEN THE UNIT IS IN UNOCCUPIED MODE AS DETERMINED BY THE BAS, THE UNIT SHALL BE OFF. THE UNIT SHALL NOT RESPOND TO A CALL FOR COOLING.

ALARMS

THE FOLLOWING POINTS SHALL BE FIELD WIRED AND MONITORED BY THE BAS:

- SUPPLY FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
- SUPPLY FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
- SUPPLY AIR LOW LIMIT/TEMPERATURE ALARM
- HIGH SUPPLY AIR STATIC PRESSURE: IF THE SUPPLY AIR STATIC PRESSURE IS 25% (ADJ.) GREATER THAN SETPOINT.
- LOW SUPPLY AIR STATIC PRESSURE: IF THE SUPPLY AIR STATIC PRESSURE IS 25% (ADJ.) LESS THAN SETPOINT.
- DIRTY FILTER PRESSURE DROP GREATER THAN 0.75"
- RTU LEAK DETECTION SYSTEM ALARM
- DUCT SMOKE DETECTOR

ADD #1

UNDER FLOOR DISCHARGE DAMPERS
IN OCCUPIED MODE MODULATE UNDER FLOOR DAMPERS TO MAINTAIN 0.05" W.C. PRESSURE DIFFERENTIAL BETWEEN THE UNDER FLOOR PLENUM AND ABOVE FLOOR SPACE.

IN UNOCCUPIED MODE, WITH THE RTU OFF, THE UNDER FLOOR DAMPERS WILL REMAIN IN THEIR LAST POSITION UNTIL RESUMPTION OF THE NEXT OCCUPIED SCHEDULE.

SUPPLY DUCT REHEAT CONTROL

IN OCCUPIED MODE, WHEN THE OUTSIDE AIR TEMPERATURE IS BELOW 47°F, MODULATE HOT WATER REHEAT COIL TO MAINTAIN A LOCAL DUCT TEMPERATURE SETPOINT OF 60°F MIN. OTHERWISE, THE DUCT REHEAT COIL SHALL BE DISABLED.

UNDERFLOOR FCU CONTROL

REFER TO M-302 FOR SEQUENCE.

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2/2/2012	ADDENDUM 01

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PAUL B. MISKOWICZ
28801
PROFESSIONAL ENGINEER
1/13/12
J.D.B.L

MECHANICAL CONTROL DIAGRAMS

M-303

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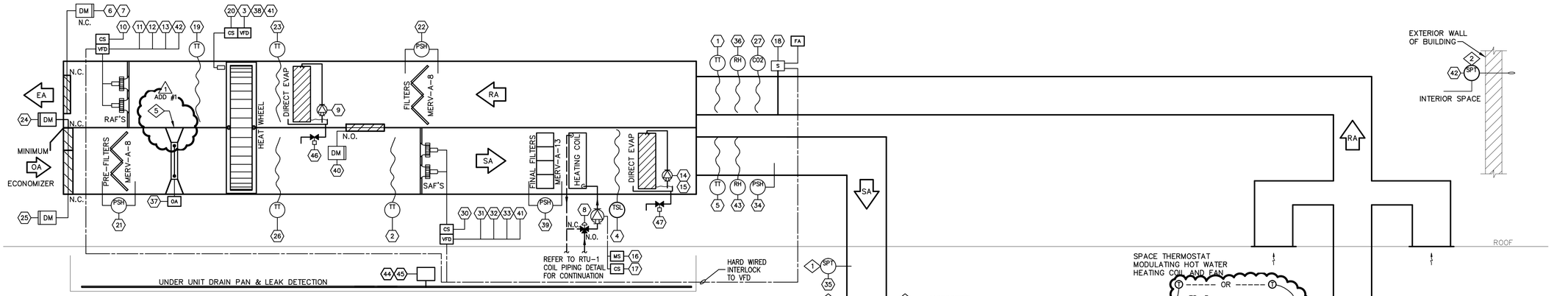

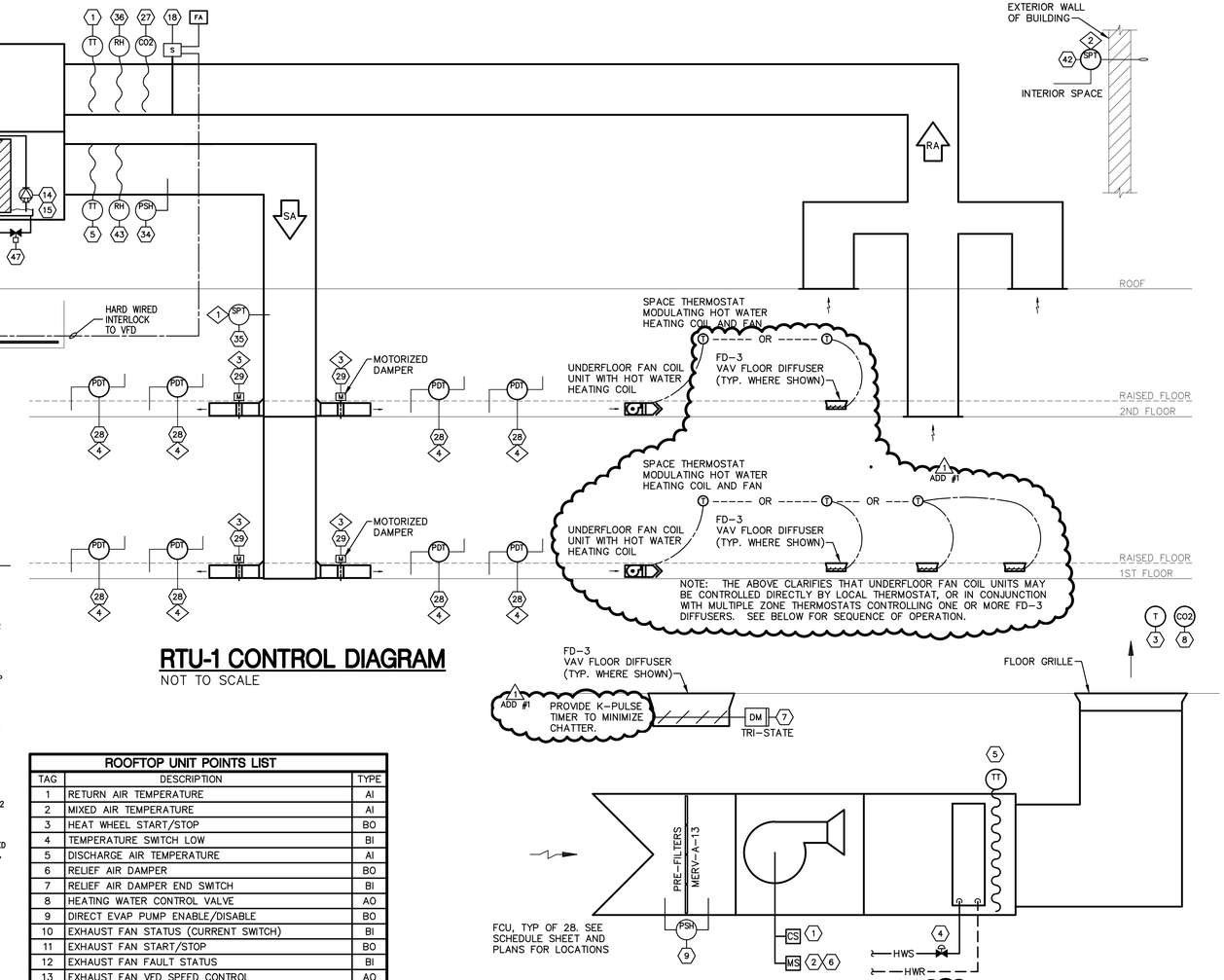

WORK NOTES:

1. LOCATE DUCT STATIC PRESSURE TRANSMITTER AT LEAST 2/3 OF THE DISTANCE BETWEEN THE UNIT DISCHARGE AND THE FARTHEST MAIN DUCT RUN.
2. COORDINATE PLACEMENT OF EXTERIOR BUILDING STATIC PRESSURE SENSOR WITH ARCHITECT AND ENGINEER.
3. SEE MECHANICAL PLANS FOR QUANTITY AND LOCATIONS OF MOTORIZED DAMPERS.
4. SEE UNDERFLOOR PLAN FOR LOCATIONS; TAGGED AS FD-2.
5. PROVIDE REDUCER IN AIRSTREAM FOR OUTSIDE AIRFLOW MONITOR TO ACHIEVE A VELOCITY OF 150 FPM ACROSS MONITOR FOR MINIMUM OCCUPIED OUTSIDE AIRFLOW RATE OF 2100 CFM.

ADD #1

SEQUENCE OF OPERATION (RTU-1)

MODES OF OPERATION
OCCUPIED MODE:
- OCCUPIED MODE SHALL BE BASED ON A USER-ADJUSTABLE SEVEN-DAY SCHEDULE AND ADDITIONAL HOLIDAY SCHEDULE.
- DURING OCCUPIED MODE THE RTU WILL BE ENABLED TO RUN AND WILL OPERATE AS DEFINED BY THIS SEQUENCE OF OPERATION TO HEAT OR COOL THE VENTILATION AIR FOR THE UNDER FLOOR AIR DISTRIBUTION SYSTEM.

UNOCCUPIED MODE:
- UNOCCUPIED MODE SHALL BE ANY TIME PERIOD THAT IS NOT SCHEDULED AS OCCUPIED.
- THE RTU WILL GENERALLY NOT BE ENABLED TO RUN, BUT MAY BE ENABLED AS IDENTIFIED IN THE SEQUENCE OF OPERATION FOR MINIMUM NIGHTTIME COOLING.
- UNOCCUPIED MODE HEATING SHALL BE PROVIDED BY THE PERIMETER UNDER FLOOR FAN COIL UNITS. SEE SEPARATE SEQUENCE OF OPERATION FOR THESE UNITS.

SUPPLY & RELIEF FANS
THE SUPPLY AND RELIEF FANS WILL RUN ANYTIME THE RTU IS ENABLED, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE SUPPLY AND RELIEF FANS WILL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.

FREEZE PROTECTION
UPON RECEIVING A FREEZESTAT STATUS, THE SUPPLY AND RELIEF FANS WILL STOP, THE OUTSIDE AIR AND RELIEF AIR DAMPERS WILL FULLY CLOSE, AND RETURN AIR DAMPER WILL OPEN, THE HEATING COIL VALVE WILL MODULATE FULLY OPEN TO THE COIL AND THE HEATING COIL CIRC PUMP WILL BE ENABLED.

SMOKE DETECTION
UPON RECEIVING A DUCT SMOKE SIGNAL, THE SUPPLY FANS AND RELIEF FANS WILL IMMEDIATELY STOP AND ALL DAMPERS WILL RETURN TO THEIR NORMAL DEENERGIZED STATE. A SEPARATE DIRECT OUTPUT WILL BE SENT TO THE FIRE ALARM SYSTEM.

HIGH STATIC PRESSURE SHUTDOWN
THE RTU WILL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A HIGH STATIC PRESSURE SHUTDOWN SIGNAL.

SUPPLY AIR DUCT STATIC PRESSURE CONTROL
THE BAS SHALL MONITOR DUCT STATIC PRESSURE AND MODULATE THE SUPPLY FAN VFD SPEED TO MAINTAIN A DUCT STATIC PRESSURE SETPOINT OF 1.5" W.C. (DEFAULT). THE T.C. CONTRACTOR WILL COORDINATE WITH THE T&S CONTRACTOR TO DETERMINE THE FINAL SETPOINT VALUE TO BE USED, WHICH SHALL BE THE LOWEST VALUE THAT ACHIEVES THE REQUIRED DESIGN FLOW RATES FOR THE UNDER FLOOR DISCHARGE DAMPERS.

RELIEF FAN CONTROL
THE RELIEF AIR DAMPER SHALL BE ACTIVATED FULLY OPEN WHENEVER THE SUPPLY FAN IS ENABLED. UPON CONFIRMING THAT THE RELIEF AIR DAMPER IS OPEN (THROUGH N.O. END SWITCH), THE RELIEF FAN SHALL BE ENABLED AND SHALL RUN CONTINUOUSLY. THE RELIEF FAN SPEED WILL BE CONTROLLED IN ORDER TO MAINTAIN A BUILDING STATIC PRESSURE SETPOINT OF 0.025" W.C.

ECONOMIZER DAMPER CONTROL
A SEPARATE ECONOMIZER DAMPER SHALL BE CONTROLLED INDEPENDENT OF THE MINIMUM OUTSIDE AIR DAMPER, AND SHALL MODULATE AS DETERMINED BY THE SEQUENCE. THE RETURN AIR DAMPER SHALL BE MODULATED IN OPPOSITION TO THE POSITION OF THE ECONOMIZER DAMPER.

SUPPLY AIR TEMPERATURE CONTROL & RESET
THE BAS SHALL MONITOR THE SUPPLY AIR TEMPERATURE AND WILL MAINTAIN AN OCCUPIED SUPPLY AIR TEMPERATURE SETPOINT BASED ON ZONE COOLING AND HEATING REQUIREMENTS.

UPON RTU STARTUP THE SUPPLY AIR TEMPERATURE SETPOINT SHALL BE SET TO 60°F (DEFAULT). AT 10 MINUTE INTERVALS THE BAS SHALL RESET THE SUPPLY TEMPERATURE SETPOINT BASED ON THE UNDER FLOOR ZONE WITH THE MOST DEMAND AS FOLLOWS:

ADD #1
- THE SUPPLY AIR TEMPERATURE SETPOINT SHALL BE RESET DOWN IN INCREMENTS OF 1°F WHEN AT LEAST TWO OR MORE ZONE MOTORIZED DAMPERS ARE AT THEIR MAXIMUM OUTPUT VALUE FOR MORE THAN 10 MINUTES.
- THE SUPPLY AIR TEMPERATURE SETPOINT SHALL BE RESET UP IN INCREMENTS OF 1°F WHEN ANY ONE OF THE ZONE MOTORIZED DAMPERS ARE LESS THAN MAXIMUM OUTPUT VALUE FOR MORE THAN 10 MINUTES.

THE RANGE OF SETPOINT VALUES SHALL BE 55°F–70°F.

SUPPLY AIR TEMPERATURE CONTROL
THE HEAT WHEEL, ECONOMIZER DAMPERS, EVAPORATIVE COOLERS AND HEATING COIL SHALL ACT IN SEQUENCE TO MAINTAIN THE SUPPLY AIR TEMPERATURE AT SETPOINT, AS DESCRIBED ABOVE.

THE SPEED OF THE HEAT WHEEL VARIES FROM 12 HERTZ TO 60 HERTZ.

ADD #1

THE HEAT WHEEL SHALL BE ENABLED WHENEVER THE RTU IS ENABLED.

HEATING MODE
THE MINIMUM OUTSIDE AIR DAMPER SHALL OPEN TO THE MINIMUM POSITION, AS DETERMINED BY THE DEMAND CONTROLLED VENTILATION REQUIREMENTS.

DURING HEATING MODE, THE ECONOMIZER DAMPER SHALL REMAIN CLOSED AND THE EXHAUST/RELIEF AIR EVAPORATIVE COOLER PUMP SHALL NOT BE ENABLED.

THE HEAT WHEEL SHALL BE ENABLED AND THE SPEED SHALL BE INCREASED TO PROVIDE MORE HEAT TRANSFER AND DECREASED TO PROVIDE LESS HEAT TRANSFER TO THE PRIMARY AIR STREAM.

IF ADDITIONAL HEAT IS REQUIRED, THE HEAT WHEEL SPEED IS AT 100%, AND THE HOT WATER BOILERS HAVE BEEN ENABLED (SEE BOILER SEQUENCE FOR DETAILS), THEN THE HOT WATER COIL PUMP SHALL BE ENABLED AND THE COIL CONTROL VALVE SHALL MODULATE IN SEQUENCE TO PROVIDE ADDITIONAL HEAT TO THE PRIMARY AIR STREAM. WHILE THE HOT WATER COIL IS ENABLED, THE HEAT WHEEL SPEED SHALL REMAIN AT 100% TO MAXIMIZE HEAT RECOVERY POTENTIAL.

ON A FALLING DEMAND FOR HEATING, THE HOT WATER COIL WILL BE DISABLED FIRST, FOLLOWED BY REDUCED SPEED OF THE HEAT WHEEL UNTIL THE HEAT WHEEL IS AT MINIMUM RPM. IF THE HEAT WHEEL IS AT MINIMUM RPM FOR MORE THAN 15 MINUTES, THE WHEEL SHALL BE DISABLED.

WHEN THE OUTSIDE AIR TEMPERATURE IS BELOW 14°F (ADJ); THE RTU SHALL BE MONITORED TO ENSURE THAT A HEAT WHEEL FROSTING CONDITION DOES NOT OCCUR. WHEN THE HEAT WHEEL EXHAUST AIR TEMPERATURE DROPS BELOW 8°F. THE BAS SHALL START A TIMER; AFTER 5 HOURS BAS SHALL SEND AN ALARM FOR VISUAL VERIFICATION OF WHEEL FROSTING, IF AFTER 8 HOURS THE EXHAUST TEMPERATURE HAS REMAINED BELOW 8°F THEN THE WHEEL SPEED SHALL MODULATE TO 30% SPEED. DURING THIS CONDITION THE HOT WATER COIL SHALL SUPPLEMENT THE HEATING REQUIREMENT. AFTER 30 MINUTES, OR WHEN THE OUTSIDE AIR TEMPERATURE RISES ABOVE 14°F (ADJ), RE-INITIATE THE NORMAL WHEEL SEQUENCE.

COOLING MODE
THE MINIMUM OUTSIDE AIR DAMPER SHALL OPEN TO THE MINIMUM POSITION, AS DETERMINED BY THE DEMAND CONTROLLED VENTILATION REQUIREMENTS.

THE ECONOMIZER DAMPER SHALL BE MODULATED FIRST TO PROVIDE COOLING, BEFORE ACTIVATION OF THE HEAT WHEEL, OR ANY ADDITIONAL EVAPORATIVE COOLING FUNCTIONS. ONCE ANY OF THE EVAPORATIVE COOLING SECTIONS ARE ENABLED, THE ECONOMIZER DAMPER SHALL REMAIN FULLY OPEN AND THE RETURN AIR DAMPER FULLY CLOSED.

WHILE THE RTU IS IN ECONOMIZER ONLY OPERATION, PERIODICALLY OPERATE THE HEAT WHEEL AT MINIMUM SPEED FOR APPROXIMATELY 1 MINUTE EVERY HOUR (ADJ) IN ORDER TO PREVENT LOCALIZED PARTICULATE LOADING OF THE HEAT WHEEL.

ONCE THE ECONOMIZER DAMPER HAS REACHED IT'S FULL OPEN POSITION, THE RETURN DAMPER IS FULLY CLOSED, AND THE OUTDOOR AIR TEMPERATURE IS GREATER THAN 55°F, ENABLE THE HEAT WHEEL AND THE RELIEF AIR STREAM EVAPORATIVE COOLING SECTION, AND MODULATE THE HEAT RECOVERY WHEEL TO MAINTAIN THE CURRENT SUPPLY AIR TEMPERATURE SETPOINT. INCREASE THE SPEED OF THE HEAT WHEEL TO INCREASE COOLING AFFECT.

IF THE HEAT WHEEL IS AT MINIMUM SPEED, AND THE SUPPLY AIR TEMPERATURE FALLS MORE THAN 2°F (ADJ) BELOW SETPOINT, DISABLE THE RELIEF AIR STREAM EVAPORATIVE COOLING SECTION AND HEAT WHEEL, RETURN TO ECONOMIZER ONLY OPERATION.

ON INCREASING DEMAND FOR COOLING, WITH THE RELIEF AIR STREAM EVAPORATIVE COOLING SECTION IN OPERATION, AND THE HEAT WHEEL REACHES 90% OF IT'S MAXIMUM SPEED, ENABLE THE SUPPLY AIR STREAM EVAPORATIVE COOLING SECTION PUMPS IN STAGES AS IDENTIFIED BELOW:

	1/3 CAPACITY PUMP	2/3 CAPACITY PUMP
STAGE 0:	DISABLE	DISABLE
STAGE 1:	ENABLE	DISABLE
STAGE 2:	DISABLE	ENABLE
STAGE 3:	ENABLE	ENABLE

ADD #1

AT EACH STAGE, CONTINUE TO MODULATE THE HEAT RECOVERY WHEEL TO MAINTAIN THE CURRENT SUPPLY AIR TEMPERATURE SETPOINT UNTIL THE HEAT WHEEL REACHES 90% OF IT'S MAXIMUM SPEED, THEN ADVANCE TO THE NEXT STAGE.

IF THE SUPPLY AIR TEMPERATURE FALLS MORE THAN 2°F (ADJ) BELOW SETPOINT FOR MORE THAN 15 MINUTES, REDUCE THE STAGE LEVEL OF THE SUPPLY AIR EVAPORATIVE COOLING SECTION UNTIL IT IS FULLY DISABLED (STAGE 0) WITH ONLY THE RELIEF AIR STREAM EVAPORATIVE COOLING SECTION ENABLED.

SUMMER UNOCCUPIED MODE MINIMUM COOLING
IF THE OUTSIDE AIR TEMPERATURE IS GREATER THAN 65°F DURING UNOCCUPIED MODE, THE RTU SHALL BE ENABLED TO RUN IN COOLING MODE WITH THE RELIEF AIR STREAM EVAPORATIVE COOLING SECTION ONLY IN OPERATION AS DESCRIBED IN THE COOLING SEQUENCE OF OPERATION.

SUPPLY AIR HUMIDITY LIMIT
WHEN THE RTU IS IN OPERATION THE BAS SHALL CONTINUOUSLY MONITOR THE SUPPLY AIR STREAM RELATIVE HUMIDITY. WHEN THE SUPPLY AIR STREAM EVAPORATIVE COOLING SECTION IS ENABLED AND THE SUPPLY AIR STREAM RELATIVE HUMIDITY EXCEEDS 80% RH (ADJ), THEN DISABLE THE SUPPLY AIR STREAM EVAPORATIVE COOLING SECTION UNTIL THE SUPPLY AIR STREAM RELATIVE HUMIDITY DROPS BELOW 70% RH (ADJ).

EVAPORATIVE COOLING MAINTENANCE
THE EVAPORATIVE SECTIONS WILL AUTOMATICALLY DRAIN WHEN OAT IS LESS THAN 40°F (ADJ.) FOR 60 MINUTES (ADJ.). THE EVAPORATIVE COOLER SUMP WILL FILL ONLY WHEN THE OUTSIDE AIR TEMPERATURE EXCEEDS 55°F.

WHEN ANY OF THE EVAPORATIVE COOLING SECTIONS HAVE BEEN USED IN THE PREVIOUS 24 HOURS, PROVIDE A DRY-OUT CYCLE OF 60 MINUTES (ADJ.) TO OCCUR DAILY BETWEEN 5 AM AND 6 AM, DURING WHICH SUPPLY AND RELIEF FANS SHALL RUN.

PROVIDE A WEEKLY SUMP DRAINAGE CYCLE TO COINCIDE WITH THE EVAPORATIVE COOLER DRY-OUT CYCLE.

OUTSIDE AIR VENTILATION RATE CONTROL:
A DEMAND CONTROLLED VENTILATION STRATEGY SHALL BE APPLIED WITH CO2 SENSORS LOCATED IN THE FOLLOWING ROOMS; 130 CLP AND 220 MEETING ROOM.

THE RATE OF OUTSIDE AIR VENTILATION SHALL BE CONTINUOUSLY MONITORED BY THE OUTSIDE AIR FLOW MONITORING STATION. DURING OCCUPIED HOURS, THE RATE OF OUTSIDE AIR SHALL BE ADJUSTED BETWEEN APP. 2100 CFM AND 4500 CFM AS INDICATED BELOW.

CONTINUOUSLY MONITOR THE CO2 LEVELS AT EACH OF THE SPACES LISTED ABOVE AND MODULATE THE MINIMUM OUTSIDE AIR DAMPER IN ORDER TO MAINTAIN A CO2 LEVEL OF NO HIGHER THAN 800 PPM (400 PPM AMBIENT + 400 PPM DIFFERENTIAL) IN THE MOST DEMANDING ZONE. NOTE: THIS SETPOINT MAY BE LOWERED AS OPERATIONAL SITUATIONS REQUIRE, BUT DO NOT INCREASE!

AS OCCUPANCY AND CO2 LEVELS INCREASE, INCREASE THE AMOUNT OF OUTSIDE AIR IN ORDER TO MAINTAIN THE CRITICAL SPACE CO2 LEVEL SETPOINT, OR UNTIL THE MAXIMUM VENTILATION RATE IS REACHED.

AS OCCUPANCY AND CO2 LEVELS DECREASE BELOW 600 PPM (ADJ) IN THE MOST DEMANDING ZONE, DECREASE THE AMOUNT OF OUTSIDE AIR IN ORDER TO MAINTAIN THE CRITICAL SPACE CO2 LEVEL SETPOINT, OR UNTIL THE MINIMUM VENTILATION RATE IS REACHED.

CONTINUOUSLY MONITOR AND TREND RETURN AIR CO2, AND SPACE CO2 LEVELS FOR ALL SENSORS.

ISSUE A VISUAL ALARM THROUGH THE BAS WORKSTATION IF ANY OF THE FOLLOWING CONDITIONS ARE PRESENT:
- MONITORED RETURN AIR CO2 LEVEL IS MORE THAN 1000 PPM.
- OUTSIDE AIR VENTILATION RATE IS LESS THAN THE MINIMUM CFM QUANTITY.
- ANY SPACE CO2 LEVELS EXCEED 880 PPM (10% ABOVE SETPOINT).

MAINTAIN DATA HISTORY OF CO2 LEVELS AND OUTSIDE AIR VENTILATION RATES TAKEN AT REGULAR INTERVALS, NOT LESS THAN EVERY 15 MINUTES.

ALARMS
- SUPPLY FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
- SUPPLY FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
- SUPPLY FAN VFD FAULT
- RETURN FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
- RETURN FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
- RETURN FAN VFD FAULT.
- HIGH SUPPLY AIR STATIC PRESSURE: IF THE SUPPLY AIR STATIC PRESSURE IS 25% (ADJ.) GREATER THAN SETPOINT.
- LOW SUPPLY AIR STATIC PRESSURE: IF THE SUPPLY AIR STATIC PRESSURE IS 25% (ADJ.) LESS THAN SETPOINT.
- HIGH SUPPLY AIR HUMIDITY, GREATER THAN 85% RH
- HIGH RETURN AIR HUMIDITY, GREATER THAN 55% RH
- DIRTY FILTER PRESSURE DROP GREATER THAN 0.75"
- RTU LEAK DETECTION SYSTEM ALARM
- DUCT SMOKE DETECTOR

UNDER FLOOR DISCHARGE DAMPERS
IN OCCUPIED MODE MODULATE UNDER FLOOR DAMPERS IN UNISON (BY FLOOR) TO MAINTAIN 0.05" W.C. PRESSURE DIFFERENTIAL (BASED ON LOWEST SENSOR INDICATION) BETWEEN THE UNDER FLOOR PLENUM AND ABOVE FLOOR SPACE.

IN UNOCCUPIED MODE, WITH THE RTU OFF, THE UNDER FLOOR DAMPERS WILL REMAIN IN THEIR LAST POSITION UNTIL RESUMPTION OF THE NEXT OCCUPIED SCHEDULE.

RTU-1 CONTROL DIAGRAM

NOT TO SCALE

ROOFTOP UNIT POINTS LIST

TAG	DESCRIPTION	TYPE
1	RETURN AIR TEMPERATURE	AI
2	MIXED AIR TEMPERATURE	AI
3	HEAT WHEEL START/STOP	BO
4	TEMPERATURE SWITCH LOW	BI
5	DISCHARGE AIR TEMPERATURE	AI
6	RELIEF AIR DAMPER	BO
7	RELIEF AIR DAMPER END SWITCH	BI
8	HEATING WATER CONTROL VALVE	AO
9	DIRECT EVAP PUMP ENABLE/DISABLE	BO
10	EXHAUST FAN STATUS (CURRENT SWITCH)	BI
11	EXHAUST FAN START/STOP	BO
12	EXHAUST FAN FAULT STATUS	BI
13	EXHAUST FAN VFD SPEED CONTROL	AO
14	DIRECT EVAP 1/3 PUMP ENABLE/DISABLE	BO
15	DIRECT EVAP 2/3 PUMP ENABLE/DISABLE	BO
16	COIL PUMP START/STOP (HWCP-3)	BO
17	COIL PUMP STATUS (CURRENT SWITCH)	BI
18	DUCT SMOKE DETECTOR	BI
19	RELIEF AIR TEMP	AI
20	HEAT WHEEL STATUS	BI
21	FILTER PRESSURE SENSOR	BI
22	FILTER PRESSURE SENSOR	BI
23	HEAT RECOVERY SOURCE TEMPERATURE	AI
24	OUTSIDE AIR MINIMUM DAMPER	AO
25	OUTSIDED AIR ECONOMIZER DAMPER	AO
26	PRE-HEAT/PRE-COOL TEMPERATURE	AI
27	RETURN AIR CO2	AI
28	UNDER FLOOR DIFFERENTIAL PRESSURE SENSOR (8)	AI
29	UNDER FLOOR MOTORIZED DAMPER (8)	AO
30	SUPPLY FAN STATUS (CURRENT SWITCH)	BI
31	SUPPLY FAN START/STOP	BO
32	SUPPLY FAN FAULT STATUS	BI
33	SUPPLY FAN VFD SPEED CONTROL	AO
34	SA DUCT HIGH PRESSURE	BI
35	SA DUCT STATIC PRESSURE	AI
36	RETURN AIR RELATIVE HUMIDITY	AI
37	OUTSIDE AIR FLOW MONITOR	AI
38	HEAT WHEEL VFD SPEED CONTROL	AO
39	FILTER PRESSURE SWITCH	BI
40	RETURN AIR DAMPER	AO
41	HEAT WHEEL VFD GENERAL ALARM	BI
42	INTERIOR/EXTERIOR BUILDING PRESSURE SENSOR	AI
43	SUPPLY AIR RELATIVE HUMIDITY	AI
44	RTU LEAK DETECTION SYSTEM STATUS	BI
45	RTU LEAK DETECTION SYSTEM ALARM	BI
46	DRAIN SOLENOID VALVES (3 – EXHAUST EVAP SYSTEM)	BO
47	DRAIN SOLENOID VALVES (3– SUPPLY EVAP SYSTEM)	BO

TYPICAL UNDER FLOOR FAN COIL UNIT & ZONE CONTROL DIAGRAM

NOT TO SCALE

ADD #1

SEQUENCE OF OPERATION, FLOOR DIFFUSERS & UNDER FLOOR FCU'S:

LOCAL ZONE CONTROL
IF THE FCU SERVES AN AREA THAT CONTAINS MORE THAN ONE ZONE THERMOSTAT SERVING FD-3 FLOOR DIFFUSERS, THE BAS SHALL TREAT THE STATS AS A GROUP, USING THE MAXIMUM AND MINIMUM TEMPERATURE VALUES FOR COOLING AND HEATING CONTROL AS DESCRIBED BELOW. WHERE THERE ARE NO ZONE STATS SERVING FD-3 FLOOR DIFFUSERS, THE LOCAL ZONE STAT SHALL CONTROL THE FCU DIRECTLY.

OCCUPIED MODE
FOR COOLING, MODULATE THE FD-3 FLOOR DIFFUSERS FIRST TO MAINTAIN A MAXIMUM SPACE TEMPERATURE OF 75°F (ADJ). IF THE FLOOR DIFFUSERS ARE 100% OPEN AND THE SPACE TEMPERATURE IS ABOVE LOCAL SETPOINT FOR MORE THAN 10 MINUTES (ADJ), THE FCU ECM MOTOR SHALL BE ENABLED AND MODULATED TO ACHIEVE AND MAINTAIN SPACE TEMPERATURE SETPOINT.

FOR HEATING, MODULATE THE FD-3 FLOOR DIFFUSERS TO MINIMUM POSITION (30% OF MAXIMUM COOLING) TO MAINTAIN SPACE TEMPERATURE OF 68°F (ADJ). IF SPACE TEMPERATURE IS BELOW THE LOCAL SETPOINT FOR MORE THAN 10 MINUTES (ADJ), THE FCU ECM MOTOR SHALL BE ENABLED AT MINIMUM SPEED AND THE HOT WATER VALVE SHALL BEGIN MODULATING TO ACHIEVE AND MAINTAIN SPACE TEMPERATURE SETPOINT..

UNOCCUPIED MODE
THERE IS NO UNOCCUPIED COOLING MODE, IF THE RTU IS NOT RUNNING. IF THE RTU IS RUNNING IN MINIMUM COOLING MODE, THEN MODULATE THE FD-3 FLOOR DIFFUSERS TO MAINTAIN A MAXIMUM SPACE TEMPERATURE 78°F (ADJ), BUT DO NOT ENABLE THE FCU. FOR HEATING, IF THE SPACE TEMPERATURE FALLS BELOW 58°F (ADJ) THE FD-3 FLOOR DIFFUSER(S) SHALL BE OPENED AND THE FCU SHALL BE ENABLED AT MINIMUM SPEED. THE HOT WATER VALVE SHALL MODULATE TO ACHIEVE AND MAINTAIN SPACE TEMPERATURE SETPOINT.

MORNING WARMUP
IF THE OUTSIDE AIR TEMPERATURE IS LESS THAN 45°F (ADJ) DURING UNOCCUPIED MODE, ENABLE MORNING WARMUP BY RESETTING LOCAL SETPOINT UP FROM 58°F TO THE NORMAL OCCUPIED SETPOINT 68°F (ADJ) 60 MINUTES PRIOR TO THE START OF THE NEXT OCCUPIED PERIOD. THE RTU WILL NOT BE ENABLED DURING THIS PERIOD, BUT LOCAL HEATING WILL BE THROUGH THE UNDER FLOOR FCU'S AS DESCRIBED ABOVE.

UNDER FLOOR FCU POINTS LIST

TAG	DESCRIPTION	TYPE
1	FAN STATUS	BI
2	FAN START/STOP	BO
3	SPACE TEMP	AI
4	VALVE POSITION	AO
5	DISCHARGE AIR TEMPERATURE	AI
6	FAN SPEED (ECM MOTOR)	AO
7	FLOOR DIFFUSER FD-3 DAMPER (TRI-STATE 24VAC)	BO
8	SPACE CO2 SENSOR (WHERE INDICATED ON PLANS)	AI
9	FILTER HIGH PRESSURE SWITCH	BI

COLORADO REGISTERED PROFESSIONAL ENGINEER 28801 BRIAN D. MISAKOWICZ
1/3/12
W.D.B.L

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2/2/2012	ADDENDUM 01

MECHANICAL CONTROL DIAGRAMS

M-302

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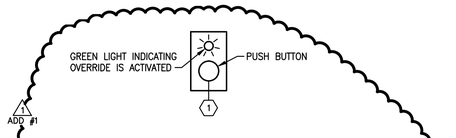


BUILDING SYSTEM OVERRIDE CONTROL DIAGRAM (RTU-1 & RTU-2)

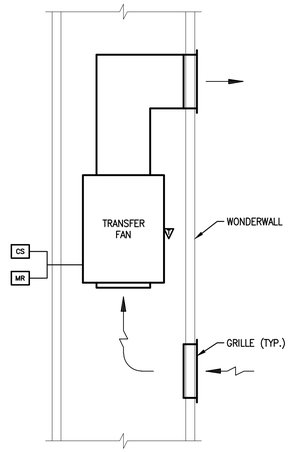
NOT TO SCALE

UNOCCUPIED MODE OVERRIDE POINTS LIST		
TAG	DESCRIPTION	TYPE
1	OVERRIDE ENABLE	BI

SEQUENCE OF OPERATION:

WHEN OVERRIDE SWITCH IS ACTIVATED, THE BAS SHALL PUT ROOFTOP UNIT AND ALL ASSOCIATED BUILDING HVAC SYSTEMS INTO "OCCUPIED" MODE OPERATION FOR A DURATION OF 2 HOURS (ADJ). THE TIMER SHALL NOT ACCUMULATE 2 HOUR INCREMENTS IF PUSHED MORE THAT ONCE BUT RATHER RESET TIMER FOR 2 HOURS WHEN ACTIVATED.

COORDINATE LOCATION OF BUILDING SYSTEM OVERRIDE SWITCH WITH OWNER.



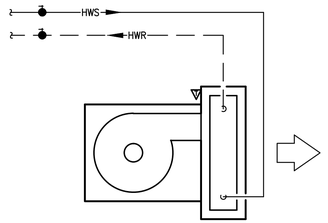
WONDERWALL TRANSFER FAN CONTROL DIAGRAM (TF-5)

NOT TO SCALE

TRANSFER FAN POINTS LIST		
TAG	DESCRIPTION	TYPE
1	FAN ENABLE/DISABLE	BO
2	FAN STATUS	BI

SEQUENCE OF OPERATION

FAN SHALL BE ENABLED WHEN OUTSIDE AIR IS 45°F OR LESS. FAN SHALL RUN CONTINUOUSLY. DISABLE FAN WHEN OUTSIDE AIR IS 48°F OR GREATER.

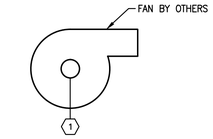


UNIT HEATER CONTROL DIAGRAM

NOT TO SCALE

SEQUENCE OF OPERATION

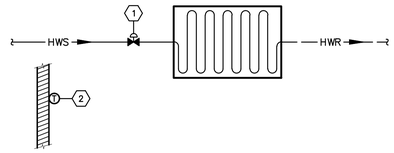
THE LINE VOLTAGE, UNIT MOUNTED, THERMOSTAT SHALL CYCLE FAN ON/OFF TO MAINTAIN SPACE TEMPERATURE. HOT WATER COIL RUNS WILD.



UNDER SLAB VENTING CONTROL DIAGRAM

NOT TO SCALE

UNDER SLAB VENT POINTS LIST		
TAG	DESCRIPTION	TYPE
1	FAN STATUS (TYPICAL OF 4)	BI



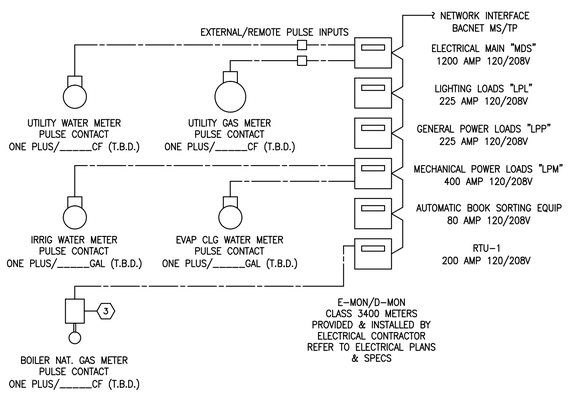
RADIANT HEATING PANEL CONTROL DIAGRAM

NOT TO SCALE

RADIANT HEATING PANEL POINTS LIST		
TAG	DESCRIPTION	TYPE
1	CONTROL VALVE	AO
2	SPACE SENSOR	AI

SEQUENCE OF OPERATION

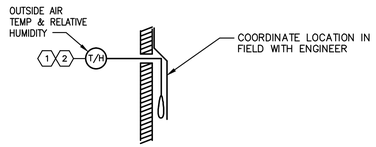
THE SPACE THERMOSTAT / SENSOR SHALL MODULATE THE NORMALLY OPEN HEATING VALVE TO MAINTAIN SPACE SETPOINT.



NOTE: METER REMOTE PULSE CONTACTS ARE NOT LIMITED TO TERMINATION AT THE DEVICE SHOWN. REMOTE PULSE CONTACTS CAN BE TERMINATED AT THE NEAREST E-MON D-MON LOCATION, MAXIMUM 2 PULSE INPUTS PER DEVICE.

SUB-METER INPUT DIAGRAM AND MISC. INPUT POINTS

NOT TO SCALE



SUB-METER & MISC. INPUT POINTS LIST		
TAG	DESCRIPTION	TYPE
1	OUTDOOR AIR TEMPERATURE	AI
2	OUTDOOR AIR RELATIVE HUMIDITY	AI
3	BOILER GAS METER FLOW, CORRECTED SCFH	AI

SEQUENCE OF OPERATION

METERING
COLLECT AND LOG METERED DATA THROUGH THE BAS INTERFACE WITH E-MON D-MON METERS, INSTALLED BY ELECTRICAL CONTRACTOR, AS SHOWN. COORDINATE FINAL PULSE CONTACT MULTIPLIERS, WITH UTILITY OR METER INSTALLER. REFER TO ELECTRICAL PLANS & SPECS FOR DETAILS.

METER DATA SHALL BE COLLECTED AND LOGGED THROUGH THE ANDOVER BAS AND STORED AT THE LOCAL WORKSTATION COMPUTER. ACCUMULATE AND TREND THE FOLLOWING MINIMUM INFORMATION AT A MINIMUM 15 MINUTE INTERVAL:

OUTSIDE AIR: CURRENT TEMPERATURE AND RELATIVE HUMIDITY

ELECTRIC: VOLTS/PHASE, AMPS/PHASE, POWER FACTOR/PHASE CURRENT KW, TOTAL CUMULATIVE KWH

1 ADD #1

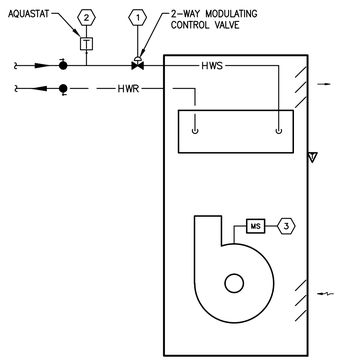
GAS: TOTAL CUMULATIVE SCF, OR MCF FROM PULSE INPUTS
CURRENT RATE OF FLOW, SCFH, USING INTEGRATION OVER TIME (WITH APPLIED PRESSURE CORRECTION FACTOR)
OR DIRECT FLOW RATE INPUT VIA A/I WHERE AVAILABLE.
METER SHALL BE BY ONICON, WITH INTEGRATED NETWORK CAPABILITY (BACNET OR MODBUS).

WATER: TOTAL CUMULATIVE GALLONS, OR MGAL FROM PULSE INPUTS
CURRENT RATE OF FLOW, GPM, USING INTEGRATION OVER TIME.
METER SHALL BE NIAGRA MTX SERIES, DRY PULSE CONTACT OUTPUT WITH COUNTER (TOTALIZER).

GRAPHIC DISPLAY
IN CONJUNCTION WITH OWNER, DEVELOP APPROPRIATE GRAPHIC DISPLAY OF BUILDING ENERGY USE. POSSIBLE VALUES TO DISPLAY MIGHT INCLUDE THE FOLLOWING:

OUTDOOR TEMP & HUMIDITY: CURRENT, MONTHLY MAX & MIN VALUES
ELECTRICAL USAGE: CURRENT BLDG KW, MONTHLY TOTALIZED KWH
NATURAL GAS USAGE: CURRENT BLDG THERMS, MONTHLY TOTALIZED THERM

DEVELOP METHODOLOGY TO ALLOW COMPARISON OF BLDG ENERGY USE WITH A "TYPICAL" BLDG OF SIMILAR FUNCTION, EITHER ON AN INSTANTANEOUS OR CUMULATIVE MONTHLY OR YEARLY BASIS.



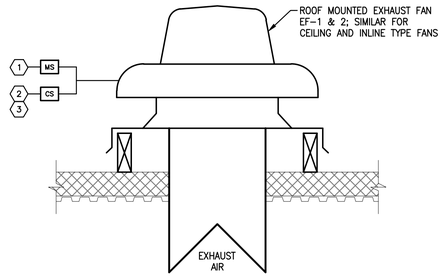
TYPICAL CUH CONTROL DIAGRAM

NOT TO SCALE

CUH POINTS LIST		
TAG	DESCRIPTION	TYPE
1	HEATING COIL VALVE	AO
2	AQUASTAT	BI
3	FAN ENABLE/DISABLE	BO

SEQUENCE OF OPERATION

THE THERMOSTAT SHALL MODULATE THE NORMALLY OPEN HEATING VALVE AND CYCLE THE FAN TO MAINTAIN SETPOINT. THE AQUASTAT SHALL PREVENT THE UNIT FROM RUNNING WHEN HOT WATER IS NOT AVAILABLE.



EXHAUST FAN CONTROL DIAGRAM (EF 1-4)

NOT TO SCALE

EXHAUST FAN POINTS LIST		
TAG	DESCRIPTION	TYPE
1	FAN ENABLE/DISABLE	BO
2	FAN STATUS	BI
3	FAN ALARM	BI

SEQUENCE OF OPERATION

EF-2 & EF-4
ENABLE FANS DURING OCCUPIED MODE AND DISABLE DURING UNOCCUPIED MODE. BAS SHALL ALARM IF FAN STATUS IS NOT PROVEN.

EF-3
FAN SHALL RUN CONTINUOUSLY. BAS SHALL ALARM IF FAN STATUS IS NOT PROVEN.

EF-1
FAN CONTROLLED BY WALL SWITCH; RE: DIVISION 26.

COLORADO REGISTERED PAUL B. MISKOWSKI 29801 PROFESSIONAL ENGINEER
1/13/12
W.D.B.L.

OWNERSHIP OF DOCUMENTS:
ALL DRAWINGS, SPECIFICATIONS AND OTHER WORK PRODUCT OF THE ENGINEER FOR THIS PROJECT ARE INSTRUMENTS OF SERVICE FOR THIS PROJECT ONLY AND SHALL REMAIN THE PROPERTY OF THE ENGINEER WHETHER THE PROJECT IS COMPLETED OR NOT. REUSE OF ANY OF THE INSTRUMENTS OF SERVICE OF THE ENGINEER BY THE OWNER OR EXTENSIONS OF THIS PROJECT WITHOUT WRITTEN PERMISSION OF THE ENGINEER SHALL BE AT THE OWNER'S RISK AND THE OWNER AGREES TO DEFEND, INDEMNIFY AND HOLD HARMLESS THE ENGINEER FROM ALL CLAIMS, DAMAGES, AND EXPENSES INCLUDING ATTORNEYS' FEES ARISING OUT OF UNAUTHORIZED REUSE OF THE ENGINEER'S INSTRUMENTS OF SERVICE BY THE OWNER OR BY OTHERS ACTING THROUGH THE OWNER.

studiotrope
design collective
1942 Nelson Street · Denver, CO 80205 · 303.308.1144 · www.studiotrope.com

OWNER
CITY AND COUNTY OF DENVER
201 W. Colfax Ave.
DENVER, COLROADO 80202

CIVIL ENGINEER
SAN ENGINEERING
6099 Windermere St.
LITTLETON, COLORADO 80120
P. 303.953.9014
F. 303.953.9016
www.sanengineeringllc.com

LANDSCAPE ARCHITECT
MUNDUS BISHOP
333 West Colfax Ave. #350
Denver, Colorado 80204
P. 303.865.5500
F. 303.865.5504
www.mundusbishop.com

STRUCTURAL ENGINEER
STUDIO NYL
2995 Baseline Road, Suite 314
Boulder, Colorado 80303
P. 303.558.3145
F. 303.440.8536
www.studionyl.com

MECH/PLUMB ENGINEER
BCER ENGINEERING
5420 Ward Road, Suite 200
Arvada, Colorado 80002-1838
P. 303.422.7400
F. 303.422.7900
www.bcer.com

ELECTRICAL ENGINEER
BCER ENGINEERING
5420 Ward Road, Suite 200
Arvada, Colorado 80002-1838
P. 303.422.7400
F. 303.422.7900
www.bcer.com

AV-IT-SECURITY
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130 W. 5th Ave.
Denver, Colorado 80204
P. 303.278.1532
F. 303.278.8533
www.ambient-e.com

PROJECT: WEST DENVER BRANCH LIBRARY
1498 NORTH IRVING STREET
DENVER, COLORADO 80204

dDC PROJECT NO: 1020.00
CCOD PROJECT NO: CIE 02089

ISSUE DATE	PHASE
1/12/2012	100% CD
2/2/2012	ADDENDUM 01

MECHANICAL CONTROL DIAGRAMS

M-304

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XREFS={xx-tb} Layouts={M-304 MECHANICAL CONTROL DIAGRAMS}
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CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS

CONTRACT NO. 201204517
PROJECT NAME: WEST DENVER LIBRARY

ADDENDUM NO. 2 TO CONTRACT DOCUMENTS

Bidders are hereby instructed that the drawings, specifications, and other contract documents are modified, corrected, supplemented and/or superseded for the above mentioned project as hereinafter described in the following attachments:

BID FORM AND SUBMITTAL PACKAGE

None

BID DOCUMENT PACKAGE

None

CLARIFICATIONS

- Requests for "Prior Approvals" will not be accepted prior to the Bid Opening to be held on March 1, 2012.
- Addendum 01, **REVISE** Drawing List Full Sheet from "A-532" to "A-521".

QUESTIONS AND ANSWERS

1) QUESTION: I do not see a hardware group for the following doors. Door #101C, #233 and #301. Any information on this hardware would be appreciated.

   CITY RESPONSE:
   a) Door 101C, provide Hdw Set 13.
   b) Door 233 is an access door with integral hardware.
   c) Door 301C, provide Hdw Set 6.

   Refer to Addendum 02, revisions to Specification Section 87100.

2) QUESTION: Question: Detail 4 on sheet A-510 shows glazing at the Window Eye Assembly. This glazing is referred to on Section 1 on Sheet A-324 as a 12-14" Glazed opening. Please identify this glass type.

   CITY RESPONSE: Refer to Addendum 01, Specification Items C. 086300 METAL-FRAMED SKYLIGHT, D.088000 GLAZING; and Drawings Items G. A-512 OPTIC WINDOW ASSEMBLY DETAILS, H. A-513 OPTIC WINDOW ASSEMBLY DETAILS

3) QUESTION:
   a) There is a note on Section 1 of Sheet A-324 that makes reference to a load of 30# per window for lenses at the Window Eye Assembly. A quick search of the specifications and plans has not turned up the particulars of this item.
   b) Is this the location of the Item referred to as Unit Price #1?
   c) Please provide a Specification for the "Optic Window Assembly" referred to on Unit Price #1.
   d) Also clarify that there are none of these assemblies included in the Base Bid.

   CITY RESPONSE:

a) Refer to clarification in Addendum 02 to sheet A-324 and A-510 and refer to Addendum 01, Specification Items C. 086300 METAL-FRAMED SKYLIGHT, D.088000 GLAZING; and Drawing Items G. A-512 OPTIC WINDOW ASSEMBLY DETAILS, H. A-513 OPTIC WINDOW ASSEMBLY DETAILS
b) Yes, Section 1 on Sheet A-324 as well as the above listed documents relate to Bid Form Submittal, Page BF-7, Unit Price Disclosure a and b.
c) Refer to Addendum 01, Specification Items C. 086300 METAL-FRAMED SKYLIGHT, D.088000 GLAZING; and Drawing Items G. A-512 OPTIC WINDOW ASSEMBLY DETAILS, H. A-513 OPTIC WINDOW ASSEMBLY DETAILS
d) Incorrect, Bid Form Submittal, Page BF-7, Unit Price Disclosure states. "… include these amounts in the Total Lump Sum Bid Amount:"

4) QUESTION: Please identify window openings for Add Alt. #6. Are you referring to S22 and S33?

CITY RESPONSE: Refer to Sheet A-201; KEYNOTES: refer to keynote " 1.05 Additive Alternate 6: Windows in Children's Area" ; Detail 1 West Elevation points to window S33 with keynote 1.05. Detail 2 South Elevation points to windows S51 and S52. Refer also to Addendum 02, clarification to sheet A-601

5) QUESTION: Please provide more detail on the Screen Assemblies on Sheet A-500 and A-501. Specifically a section through the Aluminum Panels showing the "Threads" and Pickets and means of connection of these items. Please clarify how these panels attach to the Battens.

CITY RESPONSE:
Definitions of terminology:
a) "SCREEN" : Façade covering on the north and east elevations identified as Aluminum Panels on Sheet A-501. It is envisioned that each Aluminum Panel will be shop fabricated and hung onto building Battens on site.
b) "BATTENS" : Aluminum tubing, pre-finished, secured to building façade to receive Aluminum Panels.
c) "THREADS" : Aluminum plates of varying width, pre-finished, mechanically fastened to Pickets. Corner Threads, as identified, shall have welded, mitered corners prior to pre-finishing.
d) "PICKETS" : Aluminum plate, pre-finished, mechanically fastened to battens.
Also, refer to Addendum 02, Sheets A-500, A-501, A-504

6) QUESTION: Keynotes 12.14 & 12.15 on Sheet A-130 make reference to owner provided roller window shades. Is the owner furnishing these items. There is not a Section for Owner Furnished Items.

CITY RESPONSE: The Contractor is required to furnish roller window shades. Refer to Addendum 01, Drawings Items D. 131 LEVEL 2 RCP & Sheet A-130 Level 1 RCP. Also, refer to Construction Documents: keynotes on Sheets A-110 and A-111 and Specification Section 01010 Summary of Work for a detailed listing of the Owner provided items.

7) QUESTION: Form BF-14 of the Bid Form submittal package makes reference to MBE/WBE or SBE participation. Is SBE participation allowed as part of the goals for this project?

CITY RESPONSE: The goal assigned to this project is 30.00% M/WBE. Therefore you must utilize only M/WBE's; no SBE participation will be allowed for this project. BF-14 is a standard DSBO form that is inserted for M/WBE and SBE projects. For future reference please be aware of the goal that is stated and assigned on the Notice of Invitation to Bid.

8) QUESTION: On sheets L 101 and L 401, there appears to be a thin strip of sod running along the edge of the parking lot, either acting as the gutter or sitting adjacent to it. Is this intended to be sod?

CITY RESPONSE: Delete the 'SOD' hatch, along the curb. Refer to C-101 for clarification of scope.

9) QUESTION: Are you requiring a certified Systimax installer for your cabling installation? What is being asked for in 1.4 A & B are essentially on-line certificates that any contractor can get and the one year warranty period is covered by the manufacturer for any contractor as well. Not the certified Systimax VARs'. 2.2 G makes reference to the Manufacturer's 1 year warranty which can also be provided by any contractor.

CITY RESPONSE: The City and County of Denver cabling standard is SYSTIMAX, however they do not require the system be installed by a SYSTIMAX VAR. CCOD has not requested the 20-Year SYSTIMAX warranty. The requested warranty is 1-year materials and labor as stated.

10) QUESTION: Is there a distributor that holds special pricing for the Systimax product (i.e., Anixter, Graybar).

CITY RESPONSE: The City does not have any special pricing arrangements with suppliers and vendors for Systimax products.

11) QUESTION: This spec section glazing::::"is not clear. It states 50% coverage and then says 60% coverage. It can't be both. The performances are different and we can't figure them out with the information provided. Also, we are unsure what the S-54 is.

CITY RESPONSE: Refer to Addendum 01, Specification Item D. 088000 GLAZING

12) QUESTION: Could you please clarify the difference between the broom finish and the light sand blast finish, shown on drawing L401. The hatch difference is not very visible on the plans.

CITY RESPONSE: All concrete sidewalks are to have broom finish. Delete reference to light sand blast finish.

13) QUESTION:
    a) The Graphics Open Computing 201 East signage is specified as vinyl. Door frames/other surfaces will create tricky geometry, and overall size of sign is quite large for readily-available vinyl sheet material. Request ability to substitute masking of area followed by latex painted signage.
    b) Children's Area South Graphic. Is direct to substrate digital print on pvc backer acceptable?
    c) Emergency Exit Wall Maps. Is pvc backer acceptable?

CITY RESPONSE:
    a) Request is denied
    b) PVC backer is unacceptable
    c) PVC backer is unacceptable

14) QUESTION:
    a) The Shaft wall schedule lists a CW1 but the corresponding section view is for a PC1.
    b) We see the PC1 on the floor plans but have not seen CW1.
    c) Please add PC1 to schedule with description.
    d) Partition P2 – is that to be a 3" Mtl Stud, the width of the partition is called out as 4-7/8" but the description components add up to 4-7/8"?

CITY RESPONSE:
    a) CW1 is not used. Refer to Addendum 02, revisions to Sheet G-003
    b) CW1 is not used. Refer to Addendum 02, revisions to Sheet G-003
    c) Refer to Addendum 02, revisions to Sheet G-003
    d) Wall Type – Partition P2 is correctly documented. As a point of clarification, P2 only has 1 layer of 5/8" GWB on one side only

15) QUESTION:
    a) Will (or Has) the developer be responsible for obtaining a Storm water General Permit from the State of Colorado for the entire site?
    b) If not, will be the Civil Engineer be responsible for providing a SWMP that can be used to obtain a State permit?

CITY RESPONSE:

a) The developer of the entire Mile High Vista property is responsible for obtaining the Storm water Permit for the work that they are performing. In addition, the Contractor for the Library project shall be responsible for obtaining the Storm water Permit for the work specific to the Library site.
b) The City and County of Denver has requested the West Denver Branch Library Civil Engineer prepare and submit a SWMP. This is in progress.

16) QUESTION: Specification section 051200, section 1.6 A and B call for AISC-Certified Erectors and an AISC-Certified Plant. Is this requirement mandatory?

CITY RESPONSE: The Contractor is to provide AISC requirements as specified.

17) QUESTION: In specification section 084513 – Structured Polycarbonate Panel Assemblies, Paragraph 2.1A, you have listed three manufacturers for the polycarbonate systems. CPI and Extech are system manufacturers while CO-EX is a panel manufacturer that does not offer systems tested to ASTM standards as required. This leaves you with only two manufacturers for the spec section. Also, you have cited in 2.1B 1e, 2e, and 3e the use of Nano Cell Honeycomb hexagon cell, 3 cell thick for the panel structure. Only one manufacturer in the world makes their panel with this structure and that is Danpalon located in Northern Israel. They have an exclusive agreement with CPI Daylighting for the marketing and sales of this panel in the US. No other manufacturer is permitted to purchase this panel in the US. No other manufacturer makes a panel with this design. Neither CPI nor Danpolon have offered empirical data to show the superiority of this panel structure. On the "Double Layer Curtainwall System", no other system manufacturer currently uses the double panel design with an interlocking "H" batten. Is it your intent to only allow this panel structure for use on this project? If that is your intent, isn't that considered a proprietary specification?
I was told by a member of your firm that pre-bid substitution requests were not permitted. Since you do not have three system manufacturers listed, would you consider our company's product for this project? We offer single panel standing seam systems using a 16mm X-Wall panel with higher structural loading than the 'honeycomb" panel specified. We, like Extech, use a 40mm single panel system for our insulated curtainwall. This system has higher insulation, higher light transmission, and lower installation costs over the double panel system. If you would consider another manufacturer for this spec section, I would like to include complete submittal data for your review to determine the suitability of our products on your project. Would you be willing to review our product?

CITY RESPONSE: Refer to Addendum 01, Clarifications regarding substitution requests. Refer to Addendum 02, clarifications added to Specification 084513 Structured-Polycarbonate-Panel Assemblies

18) QUESTION: I cannot find a requirement for a Final Improvement Survey that may be required by the City before the issuance of a CO.

CITY RESPONSE: The Contractor is to perform all surveys required to meet the regulatory requirements for improvements made to the Library site.

19) QUESTION: Over excavation of 3' is being required for the pad site. Specification Section "Clearing" 311000/3.02/B States that all exported soil shall be delivered to DADS. Does this apply to the over excavation?

CITY RESPONSE: Yes, all soil removed from site should be delivered to DADS.

20) QUESTION: ATS is the Alerton product controls contractor. We are the product at Denver Eastside Facility at 8315 Steel Street. I looked at the temperature controls specification for the West Denver Library project that bids on the 28th next week, and Westover Continuum is the only approved temperature controls contractor. If it remains this way, there will be no competition for them, thus increased pricing. If you allow us to bid this project, we can create competition for this scope of work and ultimately help the budget and pricing.

CITY RESPONSE: The Andover Continuum system is the DPL standard, and is the only product to be used in the construction of the Library.

SPECIFICATIONS:

A. TABLE OF CONTENTS – VOLUME 1 OF 2 and TABLE OF CONTENTS – VOLUME 1 OF 2, **ADD** the following specification divisions and titles.

024119	SELECTIVE STRUCTURE DEMOLITION,
086300	METAL-FRAMED SKYLIGHTS
102123	PULL CURTAINS

B. 024119 SELECTIVE STRUCTURE DEMOLITION
1. **ADD** new section, attached.

C. 102123 PULL CURTAINS
1. **ADD** new section, attached.

D. 074213 METAL WALL PANELS
1. 2.2, PANEL MATERIALS
   a. **REVISE** from "A. Concealed Fastener Wall Panels:" to "A., Concealed Fastener Wall Panels, Type A : Keynote 7.07"
   b. **REVISE** from "A. Standing Seam Panels:" to "B. Standing Seam Panels, Type B, color 1: Keynote 7.05 and Type B, Color 2: Keynote 7.06."

E. 084513 STRUCTURED-POLYCARBONATE-PANEL ASSEMBLIES
2. Paragraph 2.1.A.4; **ADD** "Approved Equal"

F. 87100 DOOR HARDWARE, make the following revisions to 3.7 DOOR HARDWARE SETS.
1. Legend: **REVISE** as indicated below

Products:	Manufacturer:
Exit Devices	from "*(BE) BEST*" to "**(DO) Dorma**"
Closers	from *"(BE) BEST*" to "**(DO) Dorma**"
O'Head Stop/Holders	from *"(BE) BEST*" to "**(DO) Dorma**"

2. Hwd Set 6**:** **ADD** Door "301"
3. Hdw Set 8: **ADD** general note "Coordinate with Keying Manufacturer at time of installation."
4. Hdw Set 10A: **DELETE**, section in its entirety.
5. Hdw Set 10B:
   a. **REVISE** set reference from "10B" to "10"
   b. **ADD** Door "246A"
6. Hdw Set 11: **REVISE** as follows:
   a. from "*INTERIOR - NON-LOCKING FUNCTION –STC RATED DOOR*"
      to "**INTERIOR –CLASSROOM FUNCTION–STC RATED DOOR**"
   b. from "*1 ea. Latch Set (BE) 93K-0-N-14D*"
      to "**1 ea. Classroom Lock (BE) 93K-7-R-14C**"

7. Hdw Set 12: **ADD** "Note: Provide Occupancy Indicator"
8. Hdw Set 13: **ADD** Door "101C"
9. Hdw Set 16: **REVISE** as follows:
   a. from "*INTERIOR – CLASSROOM FUNCTION*"
      to "**INTERIOR STOREROOM FUNCTION**"
   b. from "*1 ea. Classroom Lock (BE) 93K-7-R-14C*"
      to "**1 ea. Store Room Function (BE) 93K-7-D-14C**"
10. Hdw Set 22:
   a. **ADD** general note "Coordinate with Keying Manufacturer at time of installation."
   b. **DELETE** "1 ea. Exit Device (DO) 9300 DE x YC23"
   c. **ADD** "1 ea Electric Strike (DO) ES-111-A"
11. Hdw Set 24:
   a. **DELETE** "1 ea. Exit Device (DO) 9300 DE x YC23"

DRAWINGS:

A. G-001 CODE STUDY
   1. **REVISE** references from "2006 IBC" to "2009 IBC"

B. G-003 WALL ASSEMBLIES, revise as follows:
   1. WALL TYPE – ACOUSTIC TYPE legend **ADD** TYPE A2F. A2F shall be identical to A2 except Fire Rating shall be 1 HR.
   2. WALL TYPE – SHAFT, legend **DELETE** CW1 from legend.
   3. WALL TYPE – SHAFT, drawings **REVISE** as indicated in **attached AX-23.**
   4. WALL TYPE –WA-1, WA-1.1, **ADD** note, arrow and graphics "VAPOR BARRIOR" to match WALL TYPE –WA-2, WA-2.2.
   5. WALL TYPE – SHAFT, drawings **REVISE** as indicated in **attached AX-23**.
   6. WALL TYPE PC1, **ADD** legend as indicated in **attached AX-25.**

A. L-101 PLANTING PLAN
   1. **DELETE** the 'SOD' hatch, along the curb. Refer to C-101 for clarification of scope.

B. L-401 SITE FURNISHINGS PLAN
   1. Legend, **DELETE** note on center graphic, "LIGHT SAND BLAST FINISH"
   2. **DELETE** the 'SOD' hatch, along the curb. Refer to C-101 for clarification of scope.

C. AS-002 ENLARGED SITE PLANS
   1. Detail 8, SEC – DTL SITE PLANTER
      a. **REVISE** Level of earth to be flush with Level 01 F.F

D. AS-003 ENLARGED SITE PLANS AND ELEVATIONS
   1. **ADD** vertical handrail posts to Details 2, 3, 4, and 5 such that posts are 4'-0" O.C. max., typical of fourteen (14) additional posts.
      a. **ADD** associated thickened concrete slabs for each post.

E. A-102 LEVEL 02 FLOOR PLAN
   1. Detail 1, LEVEL 02 FLOOR PLAN
      a. **ADD** View Tag “13/A532” between Grid 4 and Grid 5 on Grid G, perpendicular to Grid G
      b. **ADD** Enlarged View Tag “14/A532” on Grid G and between Grid 4 and Grid 5

F. A-130 LEVEL 1 RCP
   1. Detail 1, LEVEL 1 RCP
      a. **ADD** Note “CURTAIN TRACK” To serpentine lines in soffit in between Grid J.2 and North of Grid G, East of Grid 2
      b. **ADD** Note and detail tag clarification for interior Aluminum Panel suspended from structure in Vestibule (102) as shown in **attached AX-14.**

G. A-131 LEVEL 2 RCP
   1. Detail 1, LEVEL 2 RCP
      a. **DELETE** GWB ceiling in Stair B (221).
      b. Light Fixture Type C in Stair B (221) shall be surface mounted to underside of structure.
      c. **ADD** Note and detail tag clarification for interior Aluminum Panel suspended from structure in Meeting Room (220) as shown in **attached AX-15**

H. A-200 BUILDING ELEVATIONS
   1. Detail 2, NORTH ELEVATION.
      a. **ADD**: window tag “S11” to level two window near gridline 5.
      b. **ADD**: window tag “S05” to stair landing level window near grid 2.5
      c. **ADD**: window tag “S06” to level two window near grid 2.5
      d. **DELETE**: window tag “S01” at grid 2.4 and refer to 6/A2.02 for clarification.
      e. **REVISE** Batten shown at grid 4.5, it shall run continuously in front of window type “S10”. See **attached AX-22**.
      f. **REVISE** Batten shown at grid 4.2, it shall run continuously in front of window type “S09”. See **attached AX-22**.
      g. As a point of **CLARIFICATION**, see **attached AX-22** for graphic corrections and notation.
   2. Detail 1, EAST ELEVATION.
      a. Keynote 10.15, Through Wall Book Return. See Sheet A-532 for clarifying detail.
      b. **REVISE** Batten shown at grid B.5, it shall run continuously in front of window type S15.
      c. **ADD** horizontal mullion in Single Layer Polycarbonate Curtain Wall System at datum 111’-6” as shown in Detail 3/A-327.
   3. GENERAL NOTES : ELEVATIONS
      a. Note 2, **DELETE** note in its entirety and replace as follows;
         1) **ADD** “Bottom of form liner shall be two (2) inches above grade in all locations, U.O.N. on drawings. Top of form liner varies as follows;
         2) At all locations where stucco is above concrete wall, form liner shall extend to top of concrete wall.
         3) At all locations where window openings are above concrete wall, form liner shall be held down two (2) inches from top of concrete wall, U.O.N. on drawings.”

I. A-201 BUILDING ELEVATIONS
   1. Detail 1, WEST ELEVATION
      a. **ADD** NOTE “ALUM BREAK METAL” To space between the door south of Grid D, and the window S32.
      b. **ADD** horizontal mullion in Single Layer Polycarbonate Curtain Wall System at datum 111’-6” as shown in Detail 3/A-327
   2. GENERAL NOTES : ELEVATIONS
      a. Note 2, **DELETE** note in its entirety and replace as follows;
         1) **ADD** “Bottom of form liner shall be two (2) inches above grade in all locations, U.O.N. on drawings. Top of form liner varies as follows;
         2) At all locations where stucco is above concrete wall, form liner shall extend to top of concrete wall.
         3) At all locations where window openings are above concrete wall, form liner shall be held down two (2) inches from top of concrete wall, U.O.N. on drawings.”

J. A-202 BUILDING ELEVATIONS
   1. Detail 6, NW CORNER ELEVATION
      a. **ADD**: window tag “S02” to glass unit just above window tag “S01” north of grid ‘X’, refer to Sheet A-600
      c. **ADD**: window tag “S03” to glass unit just above window tag “S02”, refer to Sheet A-600
   2. GENERAL NOTES : ELEVATIONS
      a. Note 2, **DELETE** note in its entirety and replace as follows;
         1) **ADD** “Bottom of form liner shall be two (2) inches above grade in all locations, U.O.N. on drawings. Top of form liner varies as follows;
         2) At all locations where stucco is above concrete wall, form liner shall extend to top of concrete wall.
         3) At all locations where window openings are above concrete wall, form liner shall be held down two (2) inches from top of concrete wall, U.O.N. on drawings.”
   3. KEYNOTES
      a. **REVISE** 7.05 from “EXTERIOR METAL CLADDING,TYPE 1” to read “METAL WALL PANEL, TYPE B, STANDING SEAM PANELS, COLOR 1”
      b. **REVISE** 7.06 From “EXTERIOR METAL CLADDING,TYPE 1” to read “METAL WALL PANEL, TYPE B, STANDING SEAM PANELS, COLOR 2”
      c. **REVISE** 7.07 From “EXTERIOR METAL CLADDING, TYPE 1” to read “METAL WALL PANEL, TYPE A: CONCEALED FASTENER WALL PANELS.”

K. A-324 WALL SECTIONS
   1. Detail 1, WALL SECTION – WEST 2. **DELETE** all notes related to optic window assembly and refer to sheets A-512 and A-513 issued in Addendum 01.
   2. As a point of **CLARIFICATION**, the exact location and orientation of windows will be determined by artist during construction.

L. A-401 INTERIOR ELEVATIONS
   1. Detail 1, STORYTIME 144 LEVEL1 – ENLARGED FLOOR PLAN
      a. **ADD** View Tag “11/A532” parallel to Grid 2 adjacent to wall.
      b. **ADD** Mirror View Tag “11/A532” parallel to Grid J adjacent to wall.

M. A-402 INTERIOR ELEVATIONS
1. Detail 3, STAFF LOUNGE 253 – SOUTH
   a. **ADD** Built–in-Bench to view as shown in **attached AX-24**
2. Detail 9, CLP 130 EAST
   a. As a point of clarification, **ADD** GWB beam wrap around beam supporting operable wall partition on grid 'D' as shown on Detail 4/A-522.
3. Detail 11, CLP 130 WEST
   a. As a point of clarification, **ADD** GWB beam wrap around beam supporting operable wall partition on grid 'D' as shown on Detail 4/A-522.

N. A-441 VERTICAL CIRCULATION
1. Detail 1, ENLARGED LEVEL 01 STAIR B PLAN
   a. **ADD** Wall Type tag "CW1F" to structural column wrap at grids '5' – 'E' and '5' – 'F'
2. Detail 4, ENLARGED LEVEL 02 STAIR B PLAN
   a. **ADD** Wall Type tag "CW1F" to structural column wrap at grids '5' – 'F'.

O. A-500 SCREEN ELEVATIONS
1. Detail 2, EXPLODED SCREEN
   a. **ADD** exploded Axon view of screen detail(s) as shown in **attached AX-7**.
2. Detail 7, EAST ELEVATION
   a. **ADD** Aluminum Panel tag "**A34**" and "**A35**" to interior aluminum panel units as shown on **attached AX-11**.
3. Detail 8, NORTH ELEVATION
   a. **ADD** Aluminum Panel tag "**A-10**" to missing aluminum panel unit between grid '3' and grid '4', third aluminum panel unit from bottom.

P. A-501 SCREEN DETAILS
1. Detail 40, ALUMINUM PANEL – A34
   a. **ADD** Aluminum Panel unit elevation as shown in **attached AX-12**.
2. Detail 41, ALUMINUM PANEL – A35
   a. **ADD** Aluminum Panel unit elevation as shown in **attached AX-12**.
3. Detail 34, PLAN DTL – BATTEN @ MULLION
   a. **REVISE** detail as shown in **attached AX-16.**
4. Detail 35, PLAN DTL – ENLARGED BATTEN @ MULLION
   a. **REVISE** detail as shown in **attached AX-17**
5. Detail 36, PLAN DTL – MTL SCREEN BATTEN
   a. **REVISE** detail as shown in **attached AX-18**
6. Detail 37, PLAN DTL – MTL SCREEN BATTEN 2
   a. **REVISE** detail as shown in **attached AX-19**
7. Detail 38, PLAN DTL – TYP BATTEN
   a. **REVISE** detail as shown in **attached AX-20**
8. Detail 39, PLAN DTL – BATTEN @ EMBED PLATE, TYP.
   a. **REVISE** detail as shown in **attached AX-21**
9. Details 16, 17, 18, 19, and 20, (Aluminum Corner Panels A16, A17, A18, A19, and A20 respectively)
   a. As a point of clarification, **ADD** the following note; "Miter ends of Threads at corner and weld the two Threads together (90 degrees), prior to painting".

Q. A-504 EXTERIOR DETAILS
1. **ADD** detail 15/A-504 as shown in **attached AX-8**
2. **ADD** detail 16/A-504 as shown in **attached AX-9**
3. **ADD** detail 17/A-504 as shown in **attached AX-10**

R. A-510 WINDOW DETAIL
   a. **DELETE** detail 4, SEC- DTL EYEBALL WINDOW.

S. A-522 WINDOW DETAIL
   1. Detail 4, SECTION – DTL OPERABLE PARTITION
      a. **ADD** sound attenuation batt insulation inside GWB wrap around structural beam.

T. A-531 CASEWORK DETAILS
   1. Detail 6/A-531, CASEWORK BEHIND CIRCULATION DESK: DELETE all upper cabinets shown, typ. of 5 cabinet shells, 10 door leafs, and all associated hardware. Provide blocking in wall in the event cabinets or shelving are added by building owner in the future.

U. A-532 INTERIOR DETAILS
   1. **ADD** detail 11/A-532 as shown in **attached AX-1**
   2. **ADD** detail 12/A-532 as shown in **attached AX-2**
   3. **ADD** detail 9/A-532 as shown in **attached AX-3**
   4. **ADD** detail 14/A-532 as shown in **attached AX-4**
   5. **ADD** detail 13/A-532 as shown in **attached AX-5**
   6. **ADD** detail 10/A-532 as shown in **attached AX-6**

V. A-600 WINDOW SCHEDULE
   1. WINDOW TYPE “S06”, **REVISE** upper pane of glass from Type ‘C’ to Type ‘D’ to match adjacent Window Type “S03”

W. A-601 WINDOW SCHEDULE
   1. As a point of clarification, **ADD** the following:
      a. **ADD** Keynote “**1.05 Additive Alternate 6: Windows in Children’s Area**”
      b. S33, **ADD** keynote “**1.05**”
      c. S51, **ADD** keynote “**1.05**”
      d. S52, **ADD** keynote “**1.05**”

X. A-602 DOOR SCHEDULE, **REVISE** Door Schedule Legend as following:
   1. Door no. 101C, as a point of **CLARIFICATION,** Door Type WWAD2 is an Interior HM door. Provide a custom interior HM door frame to fit the door dimensions.
   2. Door no. 233, as a point of **CLARIFICATION,** Door Type WWAD1 is an access door that will include its own frame and hardware.
   3. Door no. 301, as a point of **CLARIFICATION,** Door Type WWAD3 is an Exterior HM door. Provide a custom exterior HM door frame to fit the wall assembly: Structured-Polycarbonate-Panel Assemblies, 8.04 Single Layer polycarbonate Curtain Wall System and the door dimensions.
   4. FRAME TYPES, **REVISE** vertical frame dimensions from 3” to 2” at all locations.

Y. A-603 FINISH SCHEDULE
   1. Room 221 STAIR B, Ceiling Finish: **DELETE** “*PT12*”, **ADD** “N/A”

Z. S-100 GENERAL NOTES SHEET 1
   1. **REVISE** GENERAL NOTES as shown in **attached SX-1**.

AA. S-102 COLUMN SCHEDULE
   1. **REVISE** as shown in **attached full size S-102**

BB. S-200 SCREW PILE LOAD PLAN
   1. **REVISE** as shown in **attached full size sheet S-200**

CC. S-202 Second Floor Plan (structural)
1. **REVISE** as shown in **attached full size sheet S-202**

DD. S-203
1. **REVISE** as shown in **attached full size sheet S-203**

EE. S-204
1. **REVISE** as shown in **attached SX-2**

FF. S-400 FRAMING DETAILS
1. **REVISE** detail 3 TYP SKEWED CONN PLT TO SUPPORT CONN note from "CONN PLT RE: 2/S-400" to "CONN PLT RE: 6/S-301"
2. **DELETE** detail 7, FRAME BEAM TO COLUMN CONN.
3. detail 9 TYPICAL FRAME DETAIL, **REVISE** dimensions from "16" " to "1'-6"

GG. S-402 FRAMING DETAILS
1. Detail 2, TYPICAL BRACED FRAMED CONNECTION, **DELETE** REVISE dimension from "16" " to "1'-6" "

HH. M-101, Level 1 Under Floor Mechanical Plan
1. **REVISE** under floor distribution; see **attached sketches MX-02 & MX-03**.
2. **ADD** the following General Note to the sheet:
   a. PROVIDE 18" LONG SECTION OF HARD DUCT FOR BALANCING DAMPER INSTALLATION FOR ALL UNDER FLOOR DISTRIBUTION DUCTWORK.
3. **ADD** the following Work Notes to the sheet:
   a. PROVIDE 14"x14" UNDER FLOOR DEFLECTION GRILLE; PRICE MODEL NO. DGU, AT END OF FABRIC DUCT.
   b. PROVIDE 18"x14" UNDER FLOOR DEFLECTION GRILLE; PRICE MODEL NO. DGU, AT END OF DUCT.

II. M-103, Level 2 Under Floor Mechanical Plan
1. **REVISE** under floor distribution; see **attached sketches MX-04 & MX-05**.
2. **ADD** the following General Note to the sheet:
   a. PROVIDE 18" LONG SECTION OF HARD DUCT FOR BALANCING DAMPER INSTALLATION FOR ALL UNDER FLOOR DISTRIBUTION DUCTWORK.
3. **ADD** the following Work Notes to the sheet:
   a. 14" ROUND FABRIC DUCT; DASHED LINES INDICATE 16 LF OF ACTIVE, PERFORATED DUCT WITH DISCHARGE ON SINGLE SIDE FOR 900 CFM.
   b. PROVIDE 14"x14" UNDER FLOOR DEFLECTION GRILLE; PRICE MODEL NO. DGU, AT END OF FABRIC DUCT.

JJ. M-302, Mechanical Control Diagrams
1. **REVISE** Control Points 21 and 22, Filter Pressure Sensors to be ANALOG type in lieu of binary type points.
2. **DELETE** Control Point 41 tag from the control diagram at the Supply Fan.
3. *Note: Control Point 41 tag to remain on the control diagram for the Heat Wheel.*

KK. M-303, Mechanical Control Diagrams
1. **ADD** a CO2 sensor in the return air duct for RTU-2; Control Point #17.
2. **ADD** the following point to RTU-2 Points List:

Point #17	RETURN AIR CO2	AI (type)

LL. FP-101, Level 1 Fire Protection Plan

1. **ADD** the following General Note to the sheet:
   a. Sprinkler layout to presume curtain will be in “closed” position for Story Time Tower 144.

MM. E-001, Electrical Luminaire Schedule

1. **ADD** Narrative of Lighting Control System Intent. Refer to **attached sketch EX-03**

NN. E-102, Level 2 Lighting Plan

1. **ADD** work note #13. Refer to **attached sketch EX-04**.
2. **REVISE** (2) instances of work note #4 to #13 and **ADD** work note #13 adjacent to photosensor to describe the control of luminaires type M, M1, and M2. Refer to **attached sketch EX-04**.

Attachments:	# of sheets	DOCUMENTS:	
Spec. Sections:		024119	SELECTIVE STRUCTURE DEMOLITION
		102123	PULL CURTAINS
Drawings			
Full Sheets:	4	S-102, S-200, S-202, S-203	
8-1/2” x 11” Sketches:	32	AX-01 through AX-25, SX-01, SX-02, MX-02 through MX-05, EX-03, EX-04.	

This **ADDENDUM** shall be attached to, become a part of, and be returned with the Bid Proposal.

Lesley B. Thomas
City Engineer

2/23/12
Date

The undersigned bidder acknowledges receipt of this Addendum. The Proposal submitted herewith is in accordance with the stipulations set forth herein.

_____
Contractor

ADDENDUM NO. 2 DATE: _____

SECTION 024119 - SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Demolition and removal of selected site elements.

B. Related Sections include the following:
   1. Division 01 Section and 1999 Edition of Orange Book.
   2. Division 31 Section "Clearing" for site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 SUBMITTALS

A. Qualification Data: For demolition firm.

B. Schedule of Selective Demolition Activities: Indicate the following:

   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
   2. Interruption of utility services. Indicate how long utility services will be interrupted.
   3. Coordination for shutoff, capping, and continuation of utility services.
   4. Use of sidewalk and drive lanes..
   5. Locations of proposed dust- and noise-control temporary partitions and means of egress.
   6. Coordination of continuing occupancy of portions of site,
   7. Means of protection for items to remain and items in path of waste removal from building.

C. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.

D. Predemolition photograps: Show existing conditions of adjoining construction and site improvements, including finish surfaces,that might be misconstrued as damage caused by selective demolition operations. Comply with Division 01 Section and 1999 edition of the orange book before Work begins.

E. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1. Comply with submittal requirements in Division 01.

1.5 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Standards: Comply with ANSI A10.6 and NFPA 241.

D. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01 Section. Review methods and procedures related to selective demolition including, but not limited to, the following:

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
4. Review areas where existing construction is to remain and requires protection.

1.6 PROJECT CONDITIONS

A. Owner or construction crews will occupy portions of site immediately adjacent to selective demolition area. Conduct selective demolition so adjacent operations will not be disrupted.

1. Comply with requirements specified in Division 01 Section "Summary."

B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Owner will advise on removal procedures for hazardous materials under a separate contract.
2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.

D. Storage or sale of removed items or materials on-site is not permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.7 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Survey of Existing Conditions: Record existing conditions by use of **preconstruction photographs**.

1. Comply with requirements specified in the orange book regarding photographic Documentation.Requirement in subparagraph below is for treatment of historic facilities.
2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.

1. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary."

B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. **Owner** will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect existing curb and gutters and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."

3.4 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Comply with requirements specified in Division 01 and the requirements of the City and County of Denver, Department of Public Works, Standard specifications for Construction and Contract Documents, 1999 Edition (orange book).

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.6 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 102123 - PULL CURTAINS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Curtain tracks and curtain carriers.
   2. Pull curtains.

B. Related Sections include the following:
   1. Division 06 Section "Miscellaneous Rough Carpentry" for wood blocking for mounting items requiring anchorage.

1.03 SUBMITTALS

A. Product Data: Include durability, laundry temperature limits, fade resistance, and fire-test-response characteristics for each type of curtain fabric indicated.

B. Shop Drawings: Show track layouts, sizes of curtains, number of carriers, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.
   1. Include details on blocking above ceiling .

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Curtain track.
   2. Lighting fixtures.
   3. Air outlets and inlets.
   4. Speakers.
   5. Sprinklers.
   6. Access panels.

D. Samples: For each type of product required, prepared on Samples of size indicated below.
   1. Curtain Fabric: 12-inch- square swatch or larger as required to show complete pattern repeat, from dye lot used for the Work. Mark top and face of material.

E. Operation and Maintenance Data: For curtains, track, and hardware to include in operation and maintenance manuals.

1.04 PROJECT CONDITIONS

A. Environmental Limitations: Do not install pull curtains until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.01 CURTAIN TRACKS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. InPro Corporation.

2. Nelson, A. R. Co.
3. Silent Gliss USA Inc.

B. Extruded-Aluminum Track: Not less than 1-1/4 inches wide by 3/4 inch high; with minimum wall thickness of 0.058 inch.
1. Curved Track: Factory-fabricated, radius bends as indicated.
2. Finish: Baked enamel, acrylic, or epoxy.

C. Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.

D. Curtain Carriers: Two nylon rollers and nylon axle with chrome-plated steel hook.

E. Exposed Fasteners: Stainless steel.

F. Concealed Fasteners: Hot-dip galvanized.

2.02 CURTAINS

A. Pull Curtain Fabric: Architex Rx8001, Rising Sun

B. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6 inches o.c.; machined into top hem.

C. Curtain Tieback: Nickel-plated brass chain; one at each curtain termination.

2.03 CURTAIN FABRICATION

A. Fabricate curtains to comply with the following requirements:
1. Width: Equal to track length from which curtain is hung plus 10 percent added fullness, but not less than 12 inches added fullness.
2. Length: 88 inches.
3. Top Hem: Not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lock stitched.
4. Bottom Hem: Not less than 1 inch and not more than 1-1/2 inches wide, double thickness and single lock stitched.
5. Side Hems: Not less than 1/2 inch and not more than 1-1/4 inches wide, with double turned edges, and single lock stitched.

B. Vertical Seams: Not less than 1/2 inch wide, double turned and double stitched.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of work.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install tracks level and plumb, according to manufacturer's written instructions.

B. Up to 16 feet in length, provide track fabricated from 1 continuous length.
1. Curtain Track Mounting: Surface.
2. Surface Track Mounting: Fasten surface-mounted tracks at intervals of not less than 24 inches. Fasten support at each splice and tangent point of each corner. Center fasteners in track to ensure unencumbered carrier operation.

C. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.

D. Curtain Carriers: Provide curtain carriers adequate for 6-inch spacing along full length of curtain plus an additional carrier.

E. Curtains: Hang curtains on each curtain track. Secure with curtain tieback.

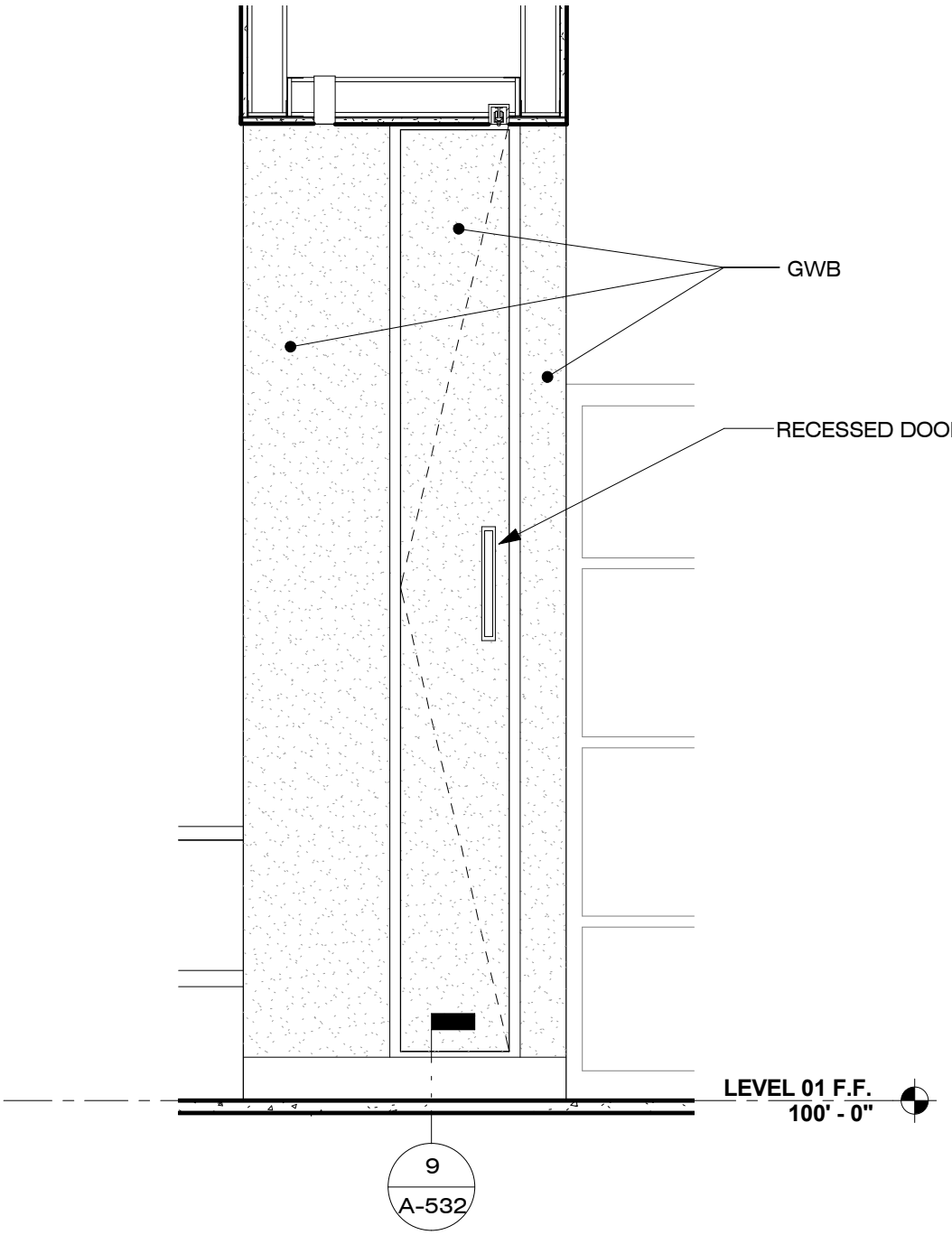
3.03 PROTECTION

A. Protect installed recessed track openings with nonresidue adhesive tape to prevent construction debris from impeding carrier operation. Remove tape prior to Substantial Completion.

3.04 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 102123



11 / A-532 AX - INT ELEVATION CURTAIN CLOSET

3/4" = 1'-0"

DRAWING REFERENCE:
11/A-532
ISSUE DATE:
02/23/12
ISSUANCE:
ADDENDA 2

DRAWING NO:
AX-01

PROJECT NO: 1020.00
PROJECT:
WEST DENVER BRANCH LIBRARY
1498 NORTH IRVING STREET
DENVER, COLORADO 80204

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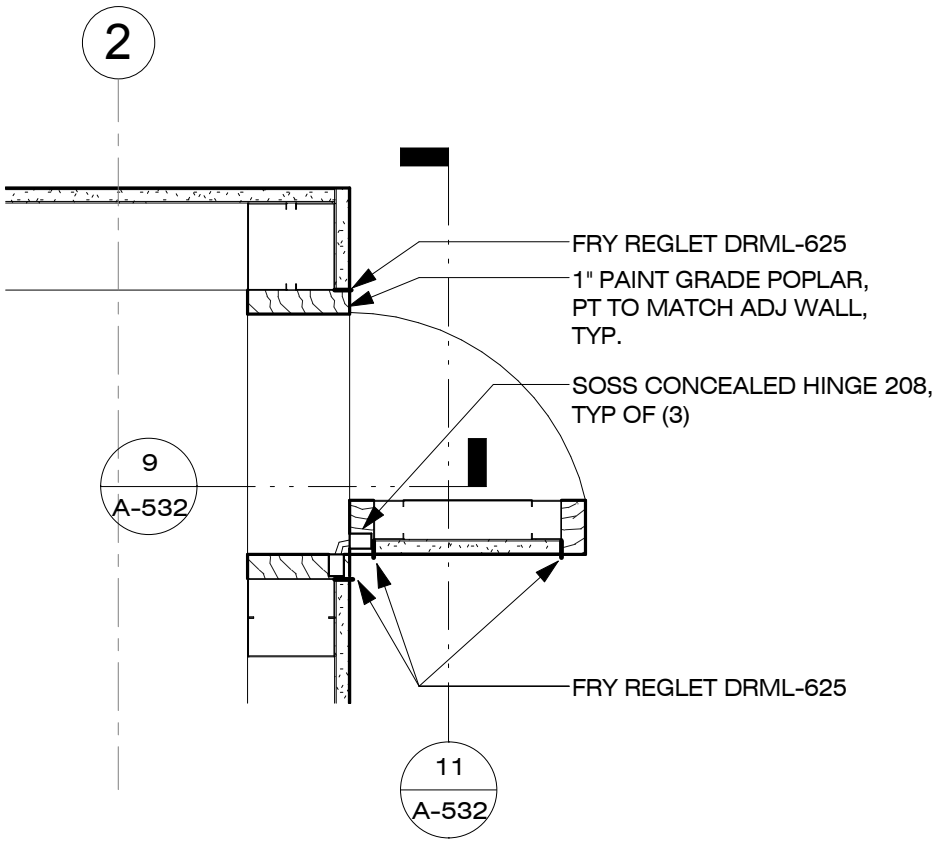

12 / A-532 AX - PLAN - DTL CURTAIN CABINET

1 1/2" = 1'-0"

DRAWING REFERENCE:
12/A-532
ISSUE DATE:
02/23/12
ISSUANCE:
ADDENDA 2

DRAWING NO:
AX-02

PROJECT NO: 1020.00
PROJECT:
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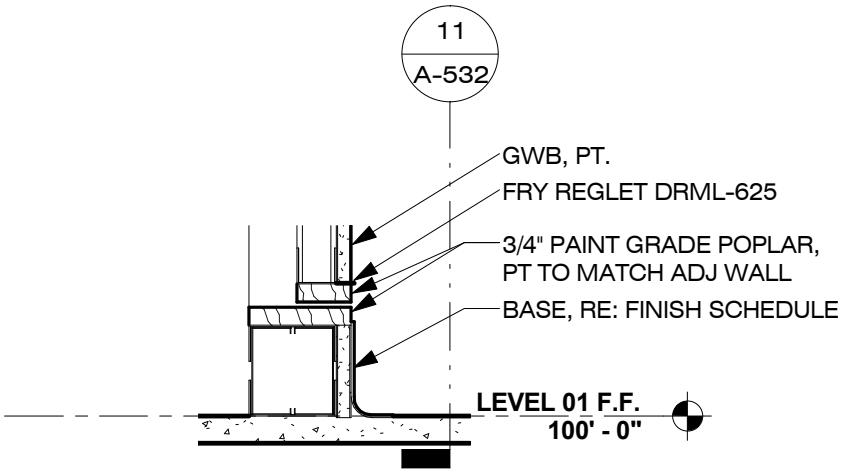

9 / A-532 AX - SEC - DTL BASE AT CABINET DOOR

1 1/2" = 1'-0"

DRAWING REFERENCE:
9/A-532
ISSUE DATE:
02/23/12
ISSUANCE:
ADDENDA 2

DRAWING NO:
AX-03

PROJECT NO: 1020.00
PROJECT:
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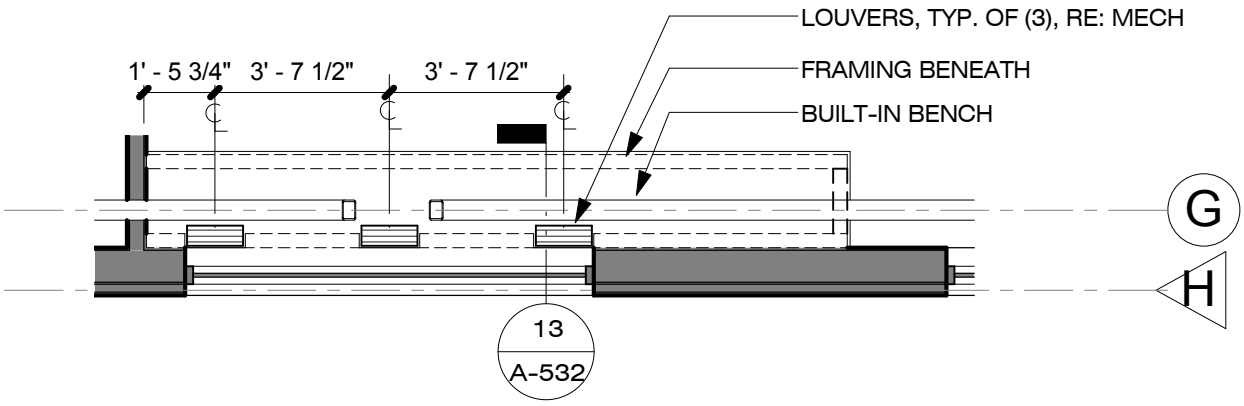

14 / A-532 AX - ENLARGED LEVEL 02 - FLOOR PLAN

1/4" = 1'-0"

DRAWING REFERENCE:
14/A-532
ISSUE DATE:
02/23/12
ISSUANCE:
ADDENDA 2

DRAWING NO:
AX-04

PROJECT NO: 1020.00
PROJECT:
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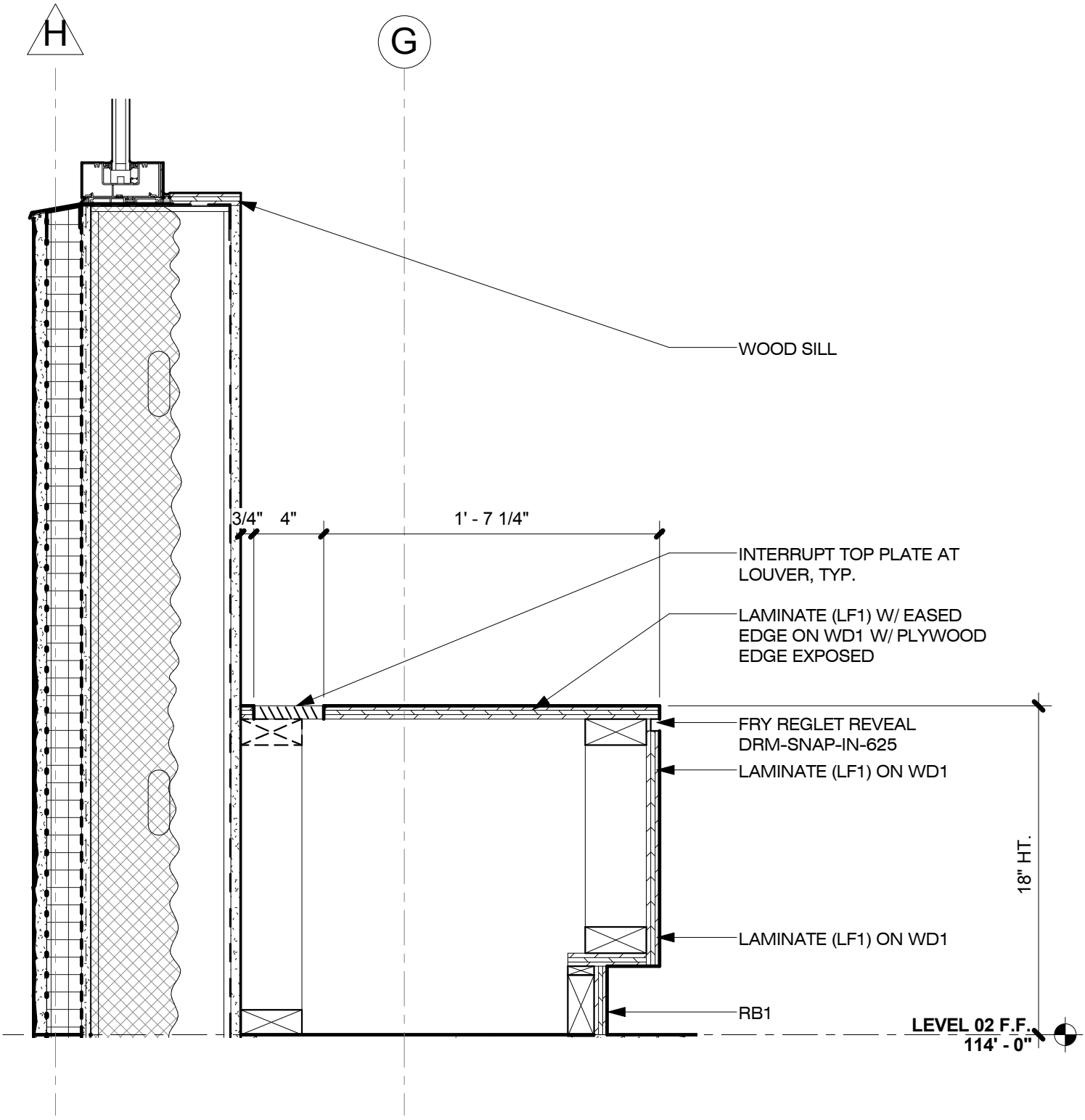

13
A-532

AX - SEC - DTL BUILT-IN-BENCH @ LEVEL 2

1 1/2" = 1'-0"

DRAWING REFERENCE:
13/A-532
ISSUE DATE:
02/23/12
ISSUANCE:
ADDENDA 2

DRAWING NO:
AX-05

PROJECT NO: 1020.00
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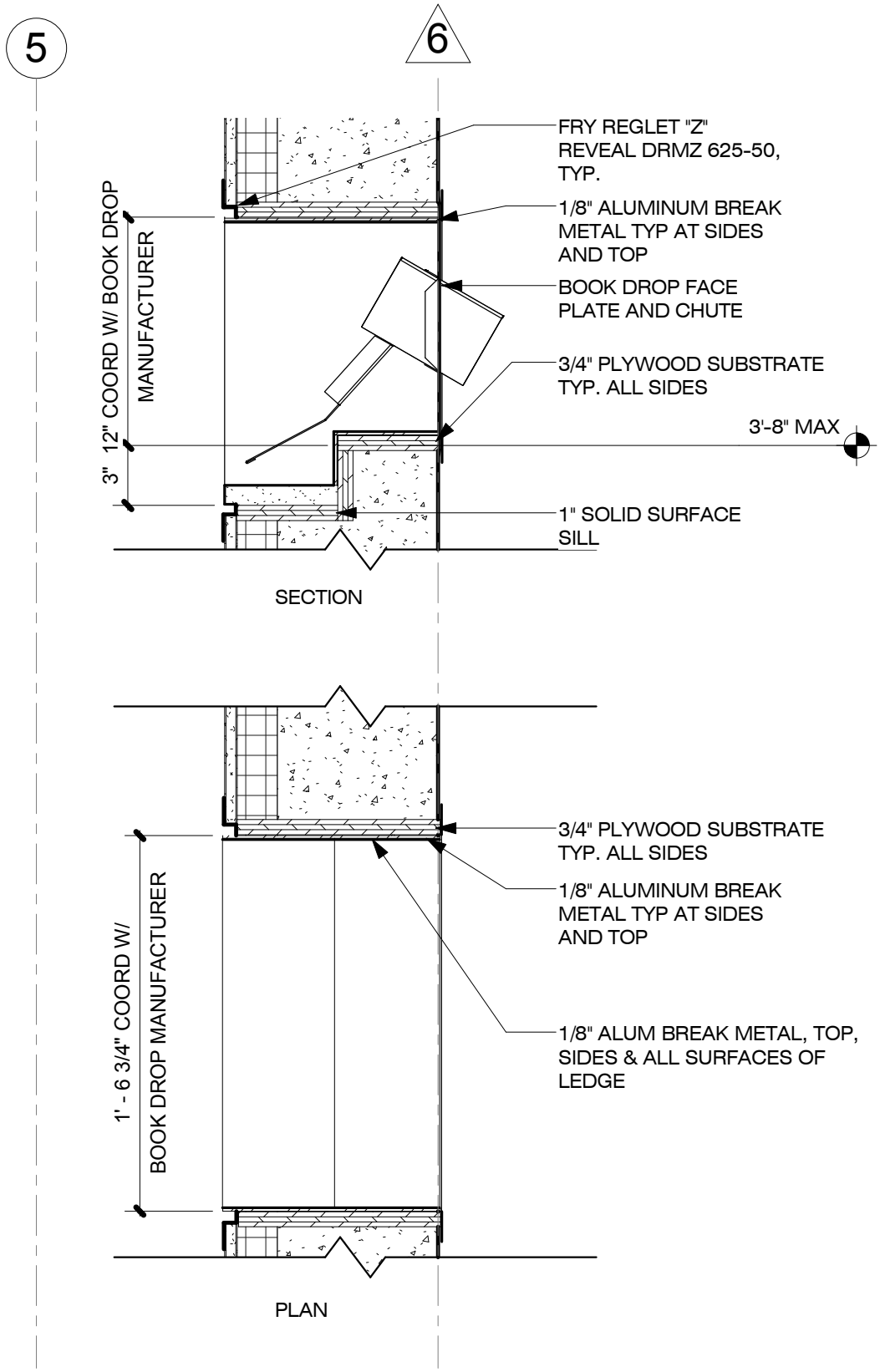

10 / A-532 AX SEC - PLAN -DTL MANUAL BOOK DROP / EXTERIOR

1 1/2" = 1'-0"

DRAWING REFERENCE:
SEC/PLAN DTL MANUAL BOOK
ISSUE DATE:
02/22/12
ISSUANCE:

DRAWING NO:
AX-06

PROJECT NO: 1020.00
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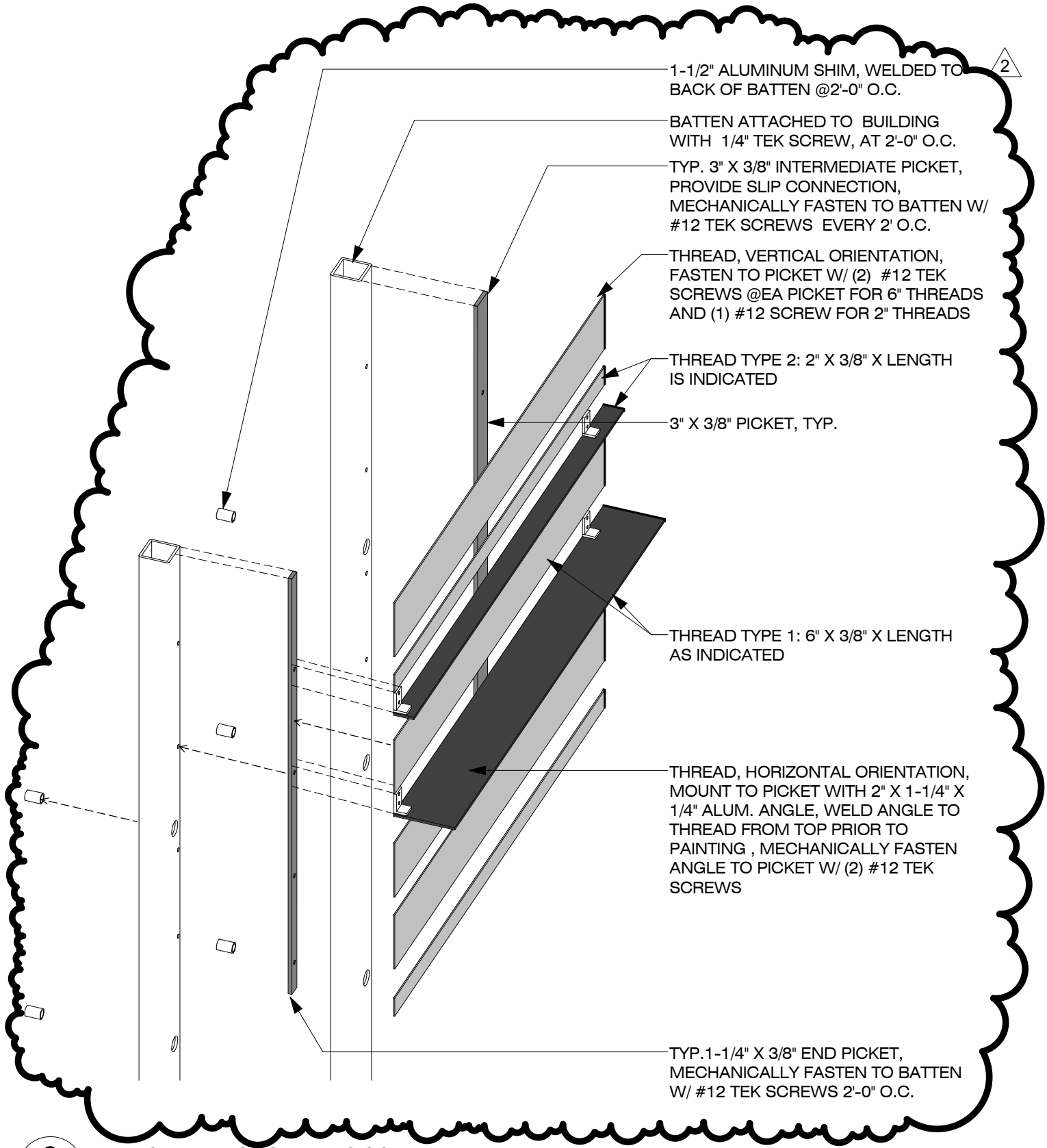

2
A-500

EXPLODED AXONOMETRIC SCREEN DETAIL

DRAWING REFERENCE:
EXPLODED SCREEN DTL
ISSUE DATE:
02/23/12
ISSUANCE:
ADDENDA 2

DRAWING NO:
AX-07

PROJECT NO: 1020.00
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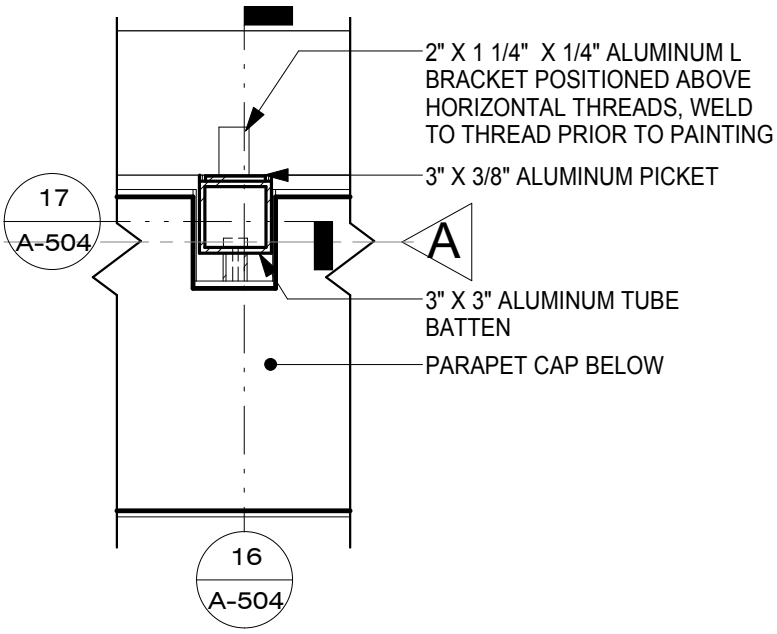

15 / A-504 AX - PLAN DTL - MTL SCREEN ABOVE PARAPET @ INTERMEDIATE PICKET

1 1/2" = 1'-0"

DRAWING REFERENCE:
15/A-504
ISSUE DATE:
02/23/12
ISSUANCE:
ADDENDA 2

DRAWING NO:
AX-08

PROJECT NO: 1020.00
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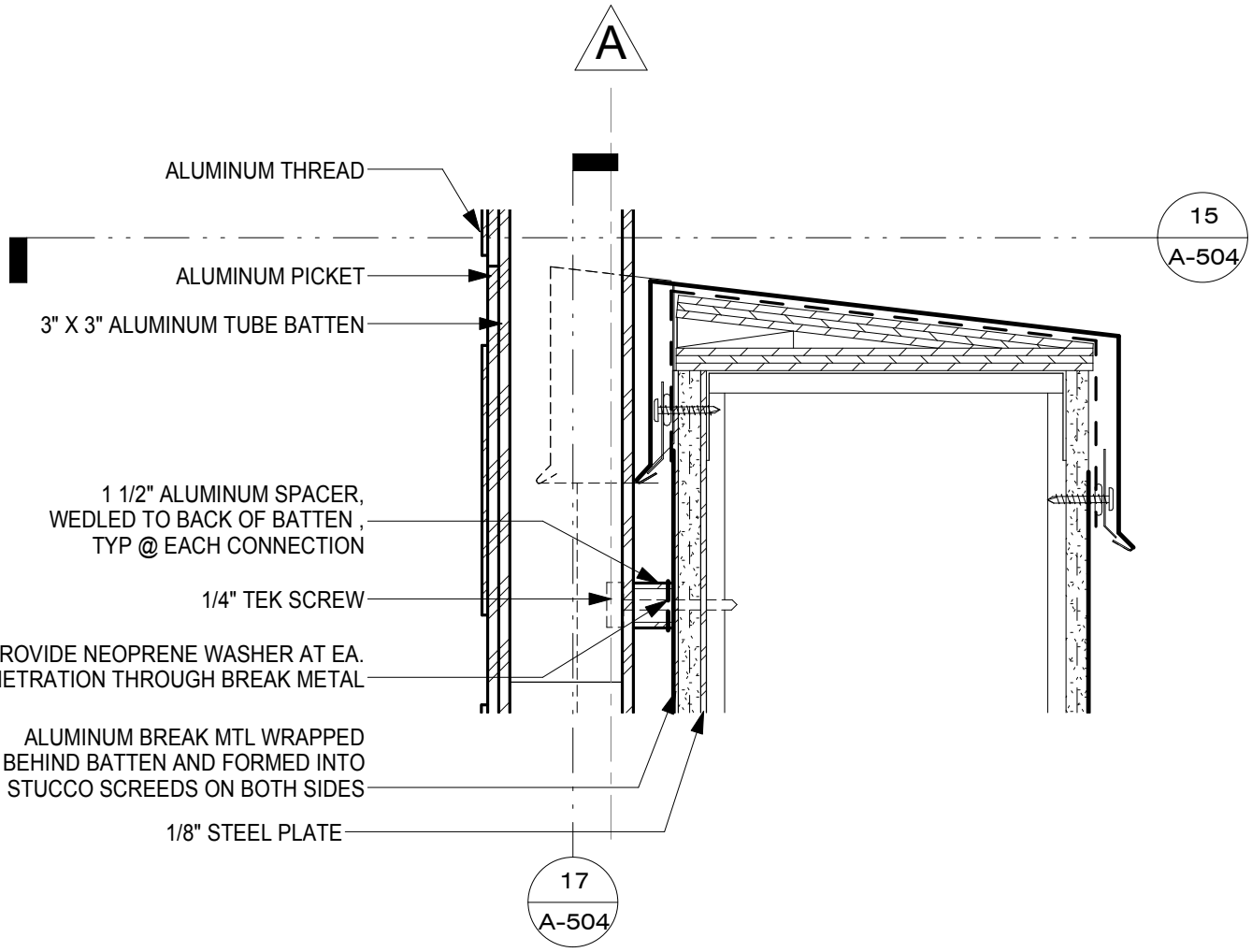

16 / A-504 AX - SECTION DTL - BATTEN @ PARAPET

3" = 1'-0"

DRAWING REFERENCE:
16/A-504
ISSUE DATE:
02/23/12
ISSUANCE:
ADDENDA 2

DRAWING NO:
AX-09

PROJECT NO: 1020.00
PROJECT:
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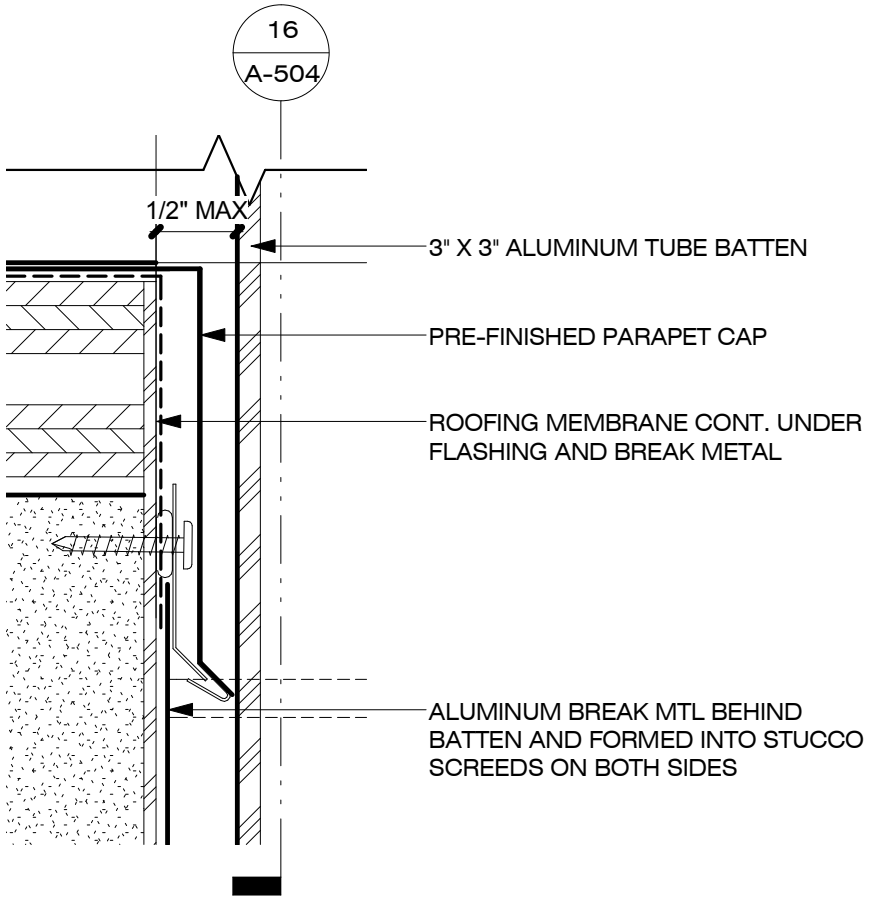

17 / A-504 AX - SECTION DTL - BATTEN @ PARAPET FLASHING

6" = 1'-0"

DRAWING REFERENCE:
17/A-504
ISSUE DATE:
02/23/12
ISSUANCE:
ADDENDA 2

DRAWING NO:
AX-10

PROJECT NO: 1020.00
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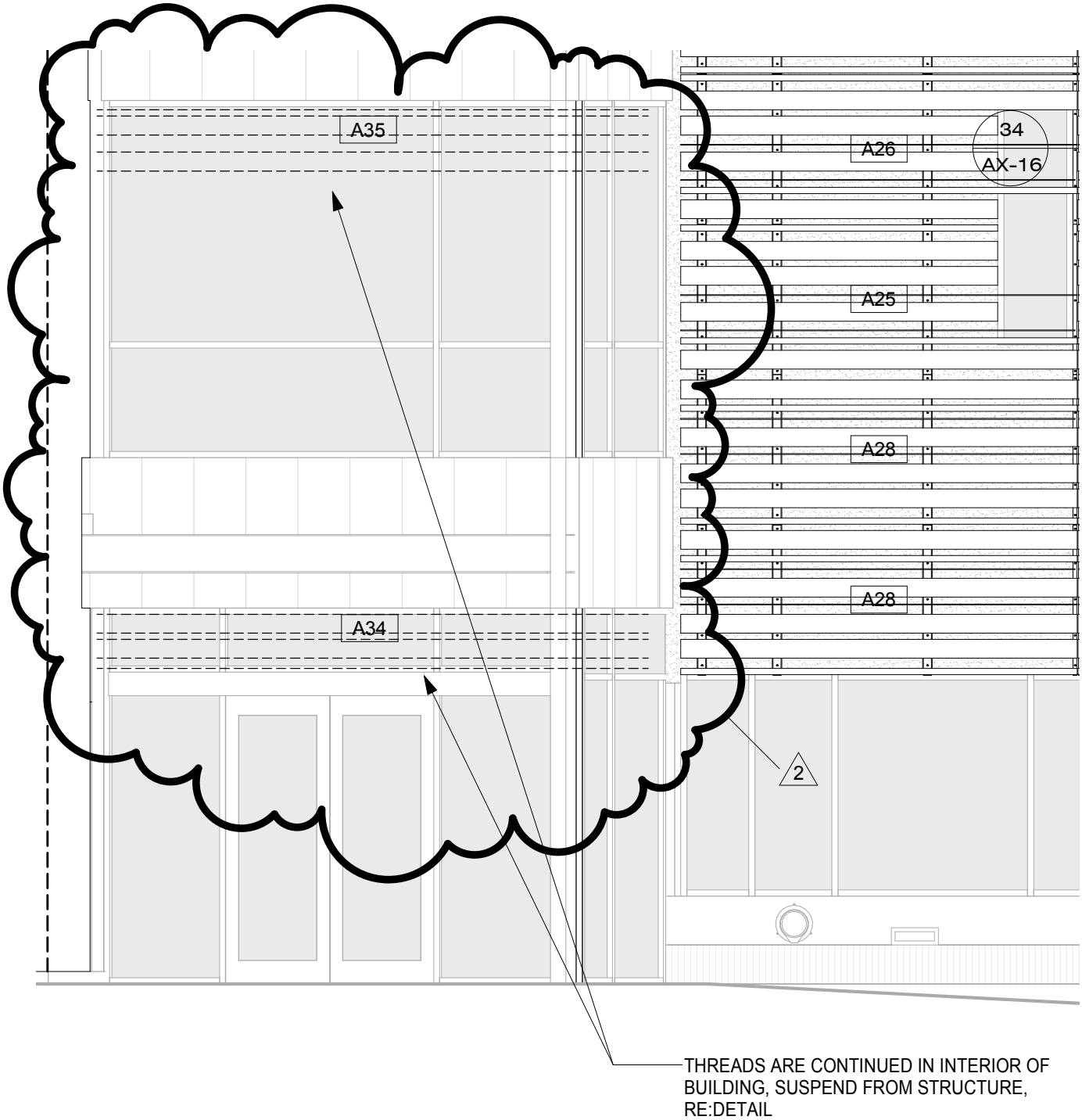

7 / A-500 AX - EAST ELEVATION - STUCCO

1/4" = 1'-0"

DRAWING REFERENCE: 7/A-500
ISSUE DATE: 02/23/12
ISSUANCE: ADDENDA 2

DRAWING NO: AX-11

PROJECT NO: 1020.00
PROJECT: WEST DENVER BRANCH LIBRARY
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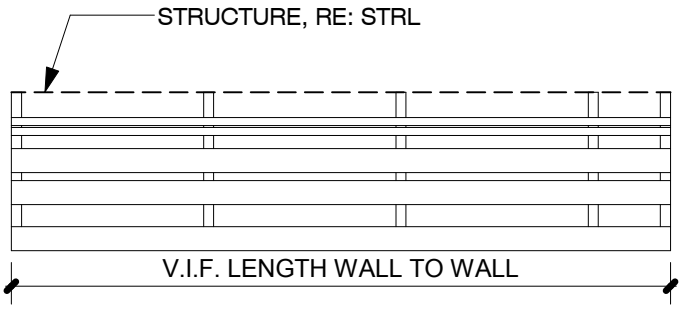
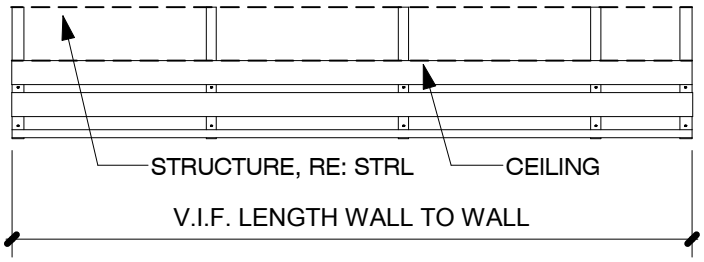


41 / A-501 AX - ALUMINUM PANEL - A35

1/4" = 1'-0"

NOTE: ALUM. THREADS SHOWN SHALL BE ON BOTH SIDES OF PICKETS, TYP.



40 / A-501 AX - ALUMINUM PANEL - A34

1/4" = 1'-0"

DRAWING REFERENCE:
40/A-501, 41/A-501
ISSUE DATE:
02/23/12
ISSUANCE:
ADDENDUM 2

DRAWING NO:
AX-12

PROJECT NO: 1020.00
PROJECT:
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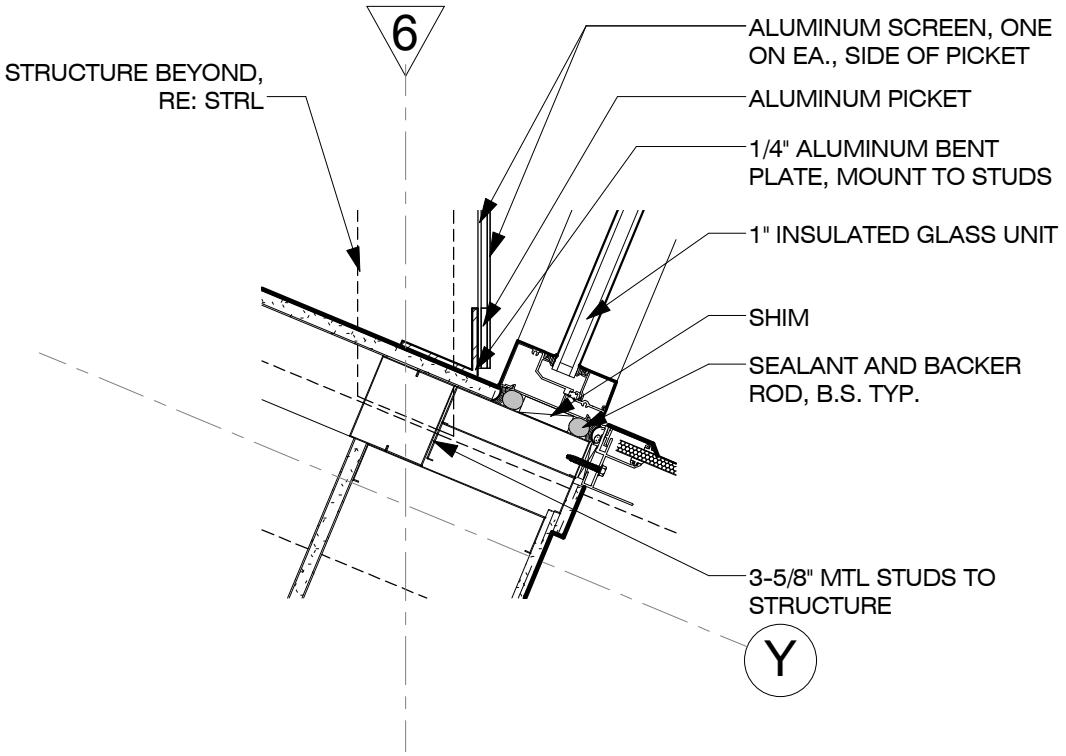

13 / A-520 RCP - DTL ALUMINUM SCREEN MOUNTING

1 1/2" = 1'-0"

DRAWING REFERENCE:
13/A-520
ISSUE DATE:
02/23/12
ISSUANCE:
ADDENDA 2

DRAWING NO:
AX-13

PROJECT NO: 1020.00
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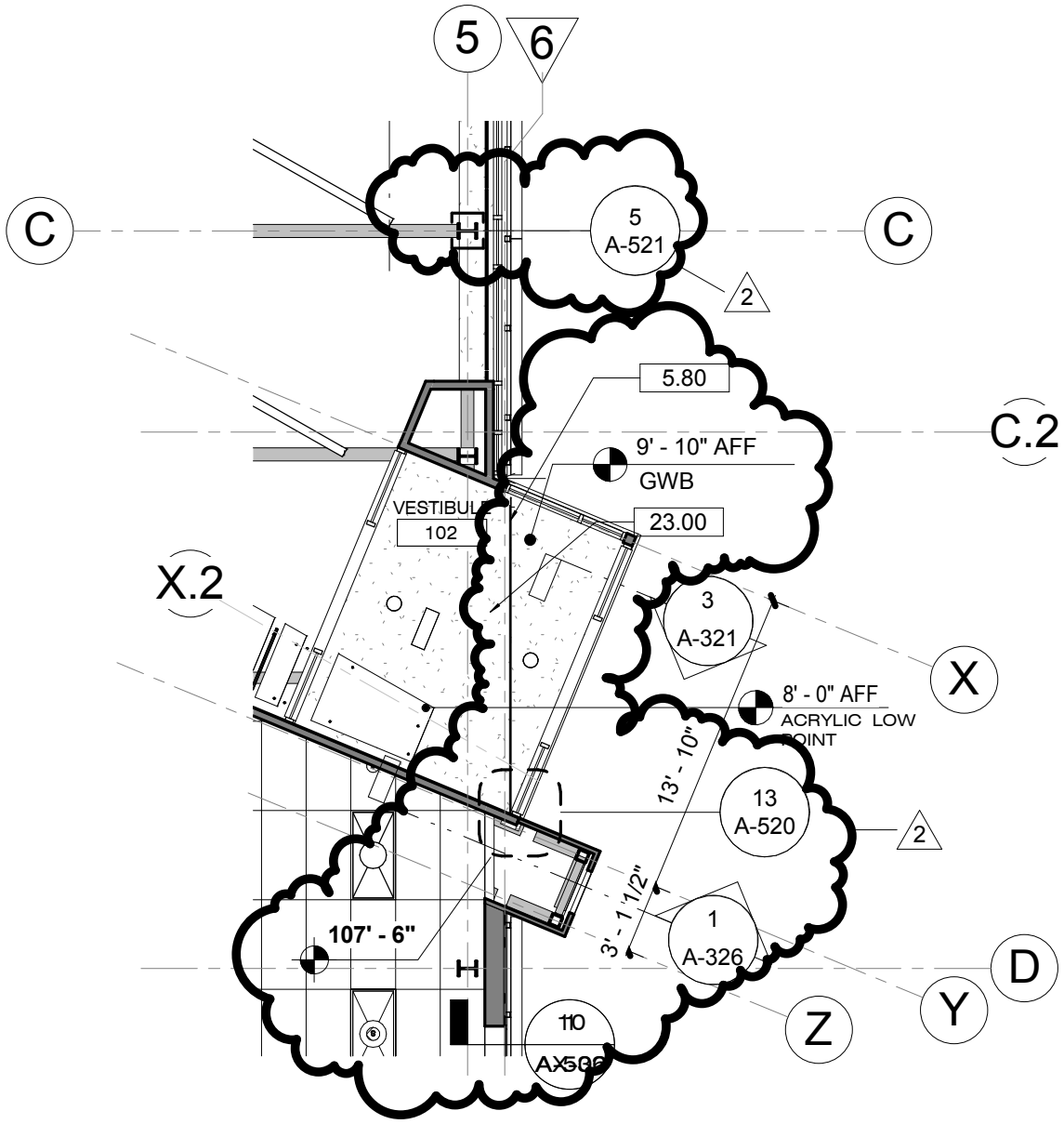

1 / A-130 AX - LEVEL 1 REFLECTED CEILING PLAN

1/8" = 1'-0"

DRAWING REFERENCE: 1/A-130
ISSUE DATE: 02/23/12
ISSUANCE: ADDENDA 2

DRAWING NO: AX-14

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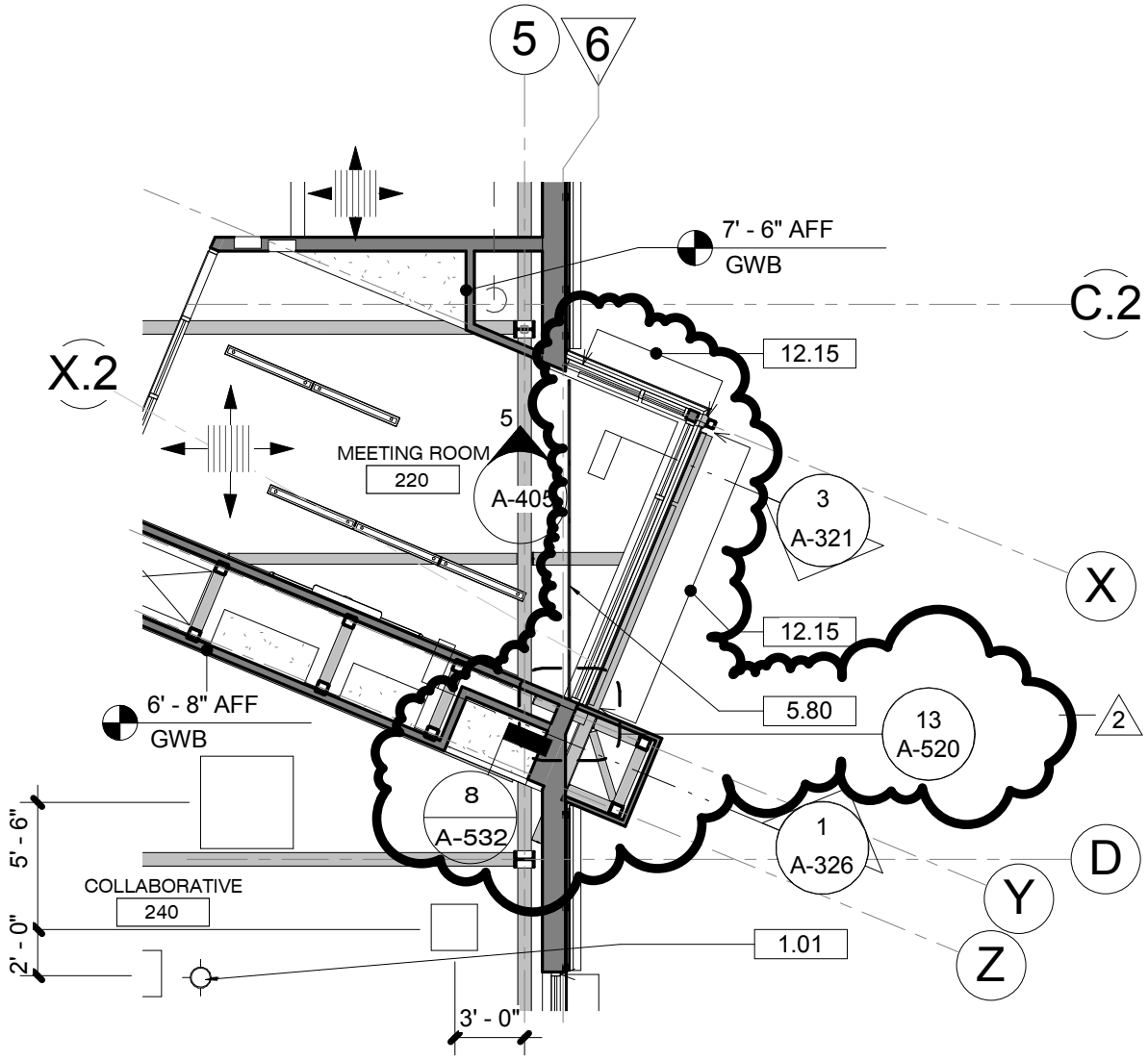

1 / A-131 AX - LEVEL 2 REFLECTED CEILING PLAN

1/8" = 1'-0"

DRAWING REFERENCE: 1/A-131
ISSUE DATE: 02/23/12
ISSUANCE: ADDENDA 2

DRAWING NO: AX-15

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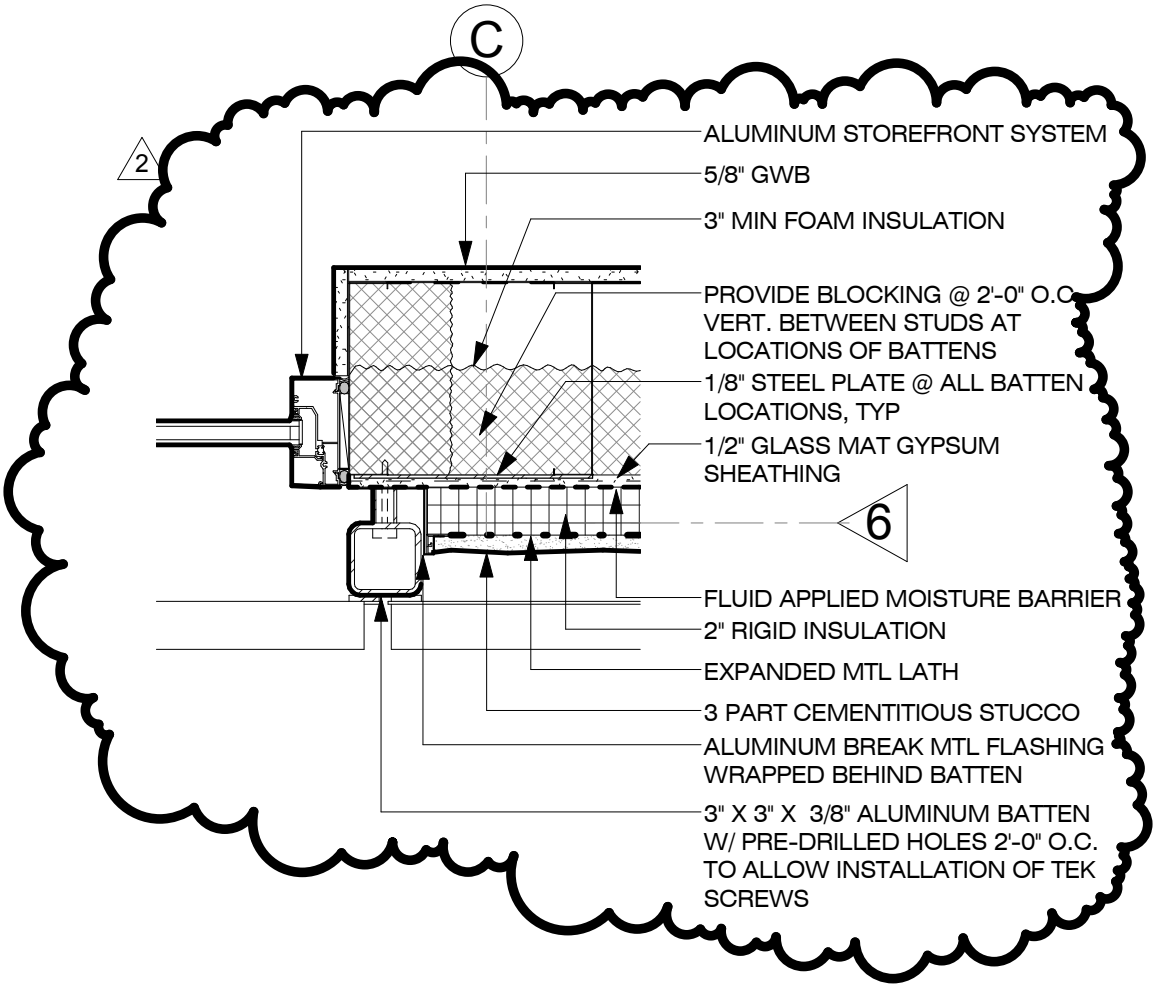

34
A-501

AX - PLAN DTL - BATTEN @ MULLION

1 1/2" = 1'-0"

DRAWING REFERENCE:
34/A-501
ISSUE DATE:
02/23/12
ISSUANCE:
ADDENDA 2

DRAWING NO:
AX-16

PROJECT NO: 1020.00
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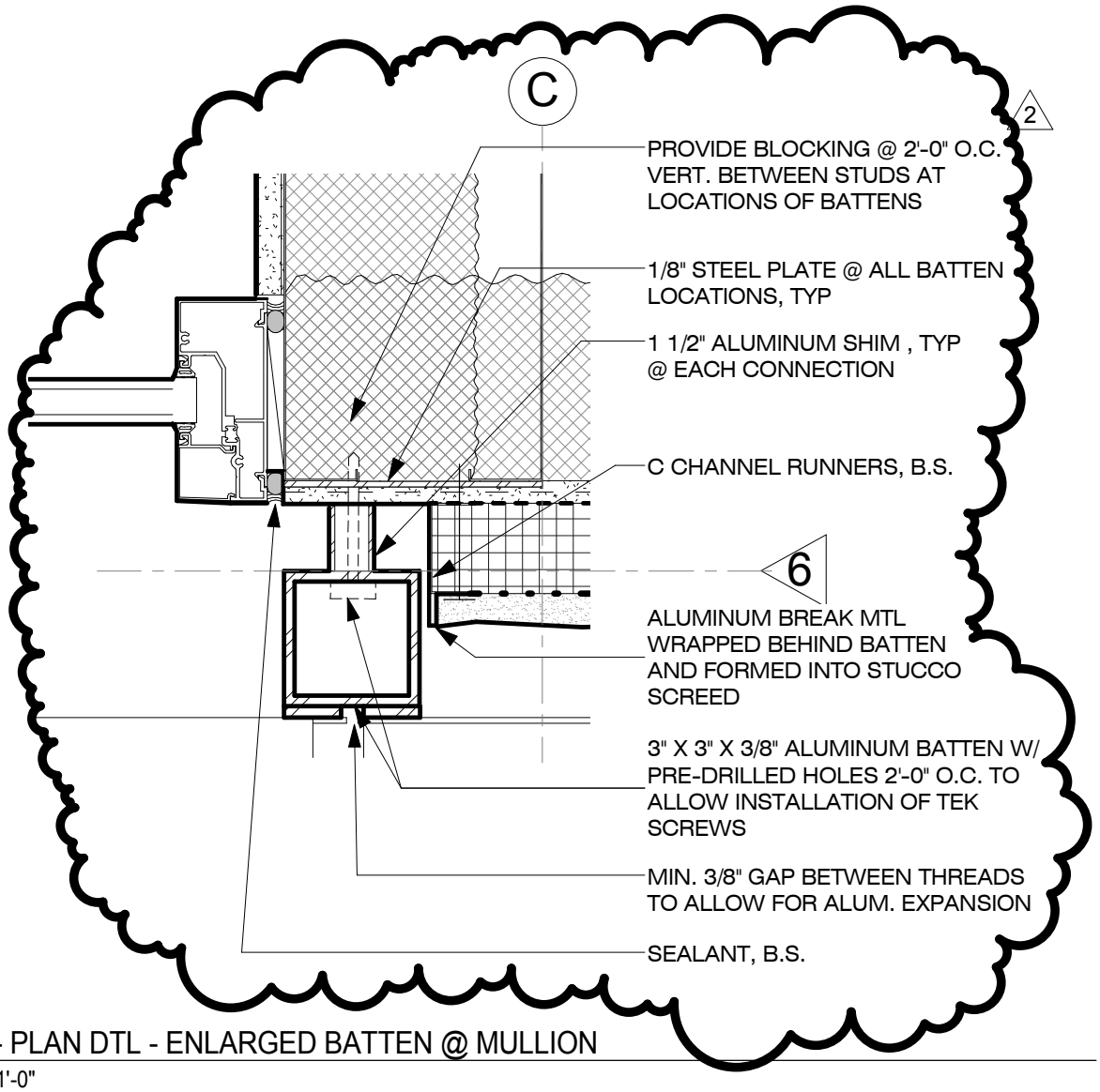

35 / A-501 AX - PLAN DTL - ENLARGED BATTEN @ MULLION

3" = 1'-0"

DRAWING REFERENCE: 35/A-501
ISSUE DATE: 02/23/12
ISSUANCE: ADDENDA 2

DRAWING NO: AX-17

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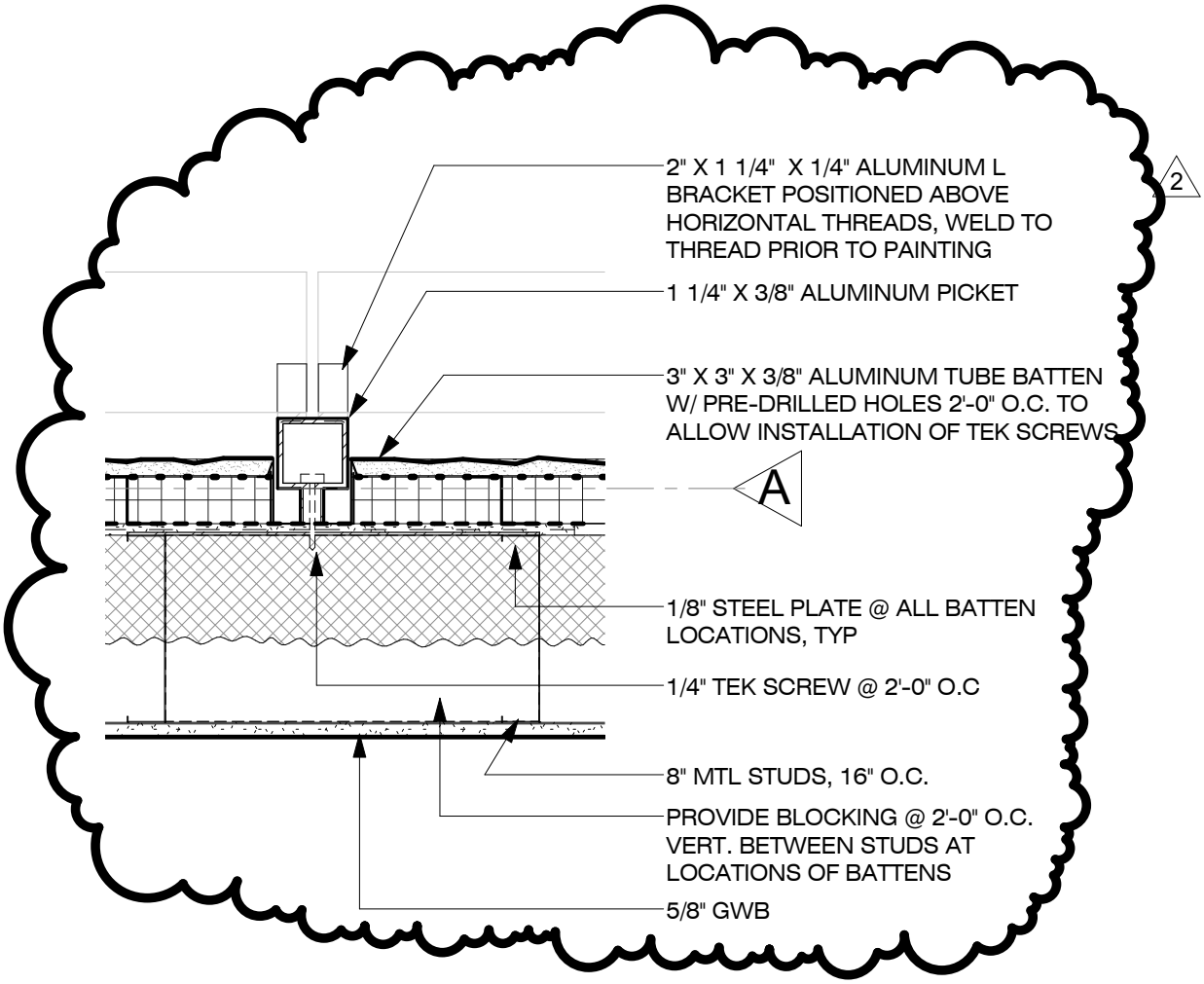

36
A-501

AX PLAN DTL - MTL SCREEN BATTEN

1 1/2" = 1'-0"

DRAWING REFERENCE:
PLAN DTL - SCREEN BATTEN
ISSUE DATE:
02/23/12
ISSUANCE:
ADDENDA 2

DRAWING NO:
AX-18

PROJECT NO: 1020.00
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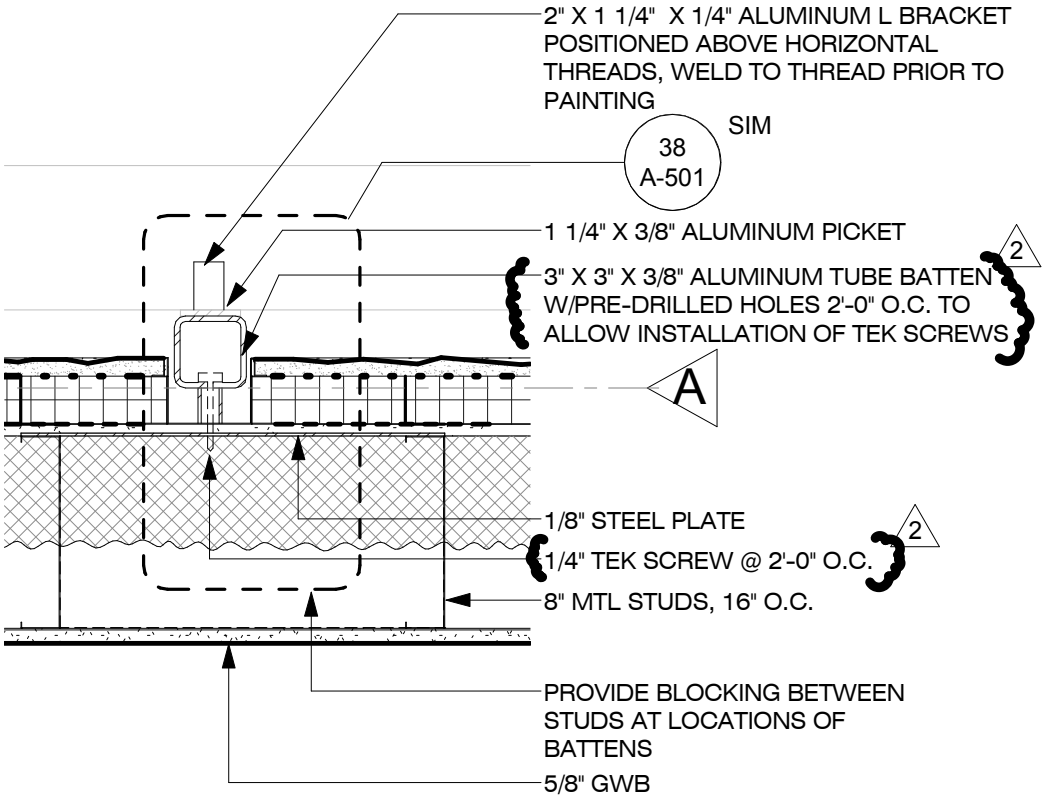

37
A-501

AX - PLAN DTL - MTL SCREEN BATTEN 2

1 1/2" = 1'-0"

DRAWING REFERENCE:
PLAN DTL - SCREEN BATTEN
ISSUE DATE:
02/23/12
ISSUANCE:
ADDENDA 2

DRAWING NO:
AX-19

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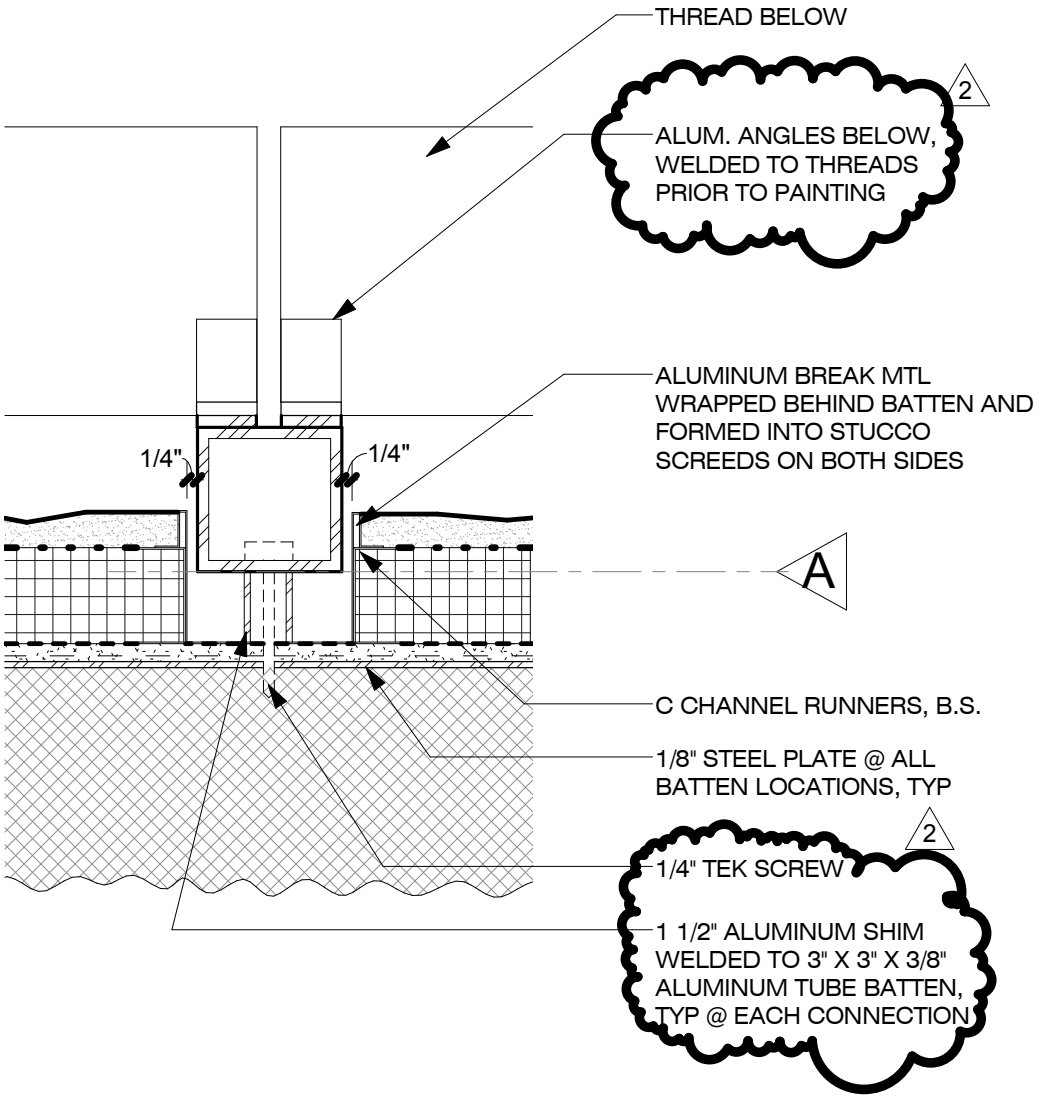

38 / A-501 AX PLAN DTL - TYP BATTEN

3" = 1'-0"

DRAWING REFERENCE:
PLAN DTL - TYP BATTEN
ISSUE DATE:
02/23/12
ISSUANCE:
ADDENDA 2

DRAWING NO:
AX-20

PROJECT NO: 1020.00
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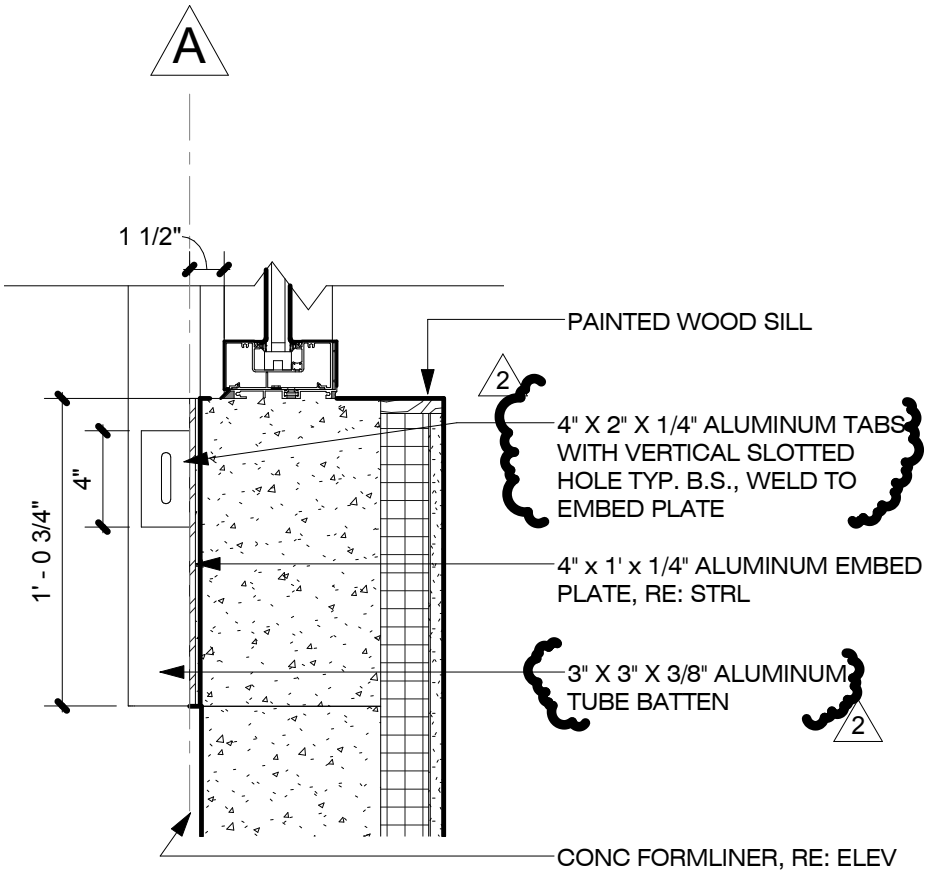

39 / A-501 AX - SECTION DTL - BATTEN @ EMBED PLATE, TYP

1 1/2" = 1'-0"

DRAWING REFERENCE:
39/A-501
ISSUE DATE:
02/23/12
ISSUANCE:
ADDENDA 2

DRAWING NO:
AX-21

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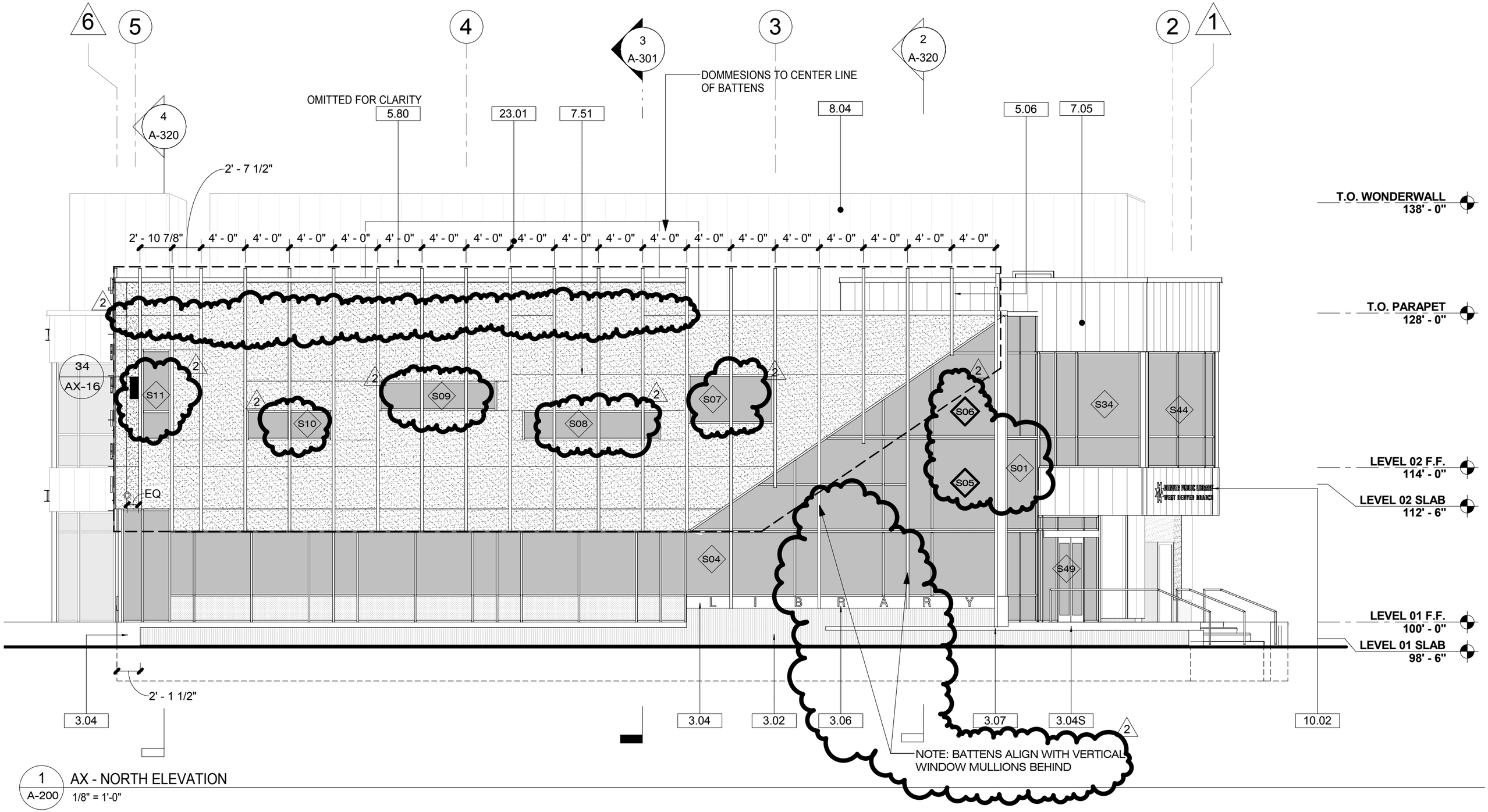

1 / A-200 — AX - NORTH ELEVATION

1/8" = 1'-0"

DRAWING REFERENCE: 1/A-200
ISSUE DATE: 02/23/12
ISSUANCE: ADDENDA 2

DRAWING NO: AX-22

PROJECT NO: 1020.00
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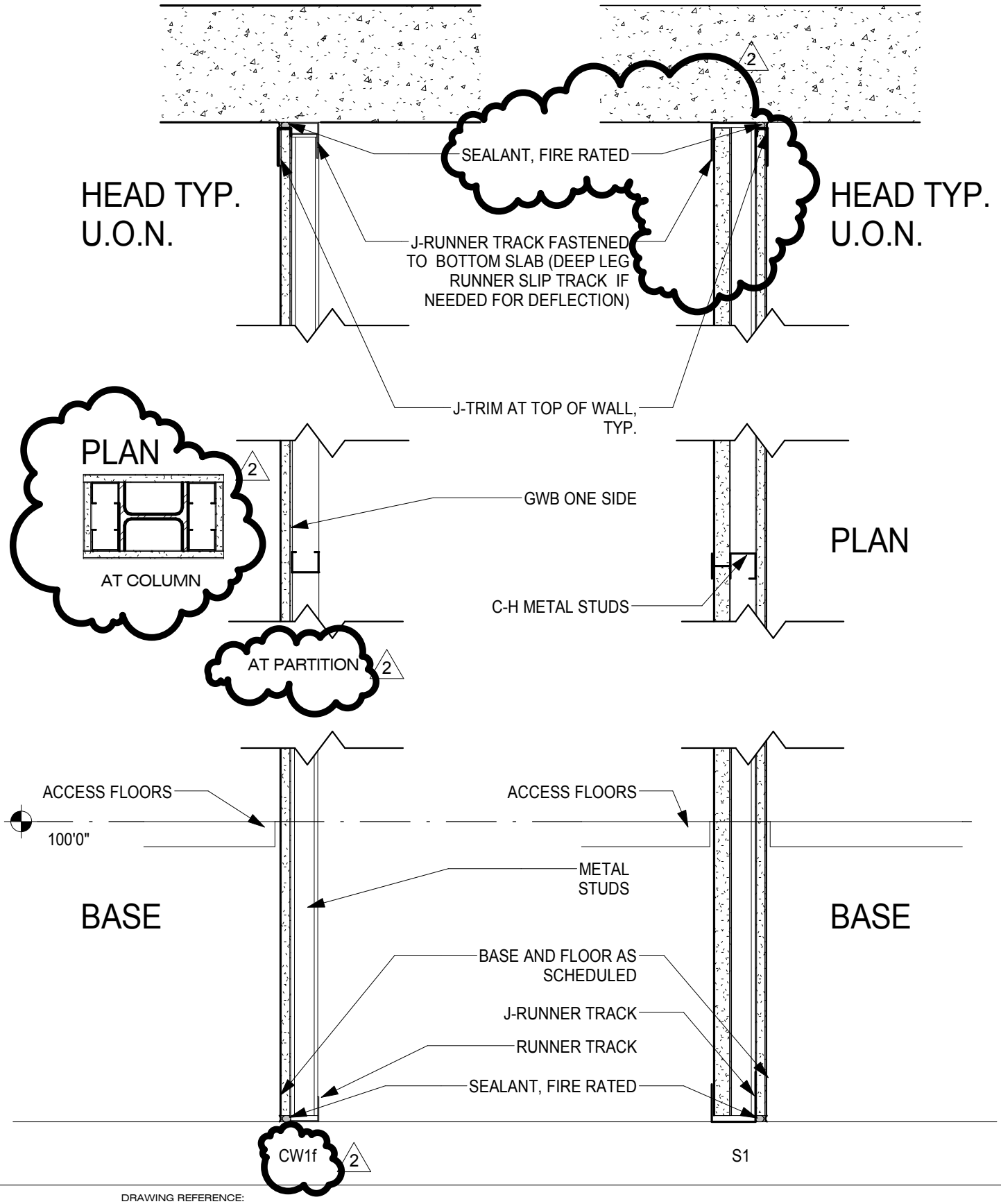

DRAWING REFERENCE:
G-003
ISSUE DATE:
02/23/12
ISSUANCE:
ADDENDA 2

DRAWING NO:
AX-23

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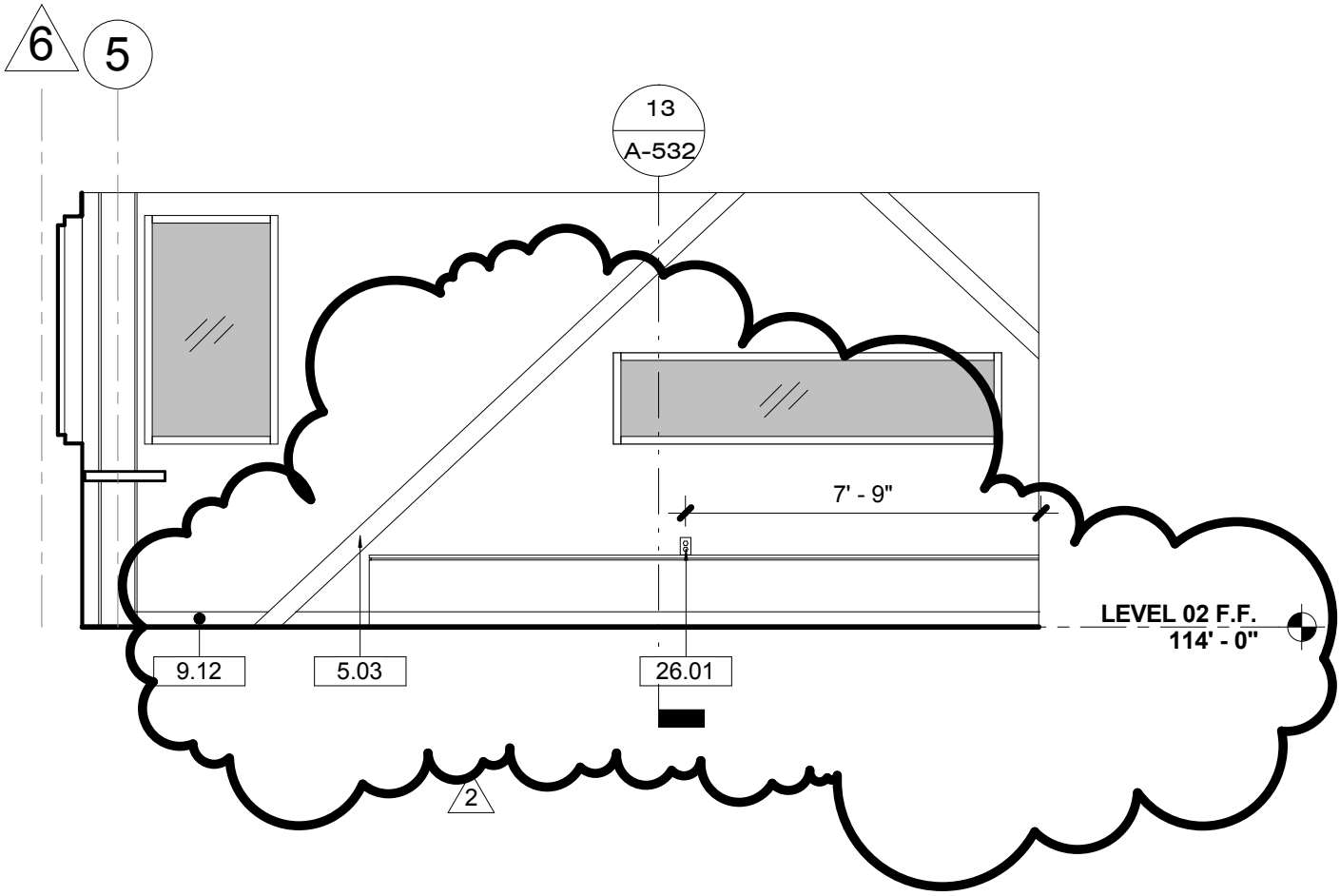

3 / A-402 AX - STAFF LOUNGE 253 - SOUTH

1/4" = 1'-0"

DRAWING REFERENCE:
3/A-402
ISSUE DATE:
01/20/12
ISSUANCE:
ADDENDA 2

DRAWING NO:
AX-24

PROJECT NO: 1020.00
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STRUCTURED POLYCARBONATE PANEL ASSEMBLY

TYPE	WIDTH	DESCRIPTION
PC1	4-1/8"	(1) LAYER OF 12MM STRUCTURED POLYCARBONATE ON ALUMINUM PANEL CLIPS. ON 1-5/8" MTL STUD LAYER

REFER SPEC SECTION 084513

DRAWING REFERENCE:
G-003
ISSUE DATE:
02/22/12
ISSUANCE:
ADDENDA 2

DRAWING NO:
AX-25

PROJECT NO: 1020.00
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GENERAL NOTES

PROJECT SCOPE: THESE STRUCTURAL DRAWINGS MAY ONLY BE USED TO CONSTRUCT THE PROJECT LOCATED AT WEST DENVER BRANCH LIBRARY, W. COLFAX AND IRVING STREET, DENVER, COLORADO

BUILDING CODE: THESE PLANS HAVE BEEN PREPARED IN ACCORDANCE WITH THE INTERNATIONAL BUILDING CODE (2009 EDITION). ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THIS CODE AND THE CITY AND COUNTY OF DENVER, CO 2011 AMENDMENTS.

DESIGN LOADS: THIS STRUCTURE SHALL BE CLASSIFIED AS A CATEGORY III STRUCTURE AS PER TABLE 1604.5:
A. DEAD LOADS ARE THE WEIGHT OF THE CONSTRUCTION MATERIALS AND SHALL BE IN ACCORDANCE WITH SECTION 1606.

B. LIVE LOADS SHALL BE IN ACCORDANCE WITH SECTION 1607.

OCCUPANCY OR USE	UNIFORM [PSF]	CONCENTRATED [LBS]
STACK LOADS (SECOND FLOOR)	150	1000
STACK LOADS (FIRST FLOOR)	150	1000
EGRESS ROUTES	100	---
RESTROOMS	60	---
LOBBIES	100	---
OFFICES	50	2000

C. SNOW LOADS SHALL BE IN ACCORDANCE WITH SECTION 1608

GROUND SNOW:	30 PSF
(IN ACCORDANCE WITH SECTION 7 OF ASCE 7)	
SNOW FACTOR:	1.2
(IN ACCORDANCE WITH BUILDING CLASSIFICATION)	
UNBALANCED SNOW LOADS PER SECTION 7.5 OF ASCE 7	
DRIFTING SNOW LOADS ON LOWER ROOFS PER SECTION 7.7 OF ASCE 7	
DRIFTING SNOW LOADS ON ROOF PROJECTIONS PER SECTION 7.8 OF ASCE 7	

D. WIND LOADS SHALL BE IN ACCORDANCE WITH SECTION 1609

V3S	90 MPH
EXPOSURE	B
WIND FACTOR	1.15
(IN ACCORDANCE WITH BUILDING CLASSIFICATION)	
HEIGHT AND EXPOSURE COEFFICIENT AS PER EACH AREA.	

E. EARTHQUAKE LOADS SHALL BE IN ACCORDANCE WITH SECTION 1613

SEISMIC IMPORTANCE FACTOR	1.25
SEISMIC USE GROUP	III
SITE CLASS	D
Ss	0.2215
S1	0.057
S DS	0.236
S D1	0.091
SEISMIC DESIGN CATEGORY	B
BASIC SEISMIC FORCE RESISTING SYSTEM	STL. SYSTEMS NOT SPECIFICALLY DETAILED FOR SEISMIC RESISTANCE
DESIGN BASE SHEAR	246.063 KIPS
RESPONSE COEFFICIENT (Cs)	0.0984 - (LRFD)
RESPONSE MODIFICATION FACTOR (R)	3.0
ANALYSIS PROCEDURE	EQUIVALENT LATERAL FORCE

F. FROST DEPTH SHALL BE 36"

CONSTRUCTION METHOD:
A. THE STRUCTURAL DRAWINGS REPRESENT THE FINAL STRUCTURE. THE DRAWINGS DO NOT INDICATE THE CONTRACTORS MEANS, METHODS, TECHNIQUES, SEQUENCES OF CONSTRUCTION AND JOB SITE SAFETY. THE ENGINEER OF RECORD IS NOT RESPONSIBLE FOR THE CONTRACTOR'S FAILURE TO FOLLOW PLANS, SPECIFICATIONS, AND/OR ENGINEERING RECOMMENDATIONS, NOR IS THE ENGINEER OF RECORD RESPONSIBLE FOR ECONOMIC LOSS

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STUDIO NYL
SX-1
EXTRACT OF S-100
ADDENDUM #2
2/21/2012

FRAMING NOTES:

1. REFER TO GENERAL STRUCTURAL NOTES DRAWING.
2. VERIFY ALL DIMENSIONS WITH ARCHITECTURAL DRAWINGS.
3. VERIFY SITE DATUM WITH ARCHITECTS DRAWINGS.
4. CONTRACTOR SHALL VERIFY ALL FIELD DIMENSIONS PRIOR TO CONSTRUCTION.
5. TYPICAL DETAILS ARE NOT CUT AT EVERY LOCATION THEY OCCUR. IF A CONDITION IS UNCLEAR, CONTACT ARCHITECT IMMEDIATELY BEFORE PROCEEDING.
6. TOP OF STEEL IS NOTED THUS (-#' -#") AND IS 138'-0" THIS LEVEL UON.
2 7. ROOF DECK IS VULCRAFT 1.5B20. THE DECK SHALL BE CONNECTED TO SUPPORT FRAMING WITH 5/8" WELDS @ 36/7 PATTERN AND (6) #10 TEK SCREWS @ SIDELAPS (DIAPHRAGM LOAD = 833 PLF).
8. COORDINATE ALL OPENINGS THROUGH ROOF AND WALLS WITH ARCHITECTURAL, MECHANICAL, ELECTRICAL, PLUMBING AND CIVIL DRAWINGS. TRIM OPENINGS AS SHOWN ON PLANS.
9. SEE MECH, ELECT, AND CIVIL DRAWINGS FOR SLEEVE LOCATIONS. PIPES, CONDUITS AND OTHER PENETRATIONS NOT SHOWN SHALL NOT PASS THROUGH MASONRY OR CONCRETE WALLS OR STEEL BEAMS OR COLUMNS WITHOUT PRIOR APPROVAL FROM STRUCTURAL ENGINEER OF RECORD.
10. REFER TO ARCHITECTURAL DRAWINGS FOR FIRE RATING AND UL DESIGN NUMBER.

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DENVER, COLORADO

sDC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02089

ISSUE DATE	PHASE
01-12-2012	100% CD
02-23-2012	2 ADDENDUM 02

UPPER ROOF PLAN

S-204

C 2010 STUDIOTROPE, LLC

NYL

STUDIO NYL
SX-2
EXTRACT OF S-204
ADDENDUM #2
2/21/2012

1 2 2.1 2.2 2.4 3 3.1 4 5 6

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FCU-1-3 450

FCU-1-2 450

TYPICAL UNDERFLOOR PERIMETER FAN COIL UNIT

FG-1 2 ADD #2 75 (TYP. 18)

12x10 14x12 14x12 12x10

WAITING 104

UP

FD-2

LD

HWR HWS

7 FD-4 (TYP.)

1"

FD-2

11

VESTIBULE 101

STACKS 103

12x10

LOBBY 100

54x14 SA UP

2 ADD #2

MENS 114

WOMENS 113

38x14

FD-1 50

STORAGE 131

14

6

2 ADD #2

FG-1 150 (TYP. 4)

14x12

CLP 130

FCU-1-4 600

FCU-1-5 450

FD-1 75 (TYP.)

7

1"

1¼"

1¼" HWS

1"

1"

14x12

FCU-1-1 450

VESTIBULE 102

54x14 SA UP

¾"

9

38x14

Plan North

0 4' 8' 16'

SCALE: 1/8" = 1'-0"

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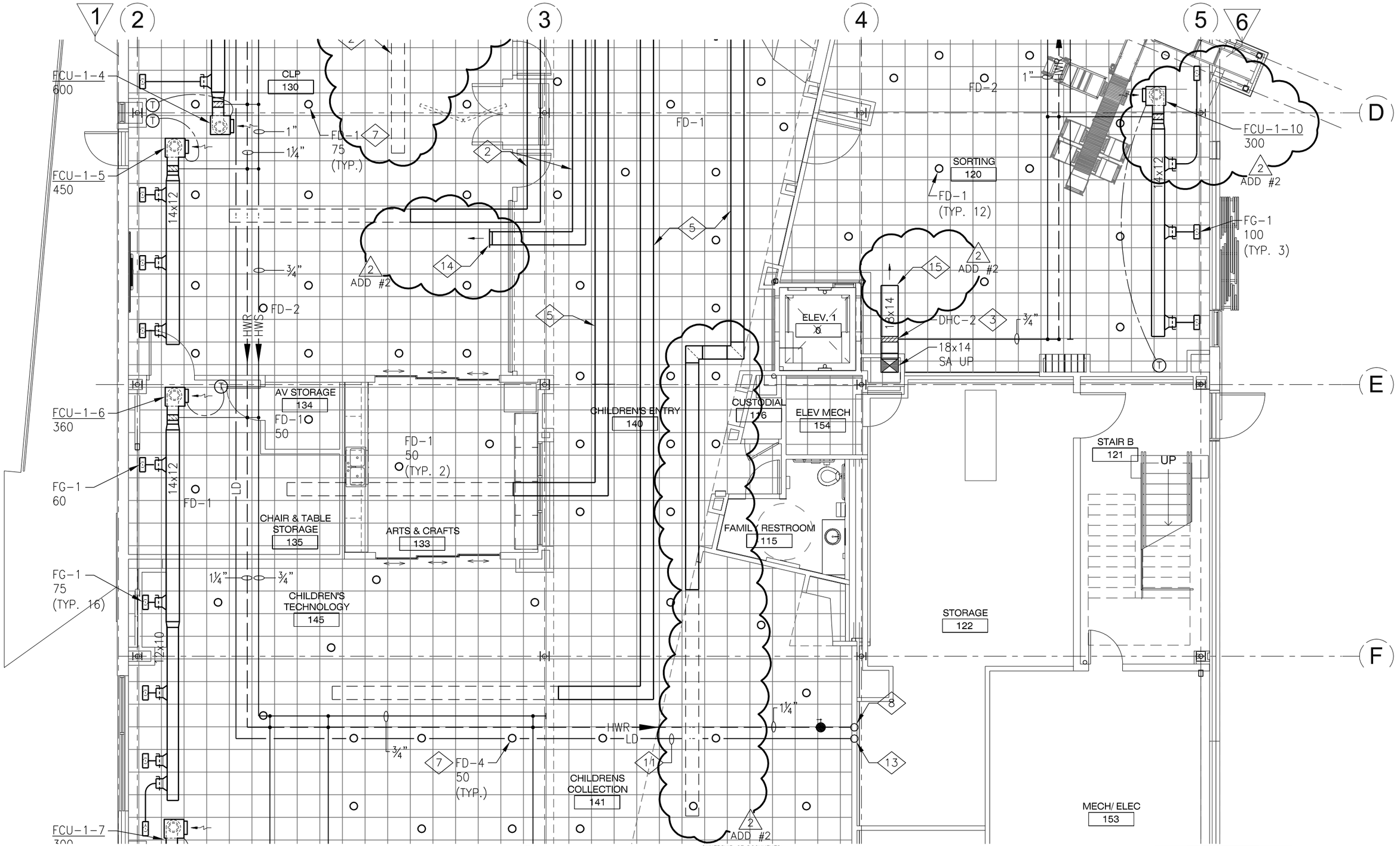
JOB NAME: WEST DENVER BRANCH LIBRARY			
SHEET TITLE: LEVEL 1 UNDER FLOOR MECHANICAL PLAN			
DRAWN BY: MJH	ISSUE: ADD #2	REV. NO.:	
CHECKED BY: WJM	DATE: 02/21/12	MX-02	
PROJ. NO.: 43810006	REF. DRAWING: M-101		



Plan North

0 4' 8' 16'

SCALE: 1/8" = 1'-0"

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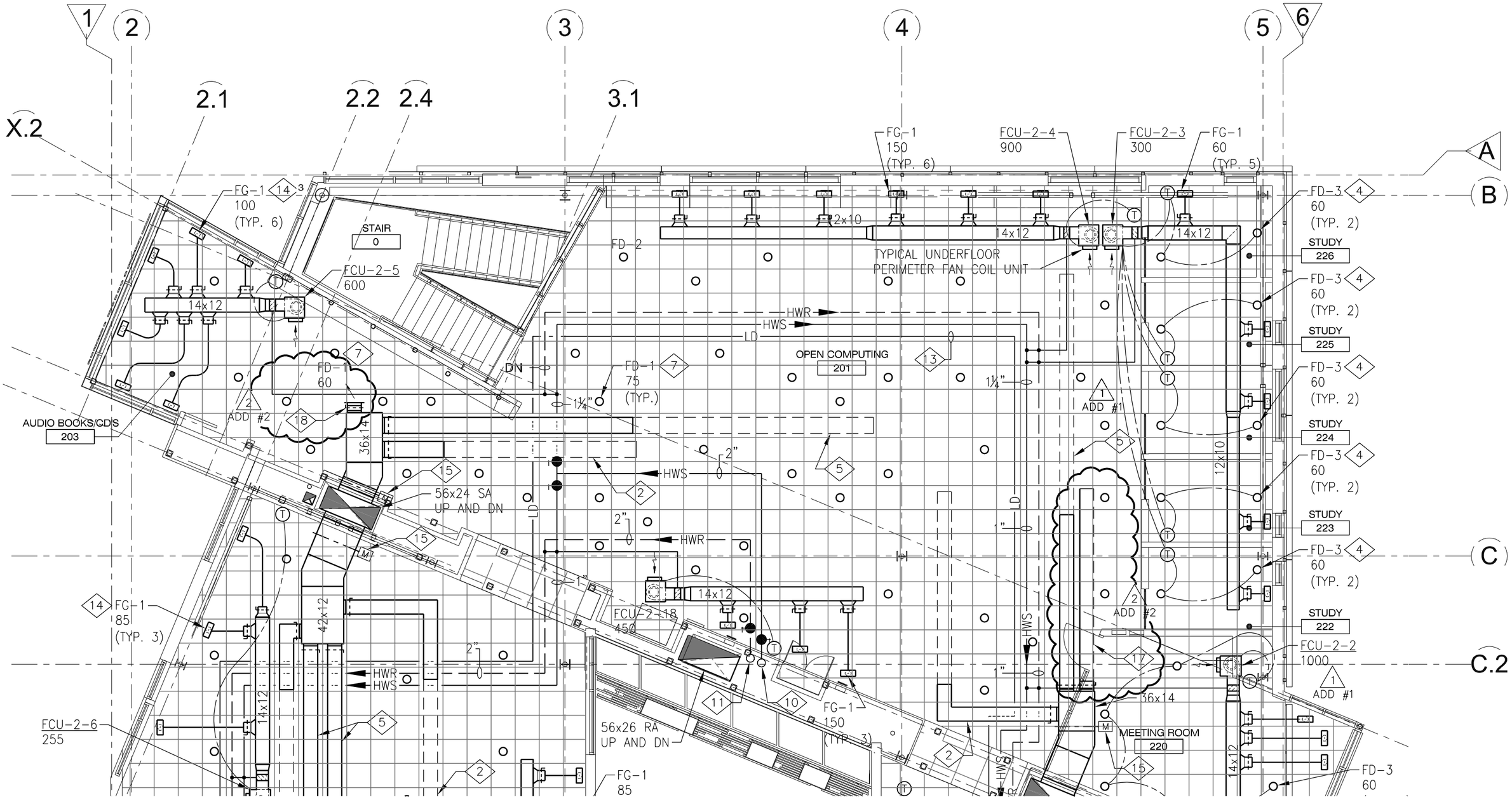
PROJ. NO.: 43810006	REF. DRAWING: M-101		



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SCALE: 1/8" = 1'-0"

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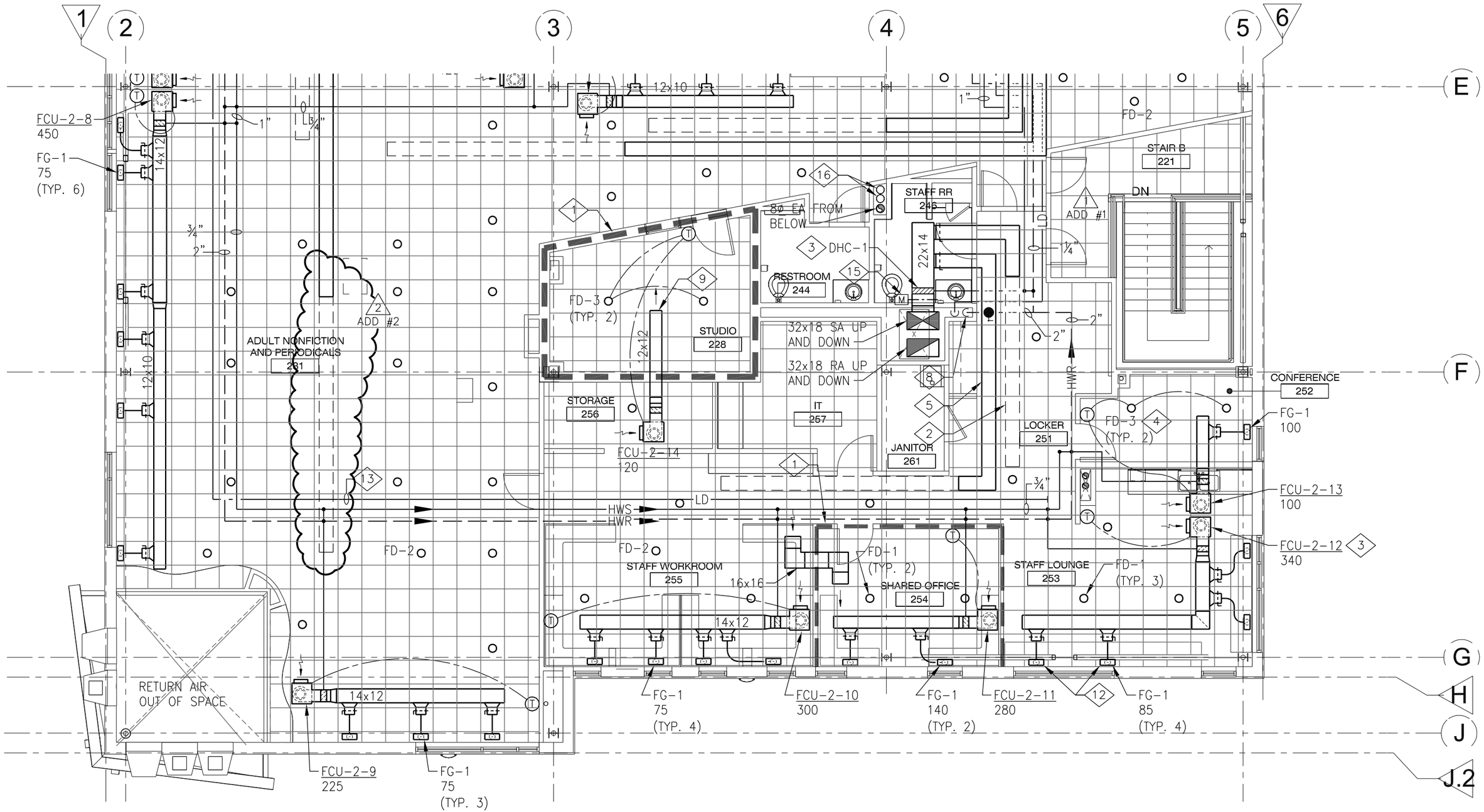
CHECKED BY: WJM	DATE: 02/21/12	MX-04	
PROJ. NO.: 43810006	REF. DRAWING: M-103		



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SCALE: 1/8" = 1'-0"

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PROJ. NO.: 43810006	REF. DRAWING: M-103		

NARRATIVE OF LIGHTING CONTROL SYSTEM INTENT:

2 ADD#2

INTERIOR LIGHTING CONTROLS:

ALL FIXED LIGHTING IN THE BUILDING SHALL BE CONNECTED TO THE SQUARE D POWERLINK CIRCUIT BREAKERS. THESE CIRCUIT BREAKERS SHALL BE ENERGIZED AT THE BEGINNING OF EACH DAY AND DE-ENERGIZED AT THE END OF EACH DAY. SQUARE D OVERRIDE SWITCHES ARE PROVIDED ON EACH FLOOR FOR AFTER HOURS CONTROL OF THE LIGHTING ON THAT FLOOR, THESE SWITCHES SHALL BE PROGRAMMED TO BE INACTIVE DURING NORMAL BUSINESS HOURS. MANUAL SWITCHES INSTALLED DOWNSTREAM OF THE CONTROLABLE CIRCUIT BREAKERS SHALL PROVIDE DUAL LEVEL OVERRIDE SWITCHING ON A PER AREA BASIS TO MEET BOTH THE REQUIREMENTS OF LEED AND THE IECC.

THE LIGHTING NEAR THE EXTERIOR WINDOWS SHALL BE DUAL LEVEL SWITCHED WITH A PHOTOSENSOR, LOCATED IN THE AREA, WHERE THE PHOTOSENSOR CONTROLS ONE HALF OF THE LIGHT OUTPUT FROM THE LUMINAIRE. THE MANUAL OVERRIDE SWITCHES SHALL NOT BE ABLE TO TURN THE LIGHTS ON WHEN THERE IS ADEQUATE DAYLIGHTING PRESENT. ALL PHOTOSENSORS SHALL BE PROGRAMMED TO TURN OFF HALF OF THE LIGHT OUTPUT FROM THE LUMINAIRES IN THE DAYLIGHTING ZONE WHEN THERE IS MORE THAN 50 FOOTCANDLES ON THE FLOOR. ALL PHOTOSENSORS SHALL BE PROGRAMMED TO TURN ON THE FULL OUTPUT OF THE LUMINAIRES IN THE DAYLIGHTING ZONE WHEN THERE IS LESS THAN 30 FOOTCANDLES ON THE FLOOR. A TIME DELAY OF 10 MINUTES SHALL BE PROGRAMMED INTO THE PHOTOSENSORS TO PREVENT THE LIGHTS FROM REPEATEDLY TURNING OFF AND ON.

IN ADDITION TO BEING CONNECTED TO THE SQUARE D POWERLINK CIRCUIT BREAKERS, ALL LIGHTING IN PRIVATE OFFICES SHALL BE CONTROLLED BY EITHER CEILING OR WALL MOUNTED OCCUPANCY SENSORS. ALL OCCUPANCY SENSORS SHALL BE MANUAL ON, AUTOMATIC OFF OPERATION WITH A TIME DELAY UNTIL OFF OF 10 MINUTES. ALL WALL MOUNTED OCCUPANCY SENSORS SHALL BE PROVIDED WITH AN INTEGRAL SWITCH TO TURN THE LIGHTS ON. ALL CEILING MOUNTED OCCUPANCY SENSORS SHALL BE INSTALLED WITH A SUPPLEMENTARY WALL MOUNTED MOMENTARY CONTACT WALL SWITCH TO TURN THE LIGHTS ON.

EXTERIOR LIGHTING CONTROLS:

ALL EXTERIOR LIGHTING ON THE BUILDING SHALL BE CONNECTED TO THE SQUARE D POWERLINK CIRCUIT BREAKERS. THESE CIRCUIT BREAKERS SHALL BE CONTROLLED BY A ROOF MOUNTED PHOTOSENSOR TO ENERGIZE 1/2 HOUR BEFORE SUNSET AND DE-ENERGIZE 1/2 HOUR AFTER SUNRISE.

RECEPTACLE LOADS CONNECTED TO POWERLINK PANELS:

THE AFTERHOURS CONTROL OF ALL RECEPTACLES CONNECTED TO THE SQUARE D POWER LINK CIRCUIT BREAKERS SHALL BE AT THE DISCRESSION OF THE LIBRARY.

OWNERSHIP OF DOCUMENTS:
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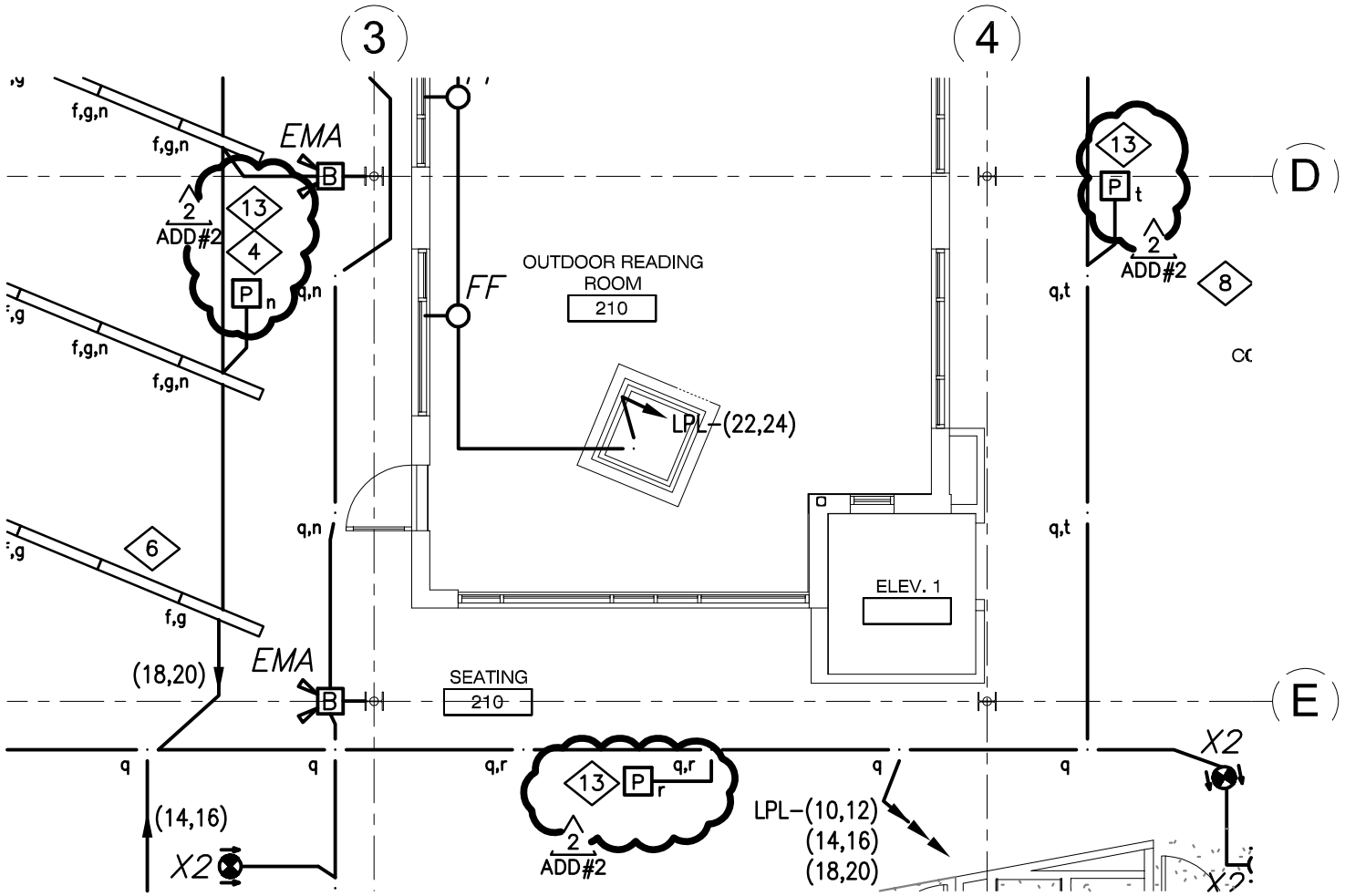
JOB NAME:	WEST DENVER BRANCH LIBRARY .		
SHEET TITLE:	ELECTRICAL LUMINAIRE SCHEDULE NARRATIVE OF LIGHTING CONTROL SYSTEM INTENT		
DRAWN BY: MVM		ISSUE: ADDENDUM #2	REV. NO.: 2
CHECKED BY: MVM		DATE: 2/22/12	EX-03
PROJ. NO.: 43810006		REF. DRAWING: E-001	



WORK NOTES:

13 / 2 ADD#2 PROVIDE CEILING MOUNTED PHOTOSENSOR, WATTSTOPPER #LS-102, WITH APPROPRIATE POWERPACK(S). IF ADEQUATE DAYLIGHTING IS REACHED, THE SENSOR WILL NOT ALLOW THE LIGHTS TO TURN ON. IF ADEQUATE DAYLIGHTING IS NOT AVAILABLE, SENSOR WILL AUTOMATICALLY TURN ON LIGHTS.

Plan North

0 4' 8' 16'

SCALE: 1/8" = 1'-0"

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JOB NAME: WEST DENVER BRANCH LIBRARY .			
SHEET TITLE: LEVEL 2 LIGHTING PLAN .			
DRAWN BY: MVM	ISSUE: ADDENDUM #2	REV. NO.: 2	EX-04
CHECKED BY: MVM	DATE: 2/22/12		
PROJ. NO.: 43810006	REF. DRAWING: E-102		

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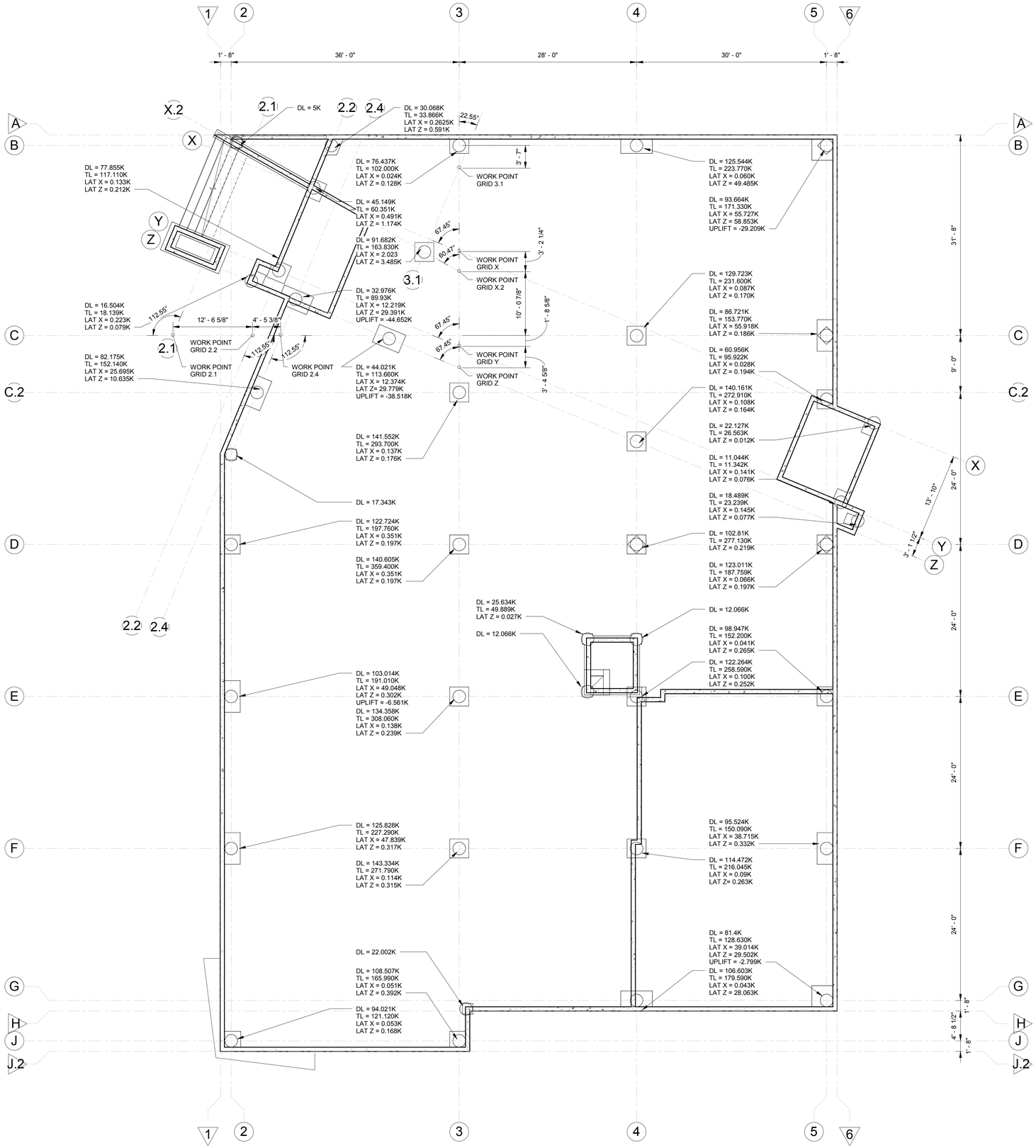

SCREW PILE NOTES

SCREW PILE NOTES:

A. ALPINE SITE SERVICES SCREW PIERS (OR EQUIVALENT APPROVED SCREW PILES OR HELICAL PIERS) SHALL BE INSTALLED BY AN AUTHORIZED CONTRACTOR TO MANUFACTURER'S DETAILS AND RECOMMENDATIONS FOLLOWING THE DESIGN LOADS SHOWN ON THE DRAWINGS.

B. A GEOTECHNICAL ENGINEER, REGISTERED IN THE STATE OF COLORADO, SHALL BE PRESENT DURING ALL DRILLING OPERATIONS, AND SHALL RECORD AND SUBMIT A PIER DRILLING LOG, SIGNED AND SEALED BY THE SUPERVISING GEOTECHNICAL ENGINEER.

C. SCREW PILES SHALL BE TORQUED PER THE MANUFACTURER TO ACHIEVE A FACTOR OF SAFETY OF 2.0 ABOVE THE DESIGN LOADS SHOWN ON THE PLANS. ALL SCREW PILES SHALL BE INSTALLED TO A MINIMUM OF 3,000 FT-LBS TORQUE.

D. ALL PIERS MUST BE CORROSION PROTECTED BY HOT DIP GALVANIZATION, U.O.N.

E. INSTALLATION TORQUE SHALL BE MONITORED THROUGHOUT THE INSTALLATION PROCESS.

LEDGEND:

◯ = PROPOSED LOCATION OF SINGLE/MULTIPLE SCREW PILES. REFER TO SCREW PILE DRAWINGS FOR LOCATION/SPACING (AND IF SCREW PILES ARE BATTER) OF SCREW PILES.

DL = DEAD LOAD AT BOTTOM OF CONCRETE PILASTER (ASD LOAD)

TL = TOTAL DESIGN LOAD (INCLUDING DEAD LOAD) AT BOTTOM OF CONCRETE PILASTER (ASD LOAD)

LAT = TOTAL LATERAL DESIGN LOAD (IN X OR Z DIRECTION) AT BOTTOM OF CONCRETE PILASTER (ASD LOAD)

X Z

UPLIFT = TOTAL UPLIFT DESIGN LOAD AT BOTTOM ON CONCRETE PILASTER (ASD LOAD)

K = KIPS

2

1 SCREW PILE LOAD PLAN
1/8" = 1'-0"

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COOD PROJECT NO: CE 02089

ISSUE DATE	PHASE
01-12-2012	100% CD
02-23-2012	2 ADDENDUM 02

SCREW PILE LOAD PLAN

S-200

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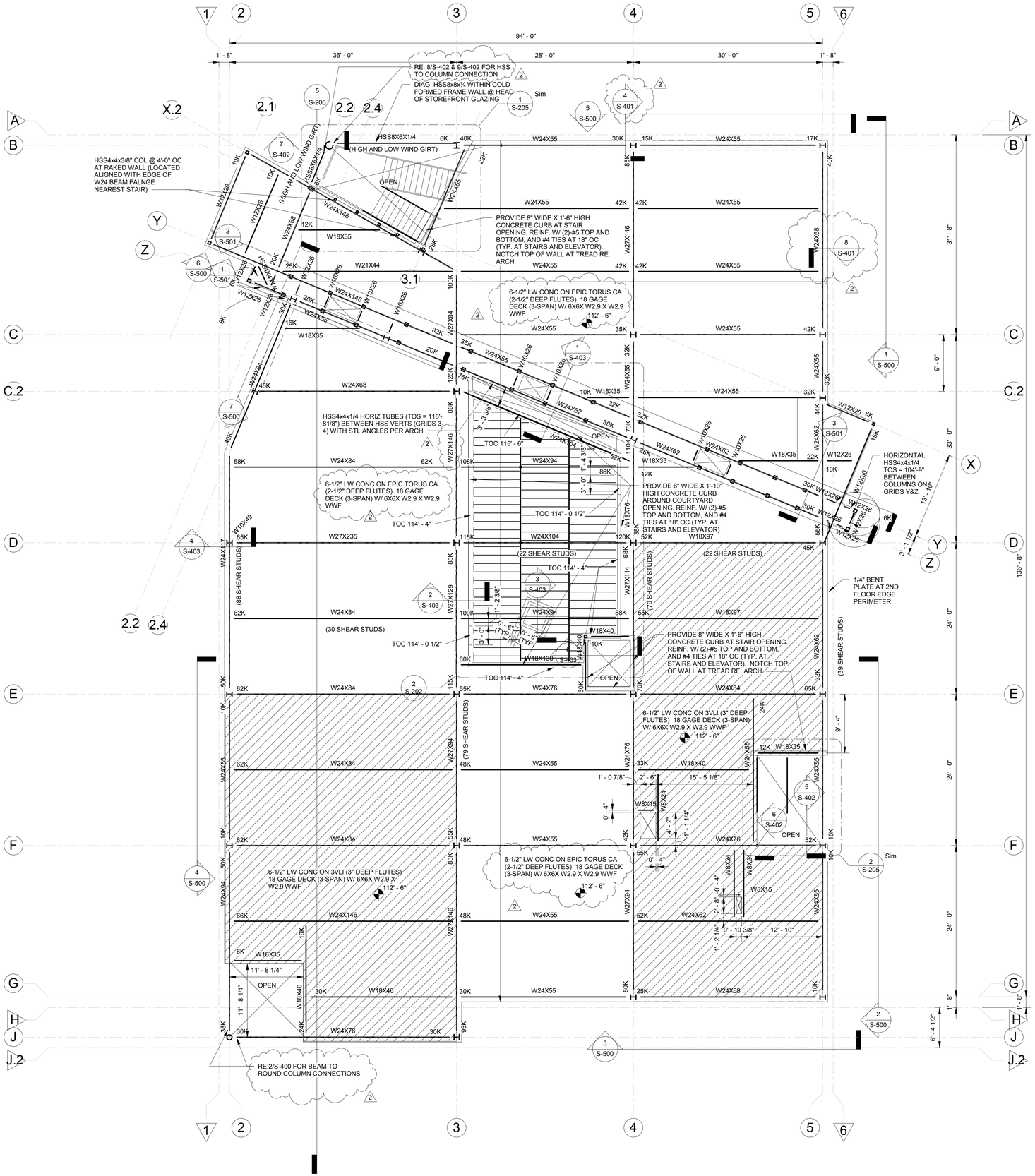
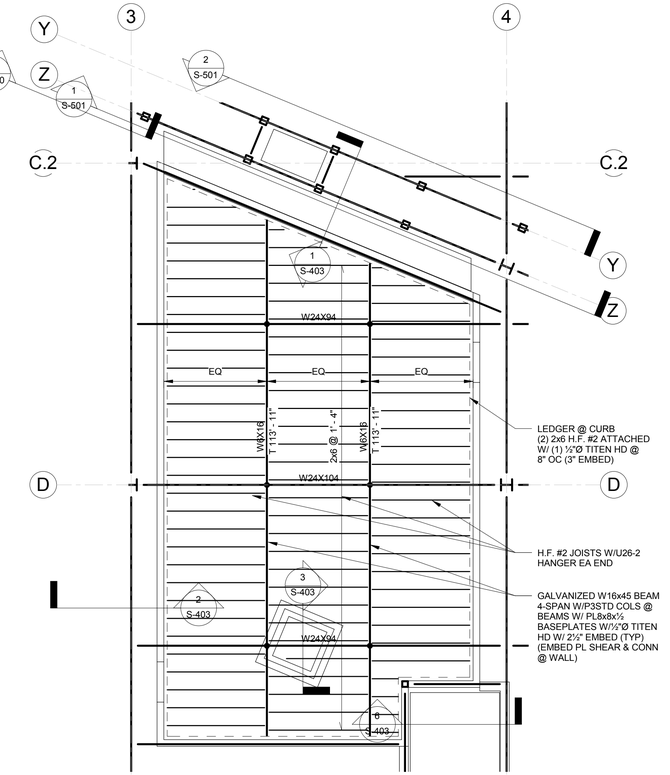
2/20/2012 5:33:32 PM



2 Callout of LEVEL 02
3/16" = 1'-0"



FRAMING NOTES:

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2. VERIFY ALL DIMENSIONS WITH ARCHITECTURALDRAWINGS.
3. VERIFY SITE DATUM WITH ARCHITECTS DRAWINGS.
4. CONTRACTOR SHALL VERIFY ALL FIELD DIMENSIONS PRIOR TO CONSTRUCTION.
5. TYPICAL DETAILS ARE NOT CUT AT EVERY LOCATION THEY OCCUR. IF A CONDITION IS UNCLEAR, CONTACT ARCHITECT IMMEDIATELY BEFORE PROCEEDING.
6. TOP OF CONCRETE SLAB IS AS NOTED ON PLAN.
7. TOP OF STEEL IS NOTED THUS (-#' -#") AND IS 111'-11 1/2" THIS LEVEL UNO.
8. ALL COMPOSITE STEEL BEAMS ARE DESIGNED FOR UNSHORED CONSTRUCTION. DO NOT SHORE COMPOSITE BEAMS WITHOUT PERMISSION OF ENGINEER.
9. CONCRETE SLAB IS LIGHTWEIGHT (115 PCF) COMPOSITE 6 1/2" EPIC TORIS CA 18 GAGE DECK (EXCEPT HATCHED AREAS WHICH ARE 6 1/2" LIGHTWEIGHT CONCRETE ON 3VLI18.) IT SHALL BE CONNECTED W/ BEAM SHEAR STUDS AS SHOWN IN ON THE PLAN AND PER MANUFACTURER'S RECOMMENDATIONS (DIAPHRAGM LOAD = 1,067 PLF). ALL DECKING SHALL BE CONTINUOUS OVER THREE SPANS (MINIMUM) OTHERWISE SHORING WILL BE REQUIRED TO SUPPORT THE DECK AT MIDSPAN UNO.
10. COMPOSITE BEAM SHEAR STUDS SHALL BE NELSON ASTM 108 ¾" DIAMETER, 4" L.A.W. (LENGTH AFTER WELDING) AT SPACING SHOWN ON PLANS (MAX. 12"O.C. ALONG BEAM LENGTH).
11. COORDINATE ALL OPENINGS THROUGH ROOF, FLOORS AND WALLS WITH ARCHITECTURAL, MECHANICAL, ELECTRICAL, PLUMBING AND CIVIL DRAWINGS. TRIM OPENINGS AS SHOWN ON PLANS.
12. SEE MECH, ELECT, AND CIVIL DRAWINGS FOR SLEEVE LOCATIONS. PIPES, CONDUITS AND OTHER PENETRATIONS NOT SHOWN SHALL NOT PASS THROUGH MASONRY OR CONCRETE WALLS OR STEEL BEAMS OR COLUMNS WITHOUT PRIOR APPROVAL FROM STRUCTURAL ENGINEER OF RECORD.
13. REFER TO ARCHITECTURAL DRAWINGS FOR FIRE RATING AND UL DESIGN NUMBER.
14. CAMBER ALL STEEL BEAMS GREATER THAN 22'-0" IN LENGTH 3/4" UNLESS OTHERWISE NOTED.
15. NOTE THAT BEAMS AND DECK WILL DEFLECT UNDER THE WEIGHT OF WET CONCRETE. CONCRETE VOLUMES SHALL BE CALCULATED TO ACCOMODATE THIS DEAD LOAD DEFLECTION.

1 LEVEL 02
1/8" = 1'-0"

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P. 303.422.7400
F. 303.422.7900
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Boulder, Colorado 80301
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SUSTAINABILITY
AMBIENT ENERGY
130 W. 5th Ave.
Denver, Colorado 80204
P. 303.278.1532
F. 303.278.8533
www.ambient-e.com

PROJECT:
WEST DENVER BRANCH LIBRARY
W. Colfax Ave. & Irving Street
DENVER, COLORADO

eDC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02089

ISSUE DATE	PHASE
01-12-2012	100% CD
02-23-2012	2 ADDENDUM 02

SECOND FLOOR PLAN

S-202

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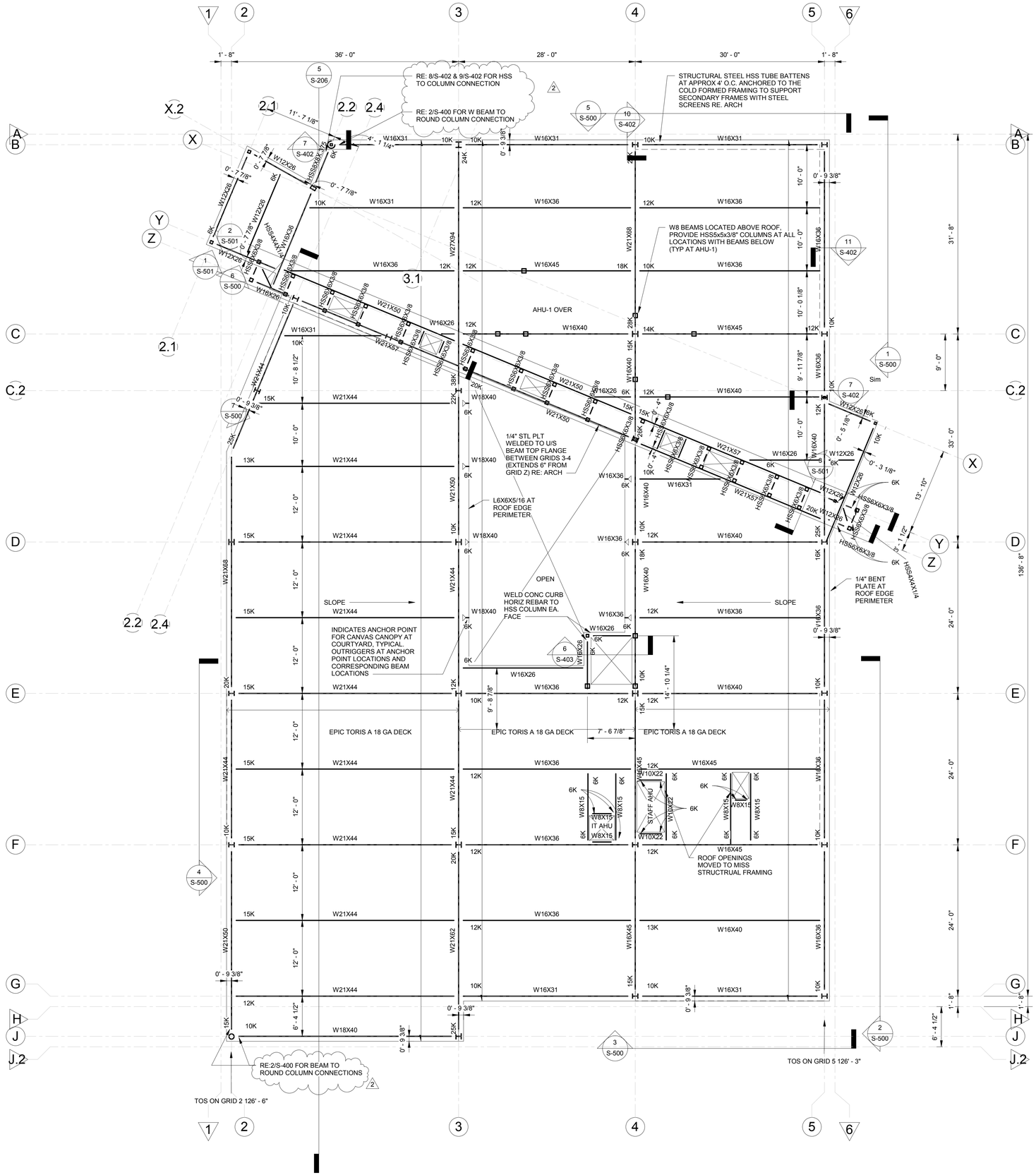

FRAMING NOTES:

1. REFER TO GENERAL STRUCTURAL NOTES DRAWING.
2. VERIFY ALL DIMENSIONS WITH ARCHITECTURAL DRAWINGS.
3. VERIFY SITE DATUM WITH ARCHITECTS DRAWINGS.
4. CONTRACTOR SHALL VERIFY ALL FIELD DIMENSIONS PRIOR TO CONSTRUCTION.
5. TYPICAL DETAILS ARE NOT CUT AT EVERY LOCATION THEY OCCUR. IF A CONDITION IS UNCLEAR, CONTACT ARCHITECT IMMEDIATELY BEFORE PROCEEDING.
6. TOP OF STEEL IS NOTED THUS (-#' -#") AND IS 125'-0" THIS LEVEL ON GRIDS 3 AND 4 AT THE ROOF LOW POINT. 126'-3" AT GRID 5 AND 126'-6" AT GRID 2.
7. ROOF DECK IS EPIC TORIS A (18 GAGE). THE DECK SHALL BE CONNECTED TO SUPPORT FRAMING WITH 3/4" WELD @ 24/3 PATTERN AND #12 TEK SIDELAPS @ 18" OC PER MANUFACTURERS RECOMMENDATIONS (DIAPHRAGM LOAD = 528 PLF). ALL DECKING SHALL BE CONTINUOUS OVER TWO SPANS (MINIMUM).
8. COORDINATE ALL OPENINGS THROUGH ROOF AND WALLS WITH ARCHITECTURAL, MECHANICAL, ELECTRICAL, PLUMBING AND CIVIL DRAWINGS. TRIM OPENINGS AS SHOWN ON PLANS.
9. SEE MECH, ELECT, AND CIVIL DRAWINGS FOR SLEEVE LOCATIONS. PIPES, CONDUITS AND OTHER PENETRATIONS NOT SHOWN SHALL NOT PASS THROUGH MASONRY OR CONCRETE WALLS OR STEEL BEAMS OR COLUMNS WITHOUT PRIOR APPROVAL FROM STRUCTURAL ENGINEER OF RECORD.
10. REFER TO ARCHITECTURAL DRAWINGS FOR FIRE RATING AND UL DESIGN NUMBER.

studiotrope
design collective
2942 Welton Street · Denver, CO 80205 · 303.308.1144 · www.studiotrope.com

OWNER
CITY AND COUNTY OF DENVER
201 W. Colfax Ave.
Denver, Colorado 80202

CIVIL ENGINEER
SAN ENGINEERING
6099 Windermere Street
Littleton, Colorado 80120
P. 303.953.9014
F. 303.953.9016
www.sanengineeringllc.com

LANDSCAPE ARCHITECT
MUNDUS BISHOP
2601 Blake Street, Suite 300
Denver, Colorado 80205
P. 303.477.5244
F. 303.477.5146
www.mundusbishop.com

STRUCTURAL ENGINEER
STUDIO NYL
2995 Baseline Road, Suite 314
Boulder, Colorado 80303
P. 303.558.3145
F. 303.440.8536
www.studionyl.com

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BCER ENGINEERING
5420 Ward Road, Suite 200
Arvada, Colorado 80002-1838
P. 303.422.7400
F. 303.422.7900
www.bcer.com

ELECTRICAL ENGINEER
BCER ENGINEERING
5420 Ward Road, Suite 200
Arvada, Colorado 80002-1838
P. 303.422.7400
F. 303.422.7900
www.bcer.com

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TECHNOLOGY PLUS
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Aurora, Colorado 80014
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02-23-2012	2 ADDENDUM 02

ROOF PLAN

S-203

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CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
Engineering Division

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CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
Engineering Division

NOTICE FOR INVITATION FOR BIDS
CONTRACT NO. 201204517

WEST DENVER LIBRARY

BID SCHEDULE:
11:00 AM, Local Time
MARCH 01, 2012

Sealed bids will be received at the Office of Economic Development (OED) Reception Desk located on the 2nd floor at 201 West Colfax, Denver, CO 80202, beginning at 10:30 a.m., no later than 11:00 a.m., on bid day.

Bids submitted prior to 10:30 a.m. on the specified bid opening date/time shall be presented at the Office of Contract Administration, Attention: Public Works Contract Administration, 201 West Colfax Avenue, Department 614, Denver, Colorado 80202. All properly delivered bids will then be publicly opened and read aloud in Room 1.D.1 on the 1st floor at 201 West Colfax, Denver, Colorado 80202:

Prior to submitting a bid, the bidder shall consult the Contractor's Bulletin Board located at 201 W. Colfax, 2nd Floor, Denver, Colorado, 80202 and/or www.work4denver.com .

GENERAL STATEMENT OF WORK:
Construct a new 27,000 square foot, two story library. The library will be LEED Silver Certified.

ESTIMATED CONSTRUCTION COST:
The estimated cost of construction for this project is between $4,800,000.00 and $5,250,000.00.

DOCUMENTS AND BID INFORMATION AVAILABLE:
Contract Documents complete with Technical Specifications and, if applicable, construction drawings will be available on the first day of publication at: www.work4denver.com . To download digital Contract Documents at a cost of $10.00 per download, reference eBid Document Number **#1862174**. Contact QuestCDN.com at 952-233-1632 or info@questcdn.com for assistance.

PRE-BID CONFERENCE:
A pre-bid conference will be held for this Project at 9:30 AM, local time, on FEBRUARY 09, 2012. This meeting will take place at: 201 W. Colfax Ave., Denver, CO. 80202, Room 4.I.4 located on the 4th floor.

DEADLINE TO SUBMIT QUESTIONS: February 16, 2012 by 12:00 P.M. Local Time.

PREQUALIFICATION REQUIREMENTS:
Each bidder must be prequalified as a **7 A GENERAL in the $7,500,000.00** monetary level in accordance with the City's Rules and Regulations Governing Prequalification of Contractors. Each bidder must have submitted a prequalification application a minimum of ten (10) calendar days prior to the bid opening date. Applications must be submitted to the Department of Public Works, Prequalification Section, 201 West Colfax Avenue, Department 506, Denver, Colorado 80202. To view the Rules and Regulations and to obtain a prequalification application, please visit our website at www.denvergov.org/prequalification or call 720-865-2539 for prequalification information ONLY.

MINORITY AND WOMAN BUSINESS ENTERPRISE PARTICIPATION:
Construction, reconstruction and remodeling contracts made and entered into by the City and County of Denver are subject to Article III, Divisions 1 and 3 of Chapter 28 of the Denver Revised Municipal Code, (Sections 28-31 to 29-36 and 28-52 to 28-90 D.R.M.C) and all Minority and Woman Business Enterprise and Equal Employment Opportunity Rules and Regulations adopted by the Director of the Division of Small Business Opportunity.

Article III, Division 3 of Chapter 28 of the D.R.M.C. directs the Director of the Division of Small Business Opportunity to establish a project goal for expenditures on construction, reconstruction, and remodeling work contracted by the City and County of Denver. The specific goal for this project is:

30.00% Minority and Woman Business Enterprise (M/WBE) Participation

Project goals must be met with certified participants as set forth in Section 28-60, D.R.M.C. or through the demonstration of a sufficient good faith effort under Section 28-62 D.R.M.C. For compliance with good faith requirements under Section 28-62(b), **the M/WBE percentage solicitation level required for this project is 100%.**

The Director of the Division of Small Business Opportunity urges all participants in City construction, reconstruction and remodeling projects to assist in achieving these goals.

MISCELLANEOUS:
Contracts for construction, reconstruction, and remodeling are subject to the City prevailing wage rate requirements established pursuant to Section 20-76, D.R.M.C.

As its best interest may appear, the City and County of Denver reserves the right to reject any or all bids and to waive informalities in bids.

If applicable, a shortened version of this Notice of Invitation for Bids and the Statement of Quantities can be viewed on the City and County of Denver website at: work4denver.com.

Publication Dates: February 1, 2, 3, 2012

Published In: The Daily Journal

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
Engineering Division

INSTRUCTIONS TO BIDDERS

IB-1 INSTRUCTION TO BIDDERS

These Instructions to Bidders are a part of the Contract Documents and are intended to serve as a guide to bidders. They are general in nature and may be amended or supplemented as needed to support any one specific invitation to bid. Each bidder shall prepare its bid in strict compliance with all requirements of the Contract Documents and by careful application of these instructions.

IB-2 BIDDING

The copy of the Contract Documents contains the Bid Form and Submittal Package for this Project, which must be used to submit a bid hereunder. The bidder must fully complete, execute and submit this Bid Form and Submittal Package, along with any other specified components of the Contract Documents, as its bid for the referenced Project.

A bidder is not required to submit as part of its bid the entire set of Contract Documents distributed by the City pursuant to the Notice of Invitation for Bids, if the bidder executes and submits the Bidder Acknowledgment Form included with the Bid Form and Submittal Package as part of its bid. However, each bidder, by submitting its bid, shall be conclusively presumed to have received and reviewed all of the information contained in the Contract Documents as this term is further defined herein.

Each bid must be enclosed in a sealed envelope, must be addressed to the Manager and must show on the face of the envelope the full name of the bidder, the City Project number, and descriptive title of the Project for which the bid is made.

The advertisement for Notice of Invitation for Bids will identify where and when the bid must be delivered.

IB-3 CONTRACT DOCUMENTS AS PUBLISHED BY CITY

Each bidder shall be responsible for, and shall be deemed to have received, all the information contained in the Contract Documents as distributed by the City pursuant to the Notice of Invitation for Bids, including addenda, whether or not such bidder has reviewed all or part of the Contract Documents in either its hard copy form or in any other format. If organizations or companies other than the City or its design professional distribute the City's Contract Documents for review by prospective bidders, whether in hard copy or via electronic or other media, neither the City nor its design professional shall be responsible for the content, completeness or accuracy of any information distributed or transmitted by any such organization or company.

IB-4 COMPLETING AND SIGNING THE BID FORMS

The bidder must complete the Bid Form by legibly writing or printing in ink, in words and figures as required, all the bidder's prices offered for the Work to be performed. All blank spaces, which require a response of the bidder, must be properly completed in full. If in the process of evaluating a bid, words and figures, as written on the Bid Form by the bidder, do not agree, the written words will govern.

For Bid Forms requiring unit price bids, the bidder shall write in the Bid Form spaces provided a unit price for each item for which a quantity is given and shall also write the product of each unit price and the quantity specified in the "Amount" or "Total" space provided.

Each bidder must sign the Bid Form and give the bidder's current business address. If an individual, the signature must be of the individual offering the bid; if a partnership, the signature must be that of a general partner; and if a corporation, both the president and the secretary must sign and the seal of the corporation must be affixed. Signatures of other persons may be acceptable if the bid contains sufficient evidence, satisfactory to the City in its sole discretion, to indicate that the other persons are authorized to bind the bidder.

IB-5 UNACCEPTABLE BIDS

The City will not accept bids from Bidders not prequalified with the Department of Public Works (if prequalification is required for this project), in arrears to the City upon debt or contract, or which are defaulters (as surety or otherwise) upon any obligation to the City.

IB-6 INFORMAL AND UNBALANCED BIDS

Any alteration, interlineations, erasure, omission, deletion or addition by the bidder to the Bid Form and Submittal Package or other parts of the Contract Documents submitted with the Bid Form and Submittal Package, as originally issued to the bidder, shall render the accompanying bid informal and may constitute cause for rejection.

Any unauthorized addition, conditional or alternate bids, failure to provide a unit price, lump sum amount or authorized alternate item specified or other irregularities of any kind which tend to render the bid incomplete, indefinite or ambiguous shall render the bid informal and may constitute cause for rejection.

Bids that are unbalanced so that each item does not reasonably carry its own proportion of cost or that contain inadequate or unreasonable prices for any item may be rejected. Bids, which have not acknowledged all addenda to the Contract Documents issued for this bid, may also be rejected.

The right is reserved by the City to reject any or all bids and to waive any informalities where it is deemed by the City to be in the best interests of the City to do so.

IB-7 ONLY ONE BID ACCEPTED

The City will accept only one bid for the same work from any one bidder. This includes bids that may be submitted under different names by one business enterprise.

IB-8 BID GUARANTEE

As a guarantee of good faith on the part of the bidder, each bid must be accompanied by a bid guarantee, consisting of either a certified or cashier's check made payable without condition to the order of the City and County of Denver or a bid bond written by an approved corporate surety in favor of the City and County of Denver. If the bid of a bidder is acceptable and the bidder is notified by the Manager that it is considered to be the Apparent Low Bidder and said bidder fails to execute a contract in the form prescribed or to furnish a performance and payment bond with a legally responsible and approved surety or to furnish the required evidence of insurance or satisfy all conditions precedent to contract execution within five (5) days after such notice is made by the City, said bid guarantee shall be forfeited to the City as liquidated damages and not as a penalty.

The bid guarantee shall be in the amount of five percent (5%) of the total bid unless otherwise specified in the Notice of Invitation for Bids and on the form appearing in the Contract Documents in the Bid Form and Submittal Package. Failure to submit a proper bid guarantee, satisfying all of the requirements specified herein and on the form provided herein shall render the bid nonresponsive and may constitute cause for rejection.

Following award and execution of the Contract by the Apparent Low Bidder, or earlier in the sole discretion of the City, bid guarantees of all but the Apparent Low Bidder will be returned. When the Apparent Low Bidder executes the Contract and delivers to the City satisfactory performance and payment bonds, required insurance documentation, and has satisfied all conditions precedent to contract execution by the City, and after approval, if any, by the Council of the City of the proposed Contract with the Apparent Low Bidder, the bid guarantee of the Apparent Low Bidder shall be returned. Such return shall be made within one hundred twenty (120) days from date bids are opened unless otherwise specified in the Special Contract Conditions.

IB-9 SITE INSPECTION AND INVESTIGATIONS

Prior to submitting a bid, the bidder is invited to inspect the work site and its surroundings. Although the bidder is not required to make such an inspection before bidding, for purposes of the Contract it shall be conclusively presumed that by failing to make such an inspection, the bidder has waived the right to later

claim additional compensation or time extensions for conditions which would have been evident had the site been inspected.

Drawings and Technical Specifications, defining the Work to be done, were prepared on the basis of interpretation by the design professionals of information derived from investigations of the work site. Such information and data are subject to sampling errors, and the interpretation of the information and data depends to a degree on the judgment of the design professional. In view of this, the bidder is invited to make such additional investigations as the bidder's judgment dictates the need for such investigations. Information about the degree of difficulty of the Work to be done cannot totally be derived from either the Drawings or Technical Specifications or from the Manager or his representatives.

Since the bid information cannot be guaranteed, the Contractor shall have assumed the risks attendant to successful performance of the Work and shall never make claim for additional compensation or time extensions on the grounds that the nature or amount of work to be done was not understood by the bidder at the time of the bidding.

IB-10 INCONSISTENCIES

Any seeming inconsistencies or ambiguities between different provisions of the Contract Documents or any point which the bidder believes requires a decision or interpretation by the City must be inquired into by the bidder by addressing a formal written communication to the Manager of Public Works and sending or delivering it to the offices of the Division of Public Works advertising this Project for bid at least forty-eight (48) hours, excluding Saturdays, Sundays, and holidays, before the time set for the opening of bids

Information about the decision or interpretation made in response to any inquiry will be posted on the Contractor's Bulletin Board (refer to IB-12 CONTRACTOR'S BULLETIN BOARD, for the location of the Contractor's Bulletin Board). If the matter raised requires, in the sole discretion of the Manager, that an addendum to the bid documents be issued, such addendum will be published and each bidder shall be required to acknowledge the addendum by signing and identifying it in the Bid Form when submitting the bid.

After bids are opened, all bidders must abide by the formal response of the Manager, as to any interpretation. The City shall not be bound and the bidder shall not rely on any oral communication, interpretation clarification or determination of the Contract Documents prior to bid opening.

IB-11 WITHDRAWAL OF BID

A bidder may withdraw its bid at any time prior to the time for receipt of bids set forth in the Notice of Invitation for Bids by making written request upon the Manager of Public Works. After such time, no bid may be withdrawn or modified.

Such request must be signed by the persons authorized to bind the bidder as defined in IB-3, COMPLETING AND SIGNING BID FORMS.

IB-12 CONTRACTOR'S BULLETIN BOARD

It shall be conclusively presumed that the bidder has, before submitting any bid, read and shall take full responsibility for all addenda, posted decisions, and other information relevant to the bid posted by the City on the Contractor's Bulletin Board. The Contractor's Bulletin Board is located at 201 W. Colfax, 2nd Floor, Denver, CO 80202, in the Wellington E. Webb Municipal Office Building.

IB-13 PRE-BID MEETING

Bidders are urged to attend the pre-bid meeting(s) scheduled for this Project. Attendance is not mandatory; however, bidders will be held responsible for all information presented at such meeting(s).

IB-14 ADDENDA

As its best interests may require, the City may issue addenda to the Contract Documents. Such addenda shall be posted on the Contractor's Bulletin Board and made available to all persons having purchased a set of Contract Documents as set forth in the Notice of Invitation for Bids contained herein. All bidders must acknowledge receipt of all addenda on the Bid Form at the time of submission of the bid.

IB-15 BID OPENING

Bidders are invited to be present at the bid opening. Unless otherwise suspended, delayed or canceled by posted notice from the Manager, bid opening will occur at the time and place designated in the Notice of Invitation for Bid.

IB-16 EVALUATION OF BIDS AND BASIS OF BID SELECTION

Bids will be evaluated after being read in open meeting at the place designated for such bid opening. All low bidders' bids will be reviewed for responsiveness to the requirements of the Contract Documents and whether or not the bids contain irregularities which could give any bidder an unfair advantage.

Selection will be made on the basis of the lowest, total, responsive, qualified bid, which bid shall include the total base bid set forth on the Bid Form, plus the total of any alternates set forth on the Bid Form and selected by the City during evaluation. Alternates, if any are included in the bid, will be selected in the priority shown on the Bid Form, subject to the limits of available funds. Bid selection will be subject to all requirements and special bidder qualifications contained herein and subject to approval of such resulting Contract in accordance with the Charter and Revised Municipal Code of the City and County of Denver. In addition to all other specified requirements, the City will correct arithmetical errors in all bids and corrected totals only will be considered as the basis of selection.

Upon concluding that the bid is, in fact, the lowest, total, responsive bid to the bidding conditions and that of a responsible, qualified bidder, the City will notify the Apparent Low Bidder.

As its best interests may appear, the City and County of Denver reserves the right to waive informalities in bids, to reject any and all bids and to rebid the Project.

IB-17 NOTICE TO APPARENT LOW BIDDER

The Notice to Apparent Low Bidder, a form of which is included in the Contract Special Conditions Section of the Contract Documents, is issued by the City directly to the selected bidder and informs the bidder that the Manager intends to seek approval of the execution of the Contract by the City in accordance with the Charter and Revised Municipal Code of the City and County of Denver. Specifically, it informs the bidder of its obligations with respect to execution of the Contract and instructs the bidder on how to proceed toward execution of the Contract. The City reserves the right to notify the Apparent Low Bidder, at any time within one hundred twenty (120) days from the date of the opening of the bids, that approval to contract with the Apparent Low Bidder shall be sought in accordance with the Charter and Revised Municipal Code of the City and County of Denver.

In accordance with the terms and conditions contained in the Bid Form and Submittal Package and any additional requirements set forth in the Notice to Apparent Low Bidder or elsewhere in the Contract Documents, the Apparent Low Bidder shall execute the Contract Form contained in the bound sets of Contract Documents made available by the City for execution in the appropriate number of counterparts. The Apparent Low Bidder shall return the fully executed Contract Document sets, along with any supplemental documents required herein, to the City and shall comply with all other conditions precedent to Contract execution within five (5) days of the date of issuance of the Notice to Apparent Low Bidder by the City. Failure to comply with each of these requirements within five (5) days of the date of issuance of the Notice to Apparent Low Bidder by the City shall render the bid nonresponsive and may constitute cause for rejection.

Issuance of such Notice shall not, however, constitute a commitment on the part of the City or create any rights in the Apparent Low Bidder to any contract with the City.

IB-18 EXECUTION OF CONTRACT

The process of executing a contract requires action by both the apparent low bidder and the City. After it notifies the Apparent Low Bidder, the City will prepare sufficient copies of the Contract Documents by incorporating all of the documents submitted by the Apparent Low Bidder into executable copies of the Contract Documents made available pursuant to the Notice of Invitation for Bids. These copies will then be made available to the Apparent Low Bidder who shall thereafter properly sign all of the copies. At this

time, the successful bidder shall also provide certain supplemental documents for incorporation into the Contract Documents. These supplemental documents shall include: the properly executed Certificate of Insurance Forms evidencing the apparent low bidder's satisfactory compliance with the insurance requirements set forth in the Contract Documents; a properly executed Payment and Performance Bond Form and appropriate Power of Attorney evidencing the Apparent Low Bidder's satisfactory compliance with the bonding requirements set forth in the Contract Documents; and documentation of compliance with any other conditions precedent to execution of the Contract by the City set forth in the Contract Documents. The insurance and bond forms contained in the Contract Special Conditions Section of the Contract Documents must be used in satisfying these supplemental document requirements.

These documents are then delivered to the City within the prescribed time period for examination of the documents to determine whether or not the Contractor has correctly executed the Contract and has correctly provided the required supplemental documents and that these documents are satisfactorily and properly completed. From here, all of the documents are forwarded to the City Attorney who will, if the insurance and bonding offered is acceptable and if all other elements of the Contract Documents are in order, recommend that the Manager and the Mayor approve the documents and, when required by the City Charter, prepare an ordinance for submittal to City Council authorizing the execution of the Contract. The City Attorney shall in all applicable instances submit the proposed contract and ordinance to City Council. After City Council approval, the Contract shall be reviewed by the City Attorney and routed for execution by the Mayor, the Clerk for attestation and the Auditor for countersignature and registration. When the total process of contract execution is complete, a Notice to Proceed will be issued and a single executed copy of the Contract will be delivered to the Contractor. Any work performed or materials purchased prior to the issuance of Notice to Proceed is at the Contractor's risk.

IB-19 BONDING REQUIREMENTS

In accordance with the provisions of General Contract Conditions, Title 15, PERFORMANCE AND PAYMENT BONDS, the minimum bonding requirements for this Contract are set forth in the form **CITY AND COUNTY OF DENVER PERFORMANCE AND PAYMENT BOND** contained in the Special Conditions Section of the Contract Documents. Upon receipt of Notice to Apparent Low Bidder, the apparent low bidder must cause this form bond to be purchased, executed and furnished, along with appropriate Powers of Attorney and a surety authorization letter (in form similar to the one attached), to the City in accordance with the instructions contained herein.

IB-20 INSURANCE REQUIREMENTS

The minimum insurance requirements for this Contract are set forth in the Special Conditions Section of the Contract Documents. Bidders are urged to consider, in preparing a bid hereunder, that each condition, requirement or specification set forth in the form certificate must be complied with by the Contractor and all subcontractors performing Work on the Project, unless such requirements are specifically accepted in writing by the City's Risk Management Office. The Contractor must either include all subcontractors performing work hereunder as insureds under each required policy or furnish a separate certificate for each subcontractor. In either case, the Contractor shall insure that each subcontractor complies with all of the coverage requirements.

IB-21 PERMITS AND LICENSES

All permits, licenses and approvals required in the prosecution of the work shall be obtained and paid for by the Contractor.

IB-22 WAGE RATE REQUIREMENTS

In preparing any bid hereunder, the Contractor must comply with and should carefully consider all requirements and conditions of the City's Payment of Prevailing Wages Ordinance, Sections 20-76 through 20-79, D.R.M.C. and any determinations made by the City pursuant thereto.

At the time of the preparation of the Contract Documents, the then-current prevailing wage rates applicable to this Project shall be bound within the Contract Documents made available to potential bidders for the Project. If, more than ten (10) days prior to the actual date of bid opening, the Career Service Board determines that prevailing wages rates different from those bound in the Contract Documents are applicable to one or more of the various classes of laborers, mechanics and workers encompassed by this Project, such

different prevailing wage rates shall be provided in an addendum. If different prevailing wage rates are determined by the Career Service Board ten (10) or less days prior to the actual date of bid opening, the City will determine on a case by case basis in its sole discretion whether such different prevailing wage rates are to be included in an addendum. In conjunction with such determination, the City may elect, in its sole discretion, to postpone the date of bid opening on the Project. In any event, the bidder will be held, at the actual date of bid opening, to those prevailing wage rates incorporated into the Contract Documents and as modified by any such addenda.

These prevailing wage rates shall be considered the **minimum** City prevailing wage rates to be paid by all contractors or subcontractors for a period not to exceed one (1) year from the date of the Contract. Increases in prevailing wages subsequent to the date of the Contract for a period not to exceed one (1) year shall not be mandatory on either the contractor or subcontractors. Future increases in prevailing wages on contracts whose period of performance exceeds one (1) year shall be mandatory for the contractor and subcontractors only on the yearly anniversary date of the Contract. The **minimum** City prevailing wage rate for any such subsequent yearly period or portion thereof shall be the wage rates in effect on the yearly anniversary date of the contract which begins such subsequent period. In no event shall any increases in prevailing wages over the amounts thereof as stated in such Technical Specifications and addenda thereto result in any increased liability on the part of the City and the possibility and risk of any such increase is assumed by all contractors entering into any such contract with the City. Decreases in prevailing wages subsequent to the date of the contract for a period not to exceed one year (1) shall not be permitted. Decreases in prevailing wages on contracts whose period of performance exceeds one (1) year shall not be effective except on the yearly anniversary date of the contract.

IB-23 TAX REQUIREMENTS

General. Bidders are referred to the General Contract Condition 322, TAXES, as to taxes to which they may be subject in performing the Work under this Contract, including but not limited to sales and use taxes and the Denver Occupational Privilege Tax. The following instructions are to be considered along with the General Contract Conditions and not in lieu of them.

Sales and Use Tax. Construction and building materials sold to contractors and subcontractors for use on structures, roads, streets, highways, and other public works owned by the City and County of Denver are exempt from state, RTD, and Cultural Facilities District sales and use taxes. However, such materials will be subject to sales and use taxes imposed by the City and County of Denver.

It is the responsibility of the Contractor and its subcontractors to apply to the Colorado Department of Revenue ("CDOR") for a certificate, or certificates, of exemption indicating that their purchase of construction or building materials is for a public project, and to deliver to the City copies of such applications as soon as possible after approval by the CDOR. Bidders shall not include in their bid amounts the exempt state, RTD, and Cultural Facilities District Sales and Use Taxes.

Denver Occupational Privilege Tax. Any employee working for a contractor, or a subcontractor, who earns over $500 working in Denver during a calendar month, is subject to the payment of the Employee Occupational Privilege Tax. The Contractor and any subcontractor must pay the Business Occupational Privilege Tax for each of its employees who are subject to such tax.

IB-24 DISCLOSURE OF PRINCIPALS

Pursuant to D.R.M.C. 20-69, any bid in excess of $100,000.00 must be accompanied by a separate detachable page setting forth the following information:

(1) The name of any officer, director, owner or principal of the business entity, including identity of any shareholder who owns or controls 5% or more of the business entity, and either 1) the names of his or her spouse, and children under eighteen years of age; or 2) a statement that he or she or his or her spouse, or children, if any, under the age of eighteen have or have not made a contribution, as defined in D.R.M.C. 15-32, or contribution in kind, as defined in D.R.M.C. 15-32, to any candidate, as defined in D.R.M.C. 15-32, during the last five years and identifying by name himself or herself or any spouse or child under the age of eighteen who has made such a contribution or contribution in-kind to a candidate.

(2) The names of any subcontractors or suppliers whose share of the bid exceeds $100,000.00 of the contract or formal bid amount.

(3) The names of any unions with which the bidder has a collective bargaining agreement.

If the total bid amount is in excess of $500,000.00, the information required in (1) above must be provided at the time of bid submittal, and the information required in (2) and (3) must be submitted in a timely fashion prior to award. The list of subcontractors required by this instrument is different and separate from the bidding list required on BF-4.

If the total bid amount is less than $500,000.00 but more than $100,000.00, such information must be provided prior to award of the contract. Failure to provide the required information in a timely fashion shall render any bid to which D.R.M.C. 20-69 applies non-responsive.

While a bidder or supplier who has already disclosed such information need not provide such information with a second or subsequent bid or proposal unless such information has changed, it shall be the responsibility of each such bidder or proposer to verify that such information is still current as of the date of such subsequent bid or proposal and is in fact on file with the City Clerk.

A form, which may be used for such disclosure, is contained in the Special Conditions Section of the Contract Documents. The form is entitled: Bidder/Contractor/Vendor/Proposer Disclosure. Failure to provide or update the required information in a timely fashion shall render any bid to which D.R.M.C. 20-69 applies non-responsive.

IB-25 MINORITY AND WOMAN BUSINESS ENTERPRISE (M/WBE) REQUIREMENTS

Article III, Divisions 1 and 3 of Chapter 28, Denver Revised Municipal Code (D.R.M.C.), designated as Sections 28-31 – 29-36 and 28-52 – 28-90 D.R.M.C. and referred to in these Bid Documents as the "M/WBE Ordinance" and any Rules or Regulations promulgated pursuant thereto apply to this Project and are incorporated into these Bid Documents by reference. Generally, the M/WBE Ordinance provides for the adoption of a good faith goals program, to be administered by the Division of Small Business Opportunity (DSBO), devised to provide increased bidding opportunities for Minority and Woman Business Enterprises (M/WBEs). As such, each bidder must comply with the terms and conditions of the M/WBE Ordinance in making its bid and, if awarded the Contract, in performing all Work thereunder. A bidder's failure to comply with the M/WBE Ordinance, any Rules or Regulations promulgated pursuant thereto, or any additional requirement contained herein shall render the bid non-responsive and shall constitute cause for rejection. Failure by the contractor awarded the contract to comply with M/WBE Ordinance requirements during the performance of the contract is a material breach of the contract, which may result in the in the imposition of sanctions on the Contractor, as deemed appropriate by DSBO. Copies of the M/WBE Ordinance and its accompanying Rules and Regulations are available for the use and review of bidders from DSBO. In order to comply with the bid requirements of the M/WBE Ordinance, a bidder shall either meet the established project goal or, in the alternative, demonstrate that the bidder has made sufficient good faith efforts to meet the goal in accordance with the M/WBE Ordinance.

Meeting Established Goal

In preparing a bid to meet the established Project goal, bidders should consider the following instructions relating to compliance with the M/WBE Ordinance:

1. Under the M/WBE Ordinance, the Director of DSBO ("Director") is directed to establish project goals for expenditures on construction, reconstruction, and remodeling work performed for the City and County of Denver. The specific goal for this project is stated in the Notice of Invitation for Bids bound herein.

2. In preparing its bid, each bidder shall list on the Bid Form pages entitled "List of Proposed MWBE or DBE Bidders, Subcontractors, Suppliers (Manufacturers) or Brokers" the name, address, work description/supply, committed level of participation and other required information for each M/WBE of any tier which the bidder intends to use in performing the work on this Project. **Only the M/WBEs identified and the precise levels of participation listed for each on the Bid Form page, at the time of bid opening, will be considered in determining whether the bidder has met the designated**

participation goal. Additional, revised or corrected participation submitted after bid opening will not be considered. M/WBE bidders may count self-performance or joint venture activity in meeting the M/WBE project goal, but only for the scope of work performed as a commercially useful function and at a percentage level the M/WBE will be performing itself.

3. If a bidder/proposer is participating in a joint venture with a certified M/WBE firm, complete the "Joint Venture Eligibility Form" and "Joint Venture Affidavit" contained in this bid document/RFP. Submit the aforementioned forms with the firm's Joint Venture Agreement, to the DSBO Director, **at least 10 working days prior to the proposal submittal.** The Joint Venture must be approved prior to the bid opening or proposal submittal by the DSBO Director. Approval by the DSBO Director includes determining the amount the Joint Venture will count towards meeting the project goal.

4. All M/WBEs listed on the Bid Form must be properly certified by the City on or before the date bids are opened in order to count towards meeting the designated goal. DSBO maintains a M/WBE Directory ("Directory"), which is a current listing of M/WBEs that have been certified by the City. A copy of the DSBO Directory is located at DSBO web site at: DSBO Compliance . Bidders are encouraged to use the Directory to assist in locating M/WBEs for the work and supplies required on the Project. Bidders are reminded that changes may be made to the Directory at anytime in accordance with the City's M/WBE Ordinance and procedures established to administer this program and a current copy of the Directory must always be used in preparing a bid. M/WBE certification or listing in the Directory is not a representation or warranty by the City as to the qualifications of any listed M/WBE.

5. In accordance with the provisions of the M/WBE Ordinance, DSBO will evaluate each bid to determine the responsiveness of the bid to the requirements of the M/WBE Ordinance. In determining whether a bidder's committed level of participation meets or exceeds the stated M/WBE goal, DSBO shall base its calculation of applicable amounts and percentages on the total base bid amount, not including any listed alternates, of each bid as follows:

   a. The bid information provided by the agency will be used to determine the total base bid amount of each bid. Each bidder's total base bid amount will be multiplied by the M/WBE percentage established for the project to determine the exact dollar amount of required M/WBE participation for the Project. This amount will then be compared against the exact dollar amounts for the M/WBE committed for participation by the bidder. If the total dollar amount of participation listed meets or exceeds the established M/WBE dollar amount goal listed, then DSBO will determine that the goal has been met.

   b. In addition, DSBO will determine the exact commitment percentage for each listed M/WBE by dividing the dollar amount listed for each M/WBE by the total base bid dollar amount submitted by the bidder. These individual percentages, when totaled for all listed M/WBE, will establish the total committed percentage level of M/WBE participation that the bidder must comply with during the life of the contract. In all cases, the committed percentage level of M/WBE participation must equal or exceed the assigned M/WBE goal for the Project.

   c. In providing the exact dollar amount of participation for each listed M/WBE, a bidder should take care never to round up in determining whether or not the total of these amounts meets or exceeds the established percentage goal. The goal must be met or exceeded by dollar amounts and percentages in order for DSBO to determine that the bidder has met or exceeded the applicable M/WBE goal.

   d. As previously mentioned, compliance with the M/WBE goal will be determined on the base bid alone. If a bid contains alternates, participation contained in any alternate will not count towards satisfaction of the Project goal. However, should any designated alternate be selected by the City for inclusion in the contract ultimately awarded, the M/WBE goal percentage level submitted at bid time, on the base bid, will also apply to the selected alternates and must be maintained for the life of the contract on the total contract amount, including any alternate work. Thus, even though such participation will not be considered in evaluating bids, bidders are urged to consider participation in preparing bids for designated alternates.

e. On projects where force account or allowance bid items have been included, bidders must meet the M/WBE goal percentage based upon the total base bid, including all such items that are submitted to the City. However, when a force account or allowance is designated by the City to be either performed or purchased from a specific company, the bidder may back out the dollar amount of the force account or allowance from the total base bid and meet the M/WBE goal on the remaining reduced amount.

f. On bids which, at the time of bid opening, are equal to or exceed Five Million Dollars ($5,000,000.00), including any alternates which may be selected, only sixty percent (60%) of the value of the commercially useful function performed by M/WBE suppliers shall count toward satisfaction of the Project goal. On Projects under Five Million ($5,000,000.00) the value of the commercially useful function of M/WBE supplier(s) will count at a one hundred percent (100%) level. Manufacturer's representatives and packagers shall be counted in the same manner as brokers.

g. In utilizing the M/WBE participation of a Broker only the bona fide commissions earned by such Broker for its performance of a commercially useful function will count toward meeting the Project goals. The bidder must separate the bona fide brokerage commissions from the actual cost of the supplies or materials provided to determine the actual dollar amount of participation that can be counted towards meeting the goal.

6. On or before the third (3rd) working day after bid opening, all of the Bidders are required to submit an executed "Letter of Intent" for each M/WBE listed on the Bid Form as a joint venture member, subcontractor, supplier, manufacturer, manufacturers' representative or broker of any tier. **A MBE or WBE Prime Bidder needs to submit a Letter of Intent <u>for itself for self-performed work</u>** and must identify their level of participation on the designated M/WBE participation page bound herein. A Letter of Intent shall be submitted <u>only</u> for the M/WBEs listed at the time of bid opening, since this is the only participation that will be counted toward satisfaction of the project goal. A form for the M/WBE Letter of Intent is included with the Bid Form. The M/WBE Letter of Intent is a written communication from the Bidder to the City evidencing an understanding that the Bidder has or will enter into a contractual relationship with the M/WBE or that its subcontractor(s) and supplier(s), manufacturer(s), manufacturers' representative(s) and broker(s) will do so. Each M/WBE Letter of Intent shall be accompanied by a copy of the City and County of Denver's M/WBE certification letter for each proposed M/WBE identified at bid time. Bidders are urged to carefully review these Letters before submission to the City to ensure that they are properly completed and executed by the appropriate parties.

Good Faith Effort.

In preparing a bid to demonstrate a good faith effort, bidders should consider the following instructions relating to compliance with the M/WBE Ordinance:

1. If the bidder or proposer has not fully met the project goal as provided in section 28-60, then it shall demonstrate that it has made good faith efforts to meet such goal. The bidder or proposer shall furnish to the director, within three (3) working days after bid opening by the City or on or before the time of the final project-specific proposal submitted to and authorized by the City pursuant to a competitive selection process, or bid selection by a private owner, a detailed statement of its good faith efforts to meet the project goal set by the director. This statement shall address each of the items in subsection (b) and any additional criteria that the director may establish by rule or regulation consistent with the purposes of this Division 3. Good faith efforts must be demonstrated to be meaningful and not merely for formalistic compliance with this Division 3. The scope and intensity of the efforts will be considered in determining whether the bidder or proposer has achieved a good faith effort.

2. The statement of good faith efforts shall include a specific response and verification with respect to each of the following good faith effort categories, which may be further defined by rule or regulation. A bidder or proposer may include any additional information it believes may be relevant. Failure of a bidder or proposer to show good faith efforts as to any one (1) of the following categories shall render its overall good faith effort showing insufficient and its bid or proposal non-responsive:

    a. If prebid or preselection meetings are scheduled by the City at which MBEs and WBEs may be informed of subcontracting or joint venture opportunities under a proposed contract to be bid, or procured pursuant to the competitive selection process, attendance at such prebid or preselection

meetings is not mandatory; however, bidders and proposers are responsible for the information provided at these meetings.

b. The bidder or proposer must solicit through all reasonable and available means, the interest of all MBEs and WBEs certified in the scopes of work of the contract. The bidder or proposer must solicit the interest of such MBEs and WBEs within sufficient time, prior to the bid opening or date of final project-specific proposal in the case of a competitive selection process, to allow such MBEs and WBEs to respond to the solicitation. The bidder or proposer must determine with certainty if the MBEs and WBEs are interested by demonstrating appropriate steps to follow up initial solicitations.

c. The bidder or proposer must select portions of the work of the contract to be performed by MBEs and WBEs in order to increase the likelihood that the project goal will be achieved. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate MBE and WBE participation as subcontractors or joint venturers, and for bidder or proposer self-performed work, as suppliers, manufacturers, manufacturer's representatives and brokers, all reasonably consistent with industry practice, even when the bidder or proposer would otherwise prefer to perform these work items with its own forces. The bidder or proposer must identify what portions of the contract will be self-performed and what portions of the contract will be opened to solicitation of bids, proposals and quotes from MBE and WBEs. All portions of the contract not self-performed must be solicited for MBE and WBE participation. The ability or desire of a bidder or proposer to perform the work of a contract with its own forces does not relieve the bidder or proposer of the responsibility to meet the project goal or demonstrate good faith efforts to do so.

d. The bidder or proposer, consistent with industry practice, must provide MBEs and WBEs at a clearly stated location with timely, adequate access to and information about the plans, specifications, and requirements of the contract, including bonding and insurance requirements, if any, to assist them in responding to a solicitation.

e. The bidder or proposer must negotiate in good faith with interested MBEs and WBEs and provide written documentation of such negotiation with each such MBE or WBE.

f. For each MBE or WBE which contacted the bidder or proposer or which the bidder or proposer contacted or attempted to subcontract or joint venture with, consistent with industry practice, the bidder or proposer must supply a statement giving the reasons why the bidder or proposer and the MBE or WBE did not succeed in negotiating a subcontracting, supplier, manufacturer, manufacturer's representative, broker or joint venture agreement, as applicable.

3. The bidder or proposer must provide verification that it rejected each non-utilized MBE and WBE because the MBE or WBE did not submit the lowest bid or it was not qualified. Such verification shall include a verified statement of the amounts of all bids received from potential or utilized subcontractors, suppliers, manufacturers, manufacturer's representatives, brokers or joint venturers on the contract, whether or not they are MBEs or WBEs. In making such a determination of not being qualified, the bidder or proposer shall be guided by the definition of qualified in section 28-54(42), but evidence of lack of qualification must be based on factors other than solely the amount of the MBE's or WBE's bid. For each MBE or WBE found not to be qualified by the bidder or proposer, the verification shall include a statement giving the bidder's or proposer's reasons for its conclusion. A bidder's or proposer's industry standing or group memberships may not be the cause of rejection of an MBE or WBE. A bidder or proposer may not reject an MBE or WBE as being unqualified without sound reasons based on a reasonably thorough investigation and assessment of the MBE's or WBE's capabilities and expertise.

4. If requested by a solicited MBE or WBE, the bidder or proposer must make reasonable efforts to assist interested MBEs and WBEs in obtaining bonding, lines of credit, or insurance as required by the City or by the bidder or proposer, provided that the bidder or proposer need not provide financial assistance toward this effort.

5. If requested by a solicited MBE or WBE, the bidder or proposer must make reasonable efforts to assist interested MBEs and WBEs in obtaining necessary and competitively priced equipment, supplies, materials, or related assistance or services for performance under the contract, provided that the bidder or proposer need not provide financial assistance toward this effort.

6. The bidder or proposer must use the DSBO MBE/WBE directories to identify, recruit, and replace MBEs and WBEs.

7. In determining whether a bidder or proposer has satisfied good faith efforts as to a project goal, the success or failure of other bidders or proposers on the contract in meeting such project goal may be considered.

Continuing Commitments.
In accordance with the provisions of the M/WBE Ordinance, the bidder agrees that it is committed to meeting either the M/WBE participation goal or the M/WBE participation set forth in its statement of good faith. This commitment must be expressly indicated on the "Commitment to MWBE SBE Participation" form included with the Bid Form. This commitment includes the following understandings:

1. The bidder understands it must maintain M/WBE goals throughout the performance of the Contract pursuant to the requirements set out in D.R.M.C. 28-72.

2. The bidder understands that it must establish and maintain records and submit regular reports, as required, which will allow the City to assess progress in achieving the M/WBE participation goal.

3. The bidder understands that if change orders or any other contract modifications are issued under the contract, the bidder shall have a continuing obligation to immediately inform DSBO in writing of any agreed upon increase or decrease in the scope of work of such contract, upon any of the bases discussed in Section 28-73 of the M/WBE Ordinance, regardless of whether such increase or decrease in scope of work has been reduced to writing at the time of notification.

4. The bidder understands that if change orders or other contract modifications are issued under the contract, that include an increase in scope of work of a contract for construction, reconstruction, or remodeling, whether by amendment, change order, force account or otherwise which increases the dollar value of the contract, whether or not such change is within the scope of work designated for performance by an M/WBE at the time of contract award, such change orders or contract modification shall be immediately submitted to DSBO for notification purposes. Those amendments, change orders, force accounts or other contract modifications that involve a changed scope of work that cannot be performed by existing project subcontractors or by the contractor shall be subject to a goal for M/WBEs equal to the original goal on the contract which was included in the bid. The contractor shall satisfy such goal with respect to such changed scope of work by soliciting new M/WBEs in accordance with Section 28-73 of the M/WBE Ordinance as applicable, or the contractor must show each element of modified good faith set out in Section 28-75(c) of the M/WBE Ordinance. The contractor shall supply to the director the documentation described in Section 28-75(c) of the M/WBE Ordinance with respect to the increased dollar value of the contract.

All bidders are charged with knowledge of and are solely responsible for complying with each and every provision of the M/WBE Ordinance in making a bid and, if awarded, in performing the work described in the Contract Documents. Failure to comply with these provisions could constitute cause for rejection of a bid or subject the selected contractor to sanctions set forth in the M/WBE Ordinance. These instructions are intended only to generally assist the bidder in preparing and submitting a compliant bid. Should any questions arise regarding specific circumstances, bidders must consult the M/WBE Ordinance or contact the Project's designated DSBO representative at (720) 913-1999.

IB- 26 DISCLOSURE OF INFORMATION

All submissions and other materials provided or produced pursuant to this Invitation for Bids may be subject to the Colorado Open Records Law, C.R.S. 24-72-201, et seq. As such, bidders are urged to review these disclosure requirements and any exceptions to disclosure of information furnished by another party and, prior to submission of a bid to the City, appropriately identify materials that are not subject to disclosure. In the event of a request to the City for disclosure of such information, the City shall advise the

bidder of such request to give the bidder an opportunity to object to the disclosure of designated confidential materials furnished to the City. In the event of the filing of a lawsuit to compel such disclosure, the City will tender all such material to the court for judicial determination of the issue of disclosure and each bidder agrees to intervene in such lawsuit to protect and assert its claims of privilege against disclosure of such material. Each bidder further agrees to defend, indemnify and save and hold harmless the City, its officers, agents and employees, from any claim, damages, expense, loss or costs arising out of the bidder's intervention to protect and assert its claims of privilege against disclosure under the Open Records Law including, but not limited to, prompt reimbursement to the City of all reasonable attorney fees, costs and damages that the City may incur directly or may be ordered to pay by such court.

IB-27 GENERAL BIDDING INFORMATION

Bidders are instructed to contact the Contract Administrator designated below for this Project for pre-bid, post-bid and general City bidding information. Bidders can also visit DenverGov.com for information, both general and project specific. The Contract Administrator assigned to this project is Toni Green who can be reached via email at toni.green@denvergov.org.

RULES AND REGULATIONS
REGARDING
EQUAL EMPLOYMENT OPPORTUNITY

Promulgated and adopted by the Manager of Public Works pursuant to and by authority of Article III, Division 2, Chapter 28 of the Revised Municipal Code of the City and County of Denver, and for the purpose of insuring that contractors, subcontractors and suppliers soliciting and receiving compensation for contract work from or through the City and County of Denver provide equal opportunity in employment without regard to race, color, creed, sex, national origin, age, religion, marital status, political opinion or affiliation or mental or physical handicap and meet certain requirements for the hiring, training, promotion, and treatment during employment of members of ethnic groups subject to differential treatment, including persons of African descent (Black), Spanish-surnamed (Hispanic), Asian-American and American Indian Groups.

RULE I - *DEFINITIONS*

A. "City" means the City and County of Denver.

B. "Manager" shall mean the Manager of Public Works for the City and County of Denver.

C. "Contract" means a contract entered into with the City and County of Denver, financed in whole or in part by local resources or funds of the City and County of Denver, for the construction of any public building or prosecution or completion of any public work.

D. "Contractor" means the original party to a contract with the City and County of Denver, also referred to as the "general" or "prime" contractor.

E. "Director" means the Director of the Division of Small Business Opportunity.

F. "Subcontractor" means any person, company, association, partnership, corporation, or other entity, which assumes by subordinate agreement some or all of the obligations of the general or prime contractor.

G. The phrase "Bidding Specifications" as used in Article III, Division 2 of Chapter 28 of the Revised Municipal Code shall include BID CONDITION, INVITATION TO BID, and NOTICE OF PROPOSAL.

H. "Affirmative Action Program" means a set of specific and result-oriented procedures or steps to which a contractor commits himself to apply every good faith effort to employ members of ethnic minority groups, to include persons of African descent (Black), Spanish surnamed (Hispanic), Asian-American, American Indians, and persons with mental or physical handicap.

I. "Division of Small Business Opportunity" means the City agency established pursuant to Article III, Division 1 of Chapter 28 of the Denver Revised Municipal Code.

RULE II - *NOTICE OF HEARING*

When results of conciliation efforts are unsatisfactory to the Manager and he is informed in accordance with Article III, Division 2 of Chapter 28 of the Revised Municipal code that a contractor or subcontractor has apparently failed to meet affirmative action and equal employment opportunity requirements after a reasonable period of notice to correct deficiencies, the Manager will, prior to imposition of any sanctions, afford the general contractor a hearing in order to determine whether the contractor or his subcontractors have failed to comply with the affirmative action and equal employment opportunity requirements of Article III, Division 2 of Chapter 28 of the Revised Municipal Code or of the contract. Written notice of such hearing shall be delivered personally or sent by certified mail, return receipt requested, to the contractor and to any subcontractor involved, at least ten (10) days prior to the date scheduled for the hearing.

RULE III - *HEARING*

A. Contractors will appear at hearings and may be represented by counsel, and may present testimony orally and other evidence.

B. Hearings shall be conducted by one or more hearing examiners designated as such by the Manager.

C. The Director of the Division of Small Business Opportunity may participate in hearings as a witness.

D. Hearings shall be held at the place specified in the notice of hearing.

E. All oral testimony shall be given under oath or affirmation and a record of such proceedings shall be made.

F. All hearings shall be open to the public.

G. The hearing officer shall make recommendations to the Manager who shall make a final decision.

REGULATIONS

REGULATION NO. 1 - ORDINANCE:

The Rules and Regulations of the Manager shall be inserted in the bidding specifications for every contract for which bidding is required.

REGULATION NO. 2 - EXEMPTIONS:

Each contract and subcontract, regardless of the dollar amount, shall be subject to affirmative action requirements unless specifically exempted in writing individually by the Manager. Exemptions apply only to "affirmative action" in equal employment opportunity, and are not to be construed as condonation in any manner of "discrimination" or "discriminatory practices" in employment because of race, color, creed, sex, age, national origin, religion, marital status, political opinion or mental or physical handicap.

REGULATION NO. 3 - DIRECTOR OF CONTRACT COMPLIANCE:

The Director of the Division of Small Business Opportunity shall perform the duties assigned to such official by Article III, Division 2 Chapter 28 of the Revised Municipal Code and by the Manager. (1) The Director of the Division of Small Business Opportunity or designated representatives shall inform bidders and contractors of affirmative action procedures, programs, and goals in accordance with the Ordinance at pre-bid and pre-construction conference; (2) make regular on-site inspections; (3) supply contractors and subcontractors with report forms to be completed by them when requested, and furnished to the Director of the Division of Small Business Opportunity; and (4) review payroll records, employment records and practices of general contractors and their subcontractors and suppliers during the performance of any contract. The Director of the Division of Small Business Opportunity shall promptly report apparent affirmative action deficiencies to the Manager.

REGULATION NO. 4 - GOALS AND TIMETABLES:

In general, goals and timetables should take into account anticipated vacancies and the availability of skills in the market place from which employees should be drawn. In addition, where discrimination in employment by a general contractor or any of his subcontractors is indicated, a corrective action program will take into account the need by the general contractor and his subcontractors to correct past discriminatory practices and reach goals of minority manpower utilization on a timely basis through such recruiting and advertising efforts as are necessary and appropriate.

REGULATION NO. 5 - AWARD OF CONTRACTS:

It shall be the responsibility of the Director of the Division of Small Business Opportunity to determine the affirmative action capability of bidders, contractors and subcontractors and to recommend to the Manager the award of contracts to those bidders, contractors and subcontractors and suppliers who demonstrate the ability and willingness to comply with the terms of their contract.

REGULATION NO. 6 - PUBLICATION AND DUPLICATION:

Copies of these Rules and Regulations as amended by the Manager from time to time, shall as soon as practicable and after Notice being published will be made a part of all City Contracts.

REGULATION NO. 7 - NOTICE TO PROCEED:

Prior to issuance of the Notice to Proceed, a sign-off will be required of the Director of the Division of Small Business Opportunity or his designee.

REGULATION NO. 8 - CONTRACTS WITH SUBCONTRACTORS:

To the greatest extent possible, the contractor shall make a good faith effort to contract with minority contractors, subcontractors and suppliers for services and supplies by taking affirmative actions, which include but are not limited to the following:

1. Advertise invitations for subcontractor bids in minority community news media.
2. Contact minority contractor organizations for referral of prospective subcontractors.
3. Purchase materials and supplies from minority material suppliers.

REGULATION NO. 9 - AGENCY REFERRALS:

It shall be no excuse that the union with which the contractor or subcontractor has an agreement providing for referral, exclusive or otherwise, failed to refer minority employees.

REGULATION NO. 10 - CLAUSES:

The Manager shall include the appropriate clauses in every contract and the contractor shall cause to be inserted in every subcontract the appropriate clauses:

1. APPENDIX A: City and County of Denver Equal Opportunity Clause - ALL CONTRACTS funded only with City and County of Denver monies.
2. APPENDIX B: Equal Opportunity Clause (11246) - ALL FEDERAL ASSISTED.
3. APPENDIX C: Section 3 - Assurance of Compliance - HUD ASSISTED PROJECTS.
4. APPENDIX D: Section 3 - Clause - HUD ASSISTED PROJECTS.

All amendments to the appendices shall be included by reference.

REGULATION NO. 11 - SHOW CAUSE NOTICES:

When the Manager has reasonable cause to believe that a contractor has violated Article III, Division 2 of Chapter 28 of the Denver Revised Municipal Code, he may issue a notice requiring the contractor to show cause, within fifteen (15) days why enforcement procedures, or other appropriate action to insure compliance, should not be instituted.

REGULATION NO. 12 - BID CONDITIONS - AFFIRMATIVE ACTION REQUIREMENTS - EQUAL EMPLOYMENT OPPORTUNITY:

1. APPENDIX E: The Bid Conditions - Affirmative Action Requirements - Equal Employment Opportunity as amended and published by the U.S. Department of Labor Employment Standards Administration, Office of Federal Contract Compliance, shall be inserted verbatim for bidding specification for every non-exempt contract involving the use of Federal funds.

2. APPENDIX F: The Bid Conditions - Affirmative Action Requirements - Equal Employment Opportunity as published by the Department of Public Works, City and County of Denver, shall be inserted verbatim as bidding specifications for every non-exempt contract using City funds.

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
Engineering Division

APPENDIX A

CITY AND COUNTY OF DENVER EQUAL OPPORTUNITY CLAUSE - ALL CONTRACTS

1. The Contractor will not discriminate against any employee or applicant for employment because of race, creed, color, sex, age, national origin, religion, marital status, political opinion or affiliation, or mental or physical handicap. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, creed, color, sex, age, national origin, religion, marital status, political opinion or affiliation, or mental or physical handicap. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

2. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, creed, color, sex, age, national origin, religion, marital status, political opinion or affiliation, or mental or physical handicap.

3. The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided, advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

4. Each Contractor will comply with all provisions of Article III, Division 2 of Chapter 28 of the Revised Municipal Code, and the rules, regulations, and relevant orders of the Manager and the Director.

5. The Contractor will furnish all information and reports required by Article III, Division 2 of Chapter 28 of the Revised Municipal Code, and by rules, regulations and orders of the Manager and Director or pursuant thereto, and will permit access to his books, records, and accounts by the Manager, Director, or their designee for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

6. In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations or orders, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further City contracts in accordance with procedures authorized in Article III, Division 2, Chapter 28 of the Revised Municipal Code, or by rules, regulations, or order of the Manager.

7. The Contractor will include Regulation 12, Paragraph 2 and the provisions of paragraphs (1) through (6) in every subcontract of purchase order unless exempted by rules, regulations, or orders of the Manager issued pursuant to Article III, Division 2, Chapter 28 of the Revised Municipal Code, so that such provisions will be binding on each subcontractor or supplier. The Contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance.

   The applicant further agrees to be bound by the above equal opportunity clauses with respect to its own employment practices when it participates in City contracts. The Contractor agrees to assist and cooperate actively with the Manager and the Director in obtaining compliance of subcontractors and suppliers with the equal opportunity clause and the rules, regulations and relevant orders of the Manager, and will furnish the Manager and the Director such information as they may require for the supervision of compliance, and will otherwise assist the Manager and Director in the discharge of the City's primary responsibility for

securing compliance. The Contractor further agrees to refrain from entering into any contract or contract modification subject to Article III, Division 2 of Chapter 28 of the Revised Municipal Code with a contractor debarred from, or who has not demonstrated eligibility for, City contracts.

The Contractor will carry out such sanctions and penalties for violation of the equal opportunity clause as may be imposed upon contractors and subcontractors by the Manager and Director. In addition, the Contractor agrees that failure or refusal to comply with these undertakings the Manager may take any or all of the following actions:

A. Cancellation, termination, or suspension in whole or in part of this contract.
B. Refrain from extending any further assistance to the applicant under the program with respect to which the failure occurred until satisfactory assurance of future compliance has been received from such applicant.
C. Refer the case to the City Attorney for appropriate legal proceedings.

SUBCONTRACTS: Each prime Contractor or Subcontractor shall include the equal opportunity clause in each of its subcontracts.

CITY AND COUNTY OF DENVER

DEPARTMENT OF PUBLIC WORKS
Engineering Division

APPENDIX F

AFFIRMATIVE ACTION REQUIREMENTS

EQUAL EMPLOYMENT OPPORTUNITY

For All Non-Exempt Construction Contracts to Be Awarded by the
City and County of Denver, Department of Public Works.

NOTICE

EACH BIDDER, CONTRACTOR OR SUBCONTRACTOR (HEREINAFTER THE CONTRACTOR) MUST FULLY COMPLY WITH THE REQUIREMENTS OF THESE BID CONDITIONS AS TO EACH CONSTRUCTION TRADE IT INTENDS TO USE ON THIS CONSTRUCTION CONTRACT, AND ALL OTHER CONSTRUCTION WORK (BOTH CITY AND NON-CITY) IN THE DENVER AREA DURING THE PERFORMANCE OF THIS CONTRACT OR SUBCONTRACT. THE CONTRACTOR COMMITS ITSELF TO THE GOALS FOR MINORITY MANPOWER UTILIZATION, AS APPLICABLE, AND ALL OTHER REQUIREMENTS, TERMS AND CONDITION OF THESE BID CONDITIONS BY SUBMITTING A PROPERLY SIGNED BID.

THE CONTRACTOR SHALL APPOINT A COMPANY EXECUTIVE TO ASSUME THE RESPONSIBILITY FOR THE IMPLEMENTATION OF THE REQUIREMENTS, TERMS AND CONDITIONS OF THESE BID CONDITIONS.

/s/_____

Manager of Public Works
City and County of Denver

A. REQUIREMENTS - AN AFFIRMATIVE ACTION PLAN:

Contractors shall be subject to the provisions and requirements of these bid conditions including the goals and timetables for minority* and female utilization, and specific affirmative action steps set forth by the Division of Small Business Opportunity (DSBO). The contractor's commitment to the goals for minority, and female utilization as required constitutes a commitment that it will make every good faith effort to meet such goals.

1. GOALS AND TIMETABLES:

The goals and timetables for minority and female participation, expressed in percentage terms for the contractor's aggregate workforce in each trade are as follows:

GOALS FOR MINORITY PARTICIPATION FOR EACH TRADE	GOALS FOR FEMALE PARTICIPATION FOR EACH TRADE
From January 1, 1982 to Until Further Notice	From January 1, 1982 to Until Further Notice
21.7% - 23.5%	**6.9%**

The goals for minority and female utilization above are expressed in terms of hours of training and employment as a proportion of the total number of hours to be worked by the contractor's aggregate workforce, which includes all supervisory personnel, in each trade, on all projects for the City and County of Denver during the performance of its contract (i.e., The period beginning with the first day of work on the City and County of Denver funded construction contract and ending with the last day of work).

The hours of minority and female employment and training must be substantially uniform throughout the length of the contract in each trade and minorities and females must be employed evenly on each of a contractor's projects. Therefore, the transfer of minority or female employees from contractor to contractor or from project to project for the purpose of meeting the contractor's goals shall be a violation of these Bid Conditions.

If the Contractor counts the nonworking hours of apprentices they must be employed by the Contractor during the training period; the Contractor must have made a commitment to employ apprentices at the completion of their training subject to the availability of employment opportunities; and the apprentices must be trained pursuant to training programs approved by the Bureau of Apprenticeship and Training.

* "Minority" is defined as including, Blacks, Spanish Surname Americans, Asian Americans, and American Indians, and includes both men and minority women.

2. SPECIFIC AFFIRMATIVE ACTION STEPS:

No contractor shall be found to be in noncompliance solely on account of its failure to meet its goals, but will be given an opportunity to demonstrate that the contractor has instituted all the specific affirmative action steps specified and has made every good faith effort to make these steps work toward the attainment of its goals within the timetables, all to the purpose of expanding minority and female utilization in its aggregate workforce. A contractor, who fails to comply with its obligation under the Equal Opportunity Clause of its contract and fails to achieve its commitments to the goals for minority and female utilization has the burden of proving that it has engaged in an Affirmative Action Program directed at increasing minority and female utilization and that such efforts were at least as extensive and as specific as the following:

a. The Contractor should have notified minority and female organizations when employment opportunities were available and should have maintained records of the organization's response.

b. The Contractor should have maintained a file of the names and addresses of each minority and female referred to it by any individual or organization and what action was taken with respect to each such referred individual, and if the individual was not employed by the Contractor, the reasons. If such individual was sent to the union hiring hall for referral and not referred back by the union or if referred, not employed by the Contractor, the file should have documented this and their reasons.

c. The Contractor should have promptly notified the Department of Public Works, and the Division of Small Business Opportunity when the union or unions with which the Contractor has collective bargaining agreements did not refer to the contractor a minority or female sent by the contractor, or when the Contractor has other information that the union referral process has impeded efforts to meet its goals.

d. The Contractor should have disseminated its EEO policy within its organization by including it in any employee handbook or policy manual; by publicizing it in company newspapers and annual reports and by advertising such policy at reasonable intervals in union publications. The EEO policy should be further disseminated by conducting staff meetings to explain and discuss the policy; by posting of the policy; and by review of the policy with minority and female employees.

e. The Contractor should have disseminated its EEO policy externally by informing and discussing it with all recruitment sources; by advertising in news media, specifically including minority and female news media; and by notifying and discussing it with all subcontractors.

f. The Contractor should have made both specific and reasonably recurrent written and oral recruitment efforts. Such efforts should have been directed at minority and female organizations, schools with substantial minority and female enrollment, and minority and female recruitment and training organizations within the Contractor's recruitment area.

g. The Contractor should have evidence available for inspection that all tests and other selection techniques used to select from among candidates for hire, transfer, promotion, training, or retention are being used in a manner that does not violate the OFCCP Testing Guidelines in 41 CFR Part 60-3.

h. The Contractor should have made sure that seniority practices and job classifications do not have a discriminatory effect.

i. The Contractor should have made certain that all facilities are not segregated by race.

j. The Contractor should have continually monitored all personnel activities to ensure that its EEO policy was being carried out including the evaluation of minority and female employees for promotional opportunities on a quarterly basis and the encouragement of such employees to seek those opportunities.

k. The Contractor should have solicited bids for subcontracts from available minority and female subcontractors engaged in the trades covered by these Bid Conditions, including circulation of minority and female contractor associations.

NOTE: The Director and the Division of Small Business Opportunity will provide technical assistance on questions pertaining to minority and female recruitment sources, minority and female community organizations, and minority and female news media upon receipt of a request for assistance from a contractor.

3. **NON - DISCRIMINATION:**
In no event may a contractor utilize the goals and affirmative action steps required in such a manner as to cause or result in discrimination against any person on account of race, color, religion, sex, marital status, national origin, age, mental or physical handicap, political opinion or affiliation.

4. **COMPLIANCE AND ENFORCEMENT:**
In all cases, the compliance of a contractor will be determined in accordance with its obligations under the terms of these Bid Conditions. All contractors performing or to perform work on projects subject to these Bid Conditions hereby agree to inform their subcontractors in writing of their respective obligations under the terms and requirements of these Bid Conditions, including the provisions relating to goals of minority and female employment and training.

B. CONTRACTORS SUBJECT TO THESE BID CONDITIONS:
In regard to these Bid Conditions, if the Contractor meets the goals set forth therein or can demonstrate that it has made every good faith effort to meet these goals, the Contractor shall be presumed to be in compliance with Article III, Division 2 of Chapter 28 of the Revised Municipal Code, the implementing regulations and its obligations under these Bid Conditions. In the event, no formal sanctions or proceedings leading toward sanctions shall be instituted unless the contracting or administering agency otherwise determines that the contractor is violating the Equal Opportunity Clause.

1. Where the Office of Contract Compliance finds that a contractor failed to comply with the requirements of Article III, Division 2 of Chapter 28 of the Revised Municipal Code or the implementing regulations and the obligations under these Bid Conditions, and so informs the Manager, the Manager shall take such action and impose such sanctions, which include suspension, termination, cancellation, and debarment, as may be appropriate under the Ordinance and its regulations. When the Manager proceeds with such formal action it has the burden of proving that the Contractor has not met the goals contained in these Bid Conditions. The Contractor's failure to meet its goals shall shift to it the requirement to come forward with evidence to show that it has met the good faith requirements of these Bid Conditions.

2. The pendency of such proceedings shall be taken into consideration by the Department of Public Works in determining whether such contractor can comply with the requirements of Article III, Division 2 of Chapter 28 of the Revised Municipal Code, and is therefore a "responsible prospective contractor".

3. The Division of Small Business Opportunity shall review the Contractor's employment practices during the performance of the contract. If the Division of Small Business Opportunity determines that the Contractor's Affirmative Action Plan is no longer an acceptable program, the Director shall notify the Manager.

C. OBLIGATIONS APPLICABLE TO CONTRACTORS:
It shall be no excuse that the union with which the Contractor has a collective bargaining agreement providing for exclusive referral failed to refer minority or female employees. Discrimination in referral for employment, even if pursuant to provisions of a collective bargaining agreement, is prohibited by the National Labor Relations Act, as amended, Title VI of the Civil Rights Act of 1964, as amended, and Article III, Division 2 of Chapter 28 of the Revised Municipal Code. It is the policy of the Department of Public Works that contractors have a responsibility to provide equal employment opportunity, if they wish to participate in City and County of Denver contracts. To the extent they have delegated the responsibility for some of their employment practices to a labor organization and, as a result, are prevented from meeting their obligations pursuant to Article III, Division 2, Chapter 28 of the Revised Municipal Code, such Contractors cannot be considered to be in compliance with Article III, Division 2, Chapter 28 of the Revised Municipal Code, or its implementing rules and regulations.

D. GENERAL REQUIREMENTS:
Contractors are responsible for informing their subcontractors in writing regardless of tier, as to their respective obligations. Whenever a Contractor subcontracts a portion of work in any trade covered by

these Bid Conditions, **it shall include these Bid Conditions in such subcontracts and each subcontractor shall be bound by these Bid Conditions to the full extent as if it were the prime contractor.** The Contractor shall not, however, be held accountable for the failure of its subcontractors to fulfill their obligations under these Bid Conditions. However, the prime contractor shall give notice to the Director of any refusal or failure of any subcontractor to fulfill the obligations under these Bid Conditions. A subcontractor's failure to comply will be treated in the same manner as such failure by a prime contractor.

1. Contractors hereby agree to refrain from entering into any contract or contract modification subject to Article III, Division 2, Chapter 28 of the Revised Municipal Code with a contractor debarred from, or who is determined not to be a "responsive" bidder for the City and County of Denver contracts pursuant to the Ordinance.

2. The Contractor shall carry out such sanctions and penalties for violation of these Bid Conditions and the Equal Opportunity Clause including suspension, termination and cancellation of existing subcontracts and debarment from future contracts as may be ordered by the Manager pursuant to Article III, Division 2, Chapter 28 of the Revised Municipal Code and its implementing regulations.

3. Nothing herein is intended to relieve any contractor during the term of its contract from compliance with Article III, Division 2, Chapter 28 of the Revised Municipal Code, and the Equal Opportunity Clause of its contract with respect to matters not covered in these Bid Conditions.

4. Contractors must keep such records and file such reports relating to the provisions of these Bid Conditions as shall be required by the Office of Contract Compliance.

5. Requests for exemptions from these Bid Conditions must be made in writing, with justification, to the Manager of Public Works, 201 W. Colfax, Dept. 608, Denver, Colorado 80202, and shall be forwarded through and with the endorsement of the Director.

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
Engineering Division

CONTRACT NO. 201204517

WEST DENVER LIBRARY

CONTRACT

THIS CONTRACT AND AGREEMENT, made and entered into by and between the City and County of Denver, a municipal corporation of the State of Colorado, hereinafter referred to as the "City," party of the first part, and **White Construction Group,** hereinafter referred to as the "Contractor," party of the second part,

Ash & White Construction Co.
18 S Wilcox St., Suite 100
Castle Rock, CO 80104

WITNESSETH, Commencing on **February 1, 2012,** and for at least three (3) days the City advertised that sealed bids would be received for furnishing all labor, tools, supplies, equipment, materials, and everything necessary and required for the following:

CONTRACT NO. 201204517

WEST DENVER LIBRARY

WHEREAS, bids pursuant to said advertisement have been received by the Manager of Public Works, who has recommended that a Contract for said work be made and entered into with the above named Contractor who was the lowest, responsive, qualified bidder therefore, and

WHEREAS, said Contractor is now willing and able to perform all of said work in accordance with said advertisement and its bid.

NOW THEREFORE, in consideration of the compensation to be paid the Contractor, the mutual agreements hereinafter contained, and subject to the terms hereinafter stated, it is mutually agreed as follows:

1. **CONTRACT DOCUMENTS**
It is agreed by the parties hereto that the following list of documents, instruments, technical specifications, plans, drawings and other materials which are attached hereto and bound herewith, incorporated herein by reference or otherwise referenced in these documents constitute and shall be referred to either as the "Contract Documents" or the "Contract," and all of said documents, instruments, technical specifications, Plans, Drawings and other materials taken together as a whole constitute the Contract between the parties hereto, and they are as fully a part of this agreement as if they were set out verbatim and in full herein:

Advertisement of Notice of Invitation for Bids
Instructions to Bidders
Commitment to M/WBE Participation
Article III, Divisions 1, 2, and 3 of Chapter 28, D.R.M.C.
Bid Bond
Addenda (as applicable)

Equal Employment Opportunity Provisions (Appendix A and Appendix F)
Bid Form
Contract Form
General Contract Conditions
Special Contract Conditions
Performance and Payment Bond
Notice to Apparent Low Bidder
Notice to Proceed
Contractor's Certification of Payment Form
Final/Partial Lien Release Form
Certificate of Contract Release
Change Orders (as applicable)
Federal Requirements (as applicable)
Prevailing Wage Rate Schedule(s)
Technical Specifications
Contract Drawings
Accepted Shop Drawings

2. SCOPE OF WORK

The Contractor agrees to and shall furnish all labor, tools, supplies, equipment, materials and everything necessary for and required to do, perform and complete all of the Work described, drawn, set forth, shown and included in said Contract Documents.

3. TERMS OF PERFORMANCE

The Contractor agrees to undertake the performance of the Work under this Contract within ten (10) days after being notified to commence work by issuance of a Notice to Proceed in substantially the form contained herein from the Manager and agrees to fully complete said Work within **350 (Three Hundred Fifty Days)** consecutive calendar days from the effective date of said Notice, plus such extension or extensions of time as may be granted in accordance with the provisions of the General Contract Conditions and any applicable Special Contract Conditions.

4. TERMS OF PAYMENT

The City agrees to pay the Contractor for the performance of all of the Work required under this Contract, and the Contractor agrees to accept as the Contractor's full and only compensation therefore, such sum or sums of money as may be proper in accordance with the price or prices set forth in the Contractor's Bid Form hereto attached and made a part hereof for **Lump Sum Bid Amount plus Add Alternates No. 1, No. 2, No. 3a, No. 3b, No. 4 and No. 5**, the total estimated cost thereof being **Five Million Six Hundred Fifty Six Thousand Dollars and No Cents ($5,656,000.00)**. Adjustments to said Contract Amount and payment of amounts due hereunder shall be made in accordance with the provisions of the General Contract Conditions and any applicable Special Contract Conditions.

5. NO DISCRIMINATION IN EMPLOYMENT

In connection with the performance of the Work under this Contract, the Contractor agrees not to refuse to hire, discharge, promote or demote, or to discriminate in matters of compensation against any person otherwise qualified, solely because of race, color, religion, national origin, gender, age, military status, sexual orientation, marital status, or physical or mental disability; and the Contractor further agrees to insert the foregoing provision in all subcontracts hereunder.

6. COMPLIANCE WITH M/WBE REQUIREMENT

This Contract is subject to all applicable provisions of Divisions 1and 3 of Article III, of Chapter 28, Denver Revised Municipal Code (D.R.M.C.), designated as Sections 28-31 – 28-36 and 28-52 – 28-90 D.R.M.C. and referred to in this Contract as the "M/WBE Ordinance". Without limiting the general applicability of the foregoing, the Contractor acknowledges its continuing duty, pursuant to Sections 28-72, 28-73 and 28-75 of the D.R.M.C., to maintain throughout the duration of this Contract, compliance with the level of minority and Woman business enterprise participation, upon which the City approved the award of this Contract to the Contractor and the Contractor further acknowledges that failure to maintain such

participation commitments or otherwise comply with the requirements of the M/WBE Ordinance shall subject the Contractor to sanctions in accordance with Section 28-77 of the D.R.M.C. Nothing contained in this provision or in the M/WBE Ordinance shall negate the City's right to prior approval of subcontractors, or substitutes therefore, under this Contract

7. WAGE RATE REQUIREMENTS

In performance of all Work hereunder, the Contractor agrees to comply with and be bound by all requirements and conditions of the City's Payment of Prevailing Wages Ordinance, Sections 20-76 through 20-79, D.R.M.C. and any determinations made by the City pursuant thereto.

8. APPLICABILITY OF LAWS

The Agreement between the Contractor and the City shall be deemed to have been made in the City and County of Denver, State of Colorado and shall be subject to, governed by, and interpreted and construed by or in accordance with the laws of the State of Colorado and the Charter, Revised Municipal Code, Rules, Regulations, Executive Orders and fiscal rules of the City. As such, the Contractor shall at all times comply with the provisions of the Charter, Revised Municipal Code, Rules, Regulations, Executive Orders and fiscal rules of the City, and those State of Colorado and Federal Laws, Rules and Regulations, which in any manner limit, control or apply to the actions or operations of the Contractor, any subcontractors, employees, agents or servants of the Contractor engaged in the Work or affecting the materials and equipment used in the performance of the Work, as the same may be, from time to time, promulgated, revised or amended. The Charter and Revised Municipal Code of the City and County of Denver, as the same may be amended from time to time, are hereby expressly incorporated into this Agreement as if fully set out herein by this reference.

9. APPROPRIATION

The amount of money, which has been appropriated and encumbered for the purpose of this contract, to date, is equal to or in excess of the Contract Amount. The Manager, upon reasonable written request, will advise the Contractor in writing of the total amount of appropriated and encumbered funds, which remain available for payment for all Work under the Contract.

The issuance of any change order or other form or order or directive by the City which would cause the aggregate payable under the contract to exceed the amount appropriated for the contract is expressly prohibited. In no event shall the issuance of any change order or other form of order or directive by the City be considered valid or binding if it requires additional compensable work to be performed, which work will cause the aggregate amount available under the Contract to exceed the amount appropriated and encumbered for this Contract, unless and until such time as the Contractor has been advised in writing by the Manager that a lawful appropriation, sufficient to cover the entire cost of such additional work, has been made.

It shall be the responsibility of the Contractor to verify that the amounts already appropriated for this Contract are sufficient to cover the entire cost of such work, and any work undertaken or performed in excess of the amount appropriated is undertaken or performed in violation of the terms of this contract, without the proper authorization for such work, and at the Contractor's own risk.

10. APPROVALS

In the event this Contract calls for the payment by the City of five hundred thousand dollars ($500,000.00) or more, approval by the Board of Councilmen of the City and County of Denver, acting by ordinance, in accordance with Section 3.2.6 of the Charter of the City and County of Denver, is and shall be an express condition precedent to the lawful and binding execution and effect and performance of this contract.

11. ASSIGNMENT

The Contractor shall not assign any of its rights, benefits, obligations or duties under this Contract except upon the prior written consent and approval of the Manager to such assignment.

12. DISPUTES RESOLUTION PROCESS

It is the express intention of the parties to this Contract that all disputes of any nature whatsoever regarding the Contract including, but not limited to, any claims for compensation or damages arising out of breach or

default under this Contract, shall be resolved by administrative hearing pursuant to the provisions of Section 56-106, D.R.M.C., or, as applicable, Section 28-33 D.R.M.C. for Minority and Woman Business Enterprise disputes. The Contractor expressly agrees that this dispute resolution process is the only dispute resolution mechanism that will be recognized by the parties for any claims put forward by the Contractor, notwithstanding any other claimed theory of entitlement on the part of the Contractor or its subcontractors or suppliers.

13. CONTRACT BINDING

It is agreed that this Contract shall be binding on and inure to the benefit of the parties hereto, their heirs, executors, administrators, assigns and successors.

14. PARAGRAPH HEADINGS

The captions and headings set forth herein are for convenience of reference only and shall not be construed so as to define or limit the terms and provisions hereof.

15. SEVERABILITY

It is understood and agreed by the parties hereto that, if any part, term, or provision of this Contract, except for the provisions of this Contract requiring prior appropriation and limiting the total amount to be paid by the City, is by the courts held to be illegal or in conflict with any law of the State of Colorado, the validity of the remaining portions or provisions shall not be affected, and the rights and obligations of the parties shall be construed and enforced as if the Contract did not contain the particular part, term or provision held to be invalid.

16. ELECTRONIC SIGNATURES AND ELECTRONIC RECORDS:

Contractor consents to the use of electronic signatures by the City. The Agreement, and any other documents requiring a signature hereunder, may be signed electronically by the City in the manner specified by the City. The Parties agree not to deny the legal effect or enforceability of the Agreement solely because it is in electronic form or because an electronic record was used in its formation. The Parties agree not to object to the admissibility of the Agreement in the form of an electronic record, or a paper copy of an electronic document, or a paper copy of a document bearing an electronic signature, on the ground that it is an electronic record or electronic signature or that it is not in its original form or is not an original.

Contract Control Number:

IN WITNESS WHEREOF, the parties have set their hands and affixed their seals at Denver, Colorado as of

SEAL

CITY AND COUNTY OF DENVER

ATTEST:

By_____

_____

APPROVED AS TO FORM:

REGISTERED AND COUNTERSIGNED:

By_____

By_____

By_____

IN WITNESS WHEREOF, the parties have executed this agreement and affixed their seals at Denver, Colorado as of the day first above written.

Contract Control Number: 201204517

Vendor Name: **ASH & WHITE CONSTRUCTION CO.**

By: _____

Name: Douglas E Deeb
(please print)

Title: Vice President
(please print)

ATTEST: [if required]

By: _____

Name: Courtney White
(please print)

Title: Secretary
(please print)

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS

General Contract Conditions

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CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS
Engineering Division

SPECIAL CONTRACT CONDITIONS

SC-1 CONSTRUCTION SPECIFICATIONS

Except as amended herein or in the attached Technical Specifications, all Work performed under the terms of this Contract shall be governed by the applicable provisions of the following latest editions:

City and County of Denver:

Standard Specifications for Construction, GENERAL CONTRACT CONDITIONS,
(The Index for which is bound herein and commonly referred to as the "Orange Book")
(1999 Edition)

Transportation Standards and Details for the Engineering Division

City and County of Denver Traffic Standard Drawings

Wastewater Management Division
– *Standard Detail Drawings*

– *Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications*

Colorado Department of Transportation:

Standard Specifications for Road and Bridge Construction
(Sections 200 through 700 of the 2011 Edition)

Federal Highway Administration:

Manual on Uniform Traffic Control Devices for Streets & Highways (MUTCD)

Building & Fire Codes:

Building Code of the City and County of Denver
(International Building Code 2006 Series, City and County of Denver Amendments 2006)

National Fire Protection Association Standards
(As referenced in the Building Code of the City and County of Denver)

The aforementioned City and County of Denver documents are available for review at the Capital Projects Management Office, 201 W. Colfax Ave., Dept. 506, (5th floor), Denver, CO 80202. The *Standard Specifications for Construction, GENERAL CONTRACT CONDITIONS* is available for purchase at the Cashier, 2nd floor at 201 W. Colfax Ave., Denver, Colorado 80202. *Transportation Standards and Details for the Engineering Division* and the Wastewater Management Division – *Standard Detail Drawings*, are available at http://www.denvergov.org.

The "*Colorado Department* of *Transportation Standard Specifications for Road and Bridge Construction*" is available for review on CDOT's website at http://www.coloradodot.info/ and can be purchased from the Colorado Department of Transportation.

The *Manual on Uniform Traffic Control Devices for Streets & Highways* is available for review at the Federal Highway Administration Website at: www.fhwa.dot.gov, The FHWA website also contains purchasing information.

SC-2 CONSTRUCTION DOCUMENTS

The construction documents consist of Plans, Technical Specifications and, if applicable, Drawings as identified in the Index for Contract Drawings, the Index for Technical Specifications and any additional Plans attached hereto.

SC-3 DEPUTY MANAGER / CITY ENGINEER

General condition 109 DEPUTY MANAGER is hereby deleted in its entirety and replaced with the following:

The "Deputy Manager" means the official who reports directly to the Manager and exercises supervisory responsibility in the City agency defined in Title 2 herein that is responsible for the Project. The Manager hereby designates the City Engineer as the Deputy Manager for purposes of this Contract. The City Engineer shall have responsibility for this Project and shall undertake all duties, responsibilities, rights and authority, including specific actions and decisions, delegated to the Deputy Manager under the various terms and conditions of this Contract.

SC-4 ENGINEERING DIVISION / CITY ENGINEER

General Condition 206, TRANSPORTATION DIVISION, is hereby deleted in its entirety and replaced with the following:

The Engineering Division is a unit of the Department of Public Works and is supervised by the City Engineer, who is subordinate to the Manager of Public Works. This Division is responsible for the planning, design, construction, operation and maintenance of all of the City's transportation facilities and the planning, design and construction of all of the City's wastewater facilities, except for the City's Municipal Airport System. All other references to the Transportation Division or the Deputy Manager of Public Works for Transportation are deleted and replaced with references to the Engineering Division and City Engineer, respectively.

SC-5 WASTEWATER MANAGEMENT DIVISION

General Condition Section 208, WASTEWATER MANAGEMENT DIVISION , is hereby deleted in its entirety and replaced with the following:

The Wastewater Management Division is a unit of the Department of Public Works and is supervised by the Deputy Manager of Public Works for Wastewater Management, who is subordinate to the Manager of Public Works. This Division is responsible for the operation and maintenance of the City's wastewater facilities.

SC-6 CITY DELEGATION OF AUTHORITY

With reference to General Contract Condition 109, DEPUTY MANAGER, General Contract Condition 206, ENGINEERING DIVISION and General Contract Condition 214, CITY'S CONTRACT ADMINISTRATION LINE OF AUTHORITY, the Manager hereby designates the City Engineer as the City official responsible for those certain actions and decisions designated as the responsibility of the Deputy Manager under the General Conditions and delegates to the City Engineer the authority necessary to undertake those responsibilities under this Contract. The Director shall have supervisory responsibility over the Project Manager. Additionally, Contractor questions concerning the Plans and Technical Specifications shall be directed to:

Denver Department of Public Works / Engineering Division,

Project Manager	Telephone
City Project Manager Quentin Rockwell	(970) 402-0382

SC-7 LIQUIDATED DAMAGES

Should the Contractor fail to complete all Work within the Contract Time allocated under the Contract Form at Paragraph 3, TERMS OF PERFORMANCE, the Contractor shall become liable to the City and County of Denver for liquidated damages, and not as a penalty, at the rate of $1,000.00 for each Day that the Contractor exceeds the time limits herein specified, all in accordance with provisions of General Contract Condition 602, LIQUIDATED DAMAGES; ADMINISTRATIVE COSTS; ACTUAL DAMAGES.

Representative hourly rates for the City administrative costs described in General Contract Condition 602.2 shall be as follows for this Project:

Project Manager	$69 per hour
Project Engineer	$63 per hour
Inspector	$49 per hour
Surveying, if necessary	$100 per hour

SC-8 SUBCONTRACTS

In accordance with General Contract Condition 501, SUBCONTRACTS, no limit shall apply to that percentage of the Work, which may be sublet providing that the subcontractors receive prior approval in accordance with General Contract Condition 502, SUBCONTRACTOR ACCEPTANCE.

SC-9 PAYMENTS TO CONTRACTORS

In accordance with General Contract Condition 902, PAYMENT PROCEDURE, the party(ies) responsible for review of all Pay Applications shall be:

Agency/Firm	Name	Telephone
Public Works/Engineering Division	Quentin Rockwell	(970) 402-0382

In accordance with General Contract Condition 906, APPLICATIONS FOR PAYMENT, each Application submitted shall include the following:

1. The estimate of Work completed shall be based on the approved schedule of values or unit prices, as applicable, and the percent of the Work complete.
2. Each Application for Payment shall include each and every independent subcontractor's payroll information including pay dates and pay amounts.
3. The Contractor shall also submit to the Auditor and other appropriate officials of the City in a timely fashion, information required by General Contract Condition 1004, REPORTING WAGES PAID.

In accordance with General Contract condition 907, RELEASES AND CONTRACTORS CERTIFICATION OF PAYMENT, Applications for Payment must be accompanied by completed Partial or Final Claim Release Form, as appropriate, from EACH subcontractor and supplier, **AND** the Contractors' Certification of Payment Form. The forms, Final/Partial Release and Certificate of Payment (Subcontractor/Supplier) and the Contractor's Certification of Payment, either of which must be used are as follows:

DEPARTMENT OF PUBLIC WORKS
Engineering Division

FINAL/PARTIAL RELEASE AND CERTIFICATE OF PAYMENT (SUBCONTRACTOR/SUPPLIER)

_____ Date: _____, 20___.
(PROJECT NO. and NAME)

_____ Subcontract #:_____.
(NAME OF CONTRACTOR)

Subcontract Value: $_____.

_____ Last Progress Payment: $_____.
(NAME OF SUBCONTRACTOR/SUPPLIER) Date: _____.

Check Applicable Box: Total Paid to Date: $_____.

[ ] MBE [ ] WBE Date of Last Work: _____.

The Undersigned hereby certifies that all costs, charges or expenses incurred by the undersigned or on behalf of the undersigned for any work, labor or services performed and for any materials, supplies or equipment provided on the above referenced Project or used in connection with the above referenced Subcontract (the "Work Effort") have been duly paid in full.

The Undersigned further certifies that each of the undersigned's subcontractors and suppliers that incurred or caused to be incurred, on their behalf, costs, charges or expenses in connection with the undersigned's Work Effort on the above referenced Project have been duly paid in full.

In consideration of $_____ representing the Last Progress Payment referenced above and in further consideration of the Total Paid to Date, also referenced above, and other good and valuable consideration received and accepted by the undersigned this _____ day of _____, 20__, the Undersigned hereby releases and discharges the City and County of Denver (the "City"), the above referenced City Project, the City's premises and property and the above referenced Contractor from all claims, liens, rights, liabilities, demands and obligations, whether known or unknown, of every nature arising out of or in connection with the performance of the work effort.

As additional consideration for the payments referenced above, the undersigned agrees to defend, indemnify and save and hold harmless the City, its officers, employees, agents and assigns and the above-referenced Contractor from and against all costs, losses, damages, causes of action, judgments under the subcontract and expenses arising out of or in connection with any claim or claims against the City or the Contractor which arise out of the Undersigned's performance of the Work Effort and which may be asserted by the Undersigned or any of its suppliers or subcontractors of any tier or any of their representatives, officers, agents, or employees.

It is acknowledged that this release is for the benefit of and may be relied upon by the City and the referenced Contractor.

The foregoing shall not relieve the undersigned of any obligation under the provisions of the Undersigned's subcontract, as the subcontract may have been amended, which by their nature survive completion of the Undersigned's work effort including, without limitation, warranties, guarantees, insurance requirements and indemnities.

STATE OF COLORADO)
) ss.
CITY OF _____)

_____
(Name of Subcontractor)

Signed and sworn before me this
day of _____, 20___. By:_____

_____. Title: _____
Notary Public/Commissioner of Oaths
My Commission Expires

DENVER
THE MILE HIGH CITY

City and County of Denver

Division of Small Business Opportunity

Contractor's/Consultant's Certification of Payment (CCP)

Office of Economic Development
Compliance Unit
201 W. Colfax Ave., Dept. 907
Denver, CO 80202
Phone: 720.913.1999
Fax: 720.913.1803

Prime Contractor or Consultant:	Phone:	Project Manager:
Pay Application #:	Pay Period:	Amount Requested: $
Project #:	Project Name:	
Current Completion Date:	Percent Complete:	Prepared By:
(I) - Original Contract Amount: $		(II) - Current Contract Amount: $

		A	B	C	D	E	F	G	H
Prime/Subcontractor/Supplier Name	M/W/B/ DBE/ NON	Original Contract Amount	% Bid (A/I)	Current Contract Amount Including Amendments	% Revised (C/II)	Requested Amount of this Pay Application	Amount Paid on the Previous Pay Application # ___	Net Paid To Date	Paid % Achieved (G/II)
Totals									

The undersigned certifies that the information contained in this document is true, accurate and that the payments shown have been made to all subcontractors and suppliers used on this project and listed herein. Please use an additional form, if more space is necessary.

Prepared By (Signature):	Date:

DENVER
THE MILE HIGH CITY

Instructions for Completing the Contractor/Consultant Certification of Payment Form

Office of Economic Development
Division of Small Business Opportunity
Compliance Unit
201 W. Colfax Ave., Dept. 907
Denver, CO 80202
Phone: 720-913-1999
Fax: 720-913-1803
dsbo@denvergov.org

Note: The attached Contractor/Consultant Certification of Payment form must be completed by the Contractor/ Subconsultant and all subcontractors/subconsultant or suppliers used on the project at any tier and submitted with each pay application. The Contractor/Consultant is responsible for the accuracy of all information provided and is required to have each subcontractor/subconsultant or supplier fill out the appropriate forms. Please be sure to complete all information requested at the top of the form, including the name of the person who prepared this form.

If you reproduce this form, you must continue to list each of the originally listed firms, as well as any additional firms used during the performance period of the contract.

If you have any questions, please call the Compliance Unit of DSBO at 720.913.1999.

Instructions for Completing the Contractor/Consultant Certification of Payment Form, per Column

Contractor/Subcontractor or Subconsultant/Supplier Name: In the space provided, list all subcontractors/ subconsultants and suppliers used on the project. For all M/W/S/DBEs use the exact name listed in the DSBO Directory.

M/W/S/DBE/NON: For each name listed, indicate whether the entity is a certified M/W/S/DBE.

Column A: Provide the contract amount, as listed at bid time, for the Contractor/Consultant and each subcontractor/subconsultant or supplier.

Column B: Provide the percentage portion of each listed subcontractor/subconsultant or supplier contract amount (Column A) compared to the total original contract amount in (I).

Column C: Provide the original contract amount (Column A) for each subcontractor/subconsultant or supplier plus any awarded alternate and/or change order amounts applicable. If an alternate/change order does not apply to the listed firm, re-enter the original contract amount (Column A).

Column D: Provide the percent portion of each listed subcontractor/subconsultant or supplier contract amount (Column C) compare to the current total contract amount in (II).

Column E: Provide the amount requested for work performed or materials supplied by each listed subcontractor/subconsultant or supplier for this pay application. The sum of the items in this column should equal the estimated amount requested for this pay application.

Column F: Provide the amount paid to each subcontractor/subconsultant or supplier on the previous pay application. Enter the previous pay application number in the column heading. The sum of the items listed in this column should equal the warrant amount paid to the Contractor/Consultant on the previous pay application. The amounts paid to the subcontractor/subcontractor or suppliers should be the actual amount of each check issued.

Column G: Provide the net paid to date for the Contractor/Subconsultant and each listed subcontractor/subconsultant or supplier.

Column H: Provide the percent portion of the net paid to date (Column G) for the Contractor/Subconsultant and each listed subcontractor/subconsultant or supplier of the current total contract amount in (II).

COMP-REF-031

Rev 032211 JG

SC-10 RESERVED

SC-11 MINORITY BUSINESS ENTERPRISES AND WOMEN BUSINESS ENTERPRISES

In a March 7, 2000 opinion and order of the United States District Court for the District of Colorado, all terms, provisions and requirements relating to the implementation and enforcement of Article III, Divisions I and III, of Chapter 28 of the Denver Revised Municipal Code, (the "MBE/WBE Requirements") in effect as of the adoption of the General Conditions in 1999 were held invalid, and they are hereby deleted. All such terms, provisions and requirements in the General Conditions are hereby replaced with references to the following later-enacted ordinances:

- Denver Revised Municipal Code, Chapter 28 Article III, Division 1 (Sections 28-31 to 28-36) (establishment of Small Business Opportunity Division, "DSBO");
- Denver Revised Municipal Code, Chapter 28 Article III, Division 3 (Sections 28-52 to 28-83) (the "MBE/WBE Requirements"); and
- Denver Revised Municipal Code, Chapter 28, Article VII (Sections 28-201 to 28-234) (the "SBE Requirements").

Such revised provisions of the General Conditions include, without limitation, General Contract Condition 210.

SC-12 CONTRACT FORMS

In accordance with the terms and conditions of the Contract Documents, the City requires the use of certain form documents in complying with or satisfying various obligations, notifications and conditions in contracting with the City or performing Work hereunder. These form documents are referenced by title throughout the Contract Documents for mandatory use as directed. The following are the forms that shall be detached and utilized in accordance with the Contract Documents:

1. Performance and Payment Bond
2. Performance and Payment Bond Surety Authorization Letter (Sample)

The following are forms that will be issued by the City during construction:

1. Notice to Apparent Low Bidder (Sample)
2. Notice To Proceed (Sample)
3. Certificate of Contract Release (Sample)

SC-13 CONSTRUCTION INSPECTION BY THE CITY

General Condition 1701, CONSTRUCTION INPSECTION BY THE CITY, is modified as follows:

1701 Persons who are employees of the City or who are under contract to the City or the City as lessee will be assigned to inspect and test the Work. These persons may perform any tests and observe the Work to determine whether or not designs, materials used, manufacturing and construction processes and methods applied, and equipment installed satisfy the requirements of the drawings and specifications, accepted Shop Drawings, Product Data and Samples, and the General Contractor's warranties and guarantees. The General Contractor shall permit these inspectors unlimited access to the Work and provide means of safe access to the Work, which cost shall be included as a Cost of the Work without any increase to the Guaranteed Maximum Price. In addition, General Contractor shall provide whatever access and means of access are needed to off-site facilities used to store or manufacture materials and equipment to be incorporated into the Work and shall respond to any other reasonable request to further the inspector's ability to observe or complete any tests. Such inspections shall not relieve the General Contractor of any of its quality control responsibilities or any other obligations under the Contract. All inspections and all tests conducted by the City are for the convenience and benefit of the City. These inspections and tests do not constitute acceptance of the materials or Work tested or inspected, and the City may reject or accept any Work or materials at any time prior to the inspections pursuant to G.C. 2002, whether or not previous inspections or tests were conducted by the inspector or a City representative.

.2 The Building Inspection Division will perform building code compliance inspections for structures designed for human occupancy. It is the General Contractor's responsibility to schedule and obtain these inspections. If a code compliance inspection results in identification of a condition which will be at variance to the Contract Documents, the General Contractor shall immediately notify the Project Manager and confirm such notification with formal correspondence no later than forty-eight (48) hours after the occurrence.

.3 When any unit of government or political subdivision, utility or railroad corporation is to pay a portion of the cost of the Work, its respective representatives shall have the right to inspect the Work. This inspection shall not

make any unit of government or political subdivision, utility or railroad corporation a party to the Contract, and shall not interfere with the rights of either party.

SC-14 DISPOSAL OF NON-HAZARDOUS WASTE AT DADS

In accordance with the Landfill Agreement made between the City and Waste Management of Colorado, Inc., bidders will be required to haul dedicated loads (non-hazardous entire loads of waste) to the Denver-Arapahoe Disposal Site ("DADS") for disposal. DADS is located at Highway 30 and Hampden Avenue in Arapahoe County, Colorado. The City will pay all fees associated with such disposal but the bidder shall be responsible for the costs of transporting the loads. Non-hazardous waste is defined as those substances and materials not defined or classified as hazardous by the Colorado Hazardous Waste Commission pursuant to C.R.S. §25-15-101(6), as amended from time to time, and includes construction debris, soil and asbestos. Bidders shall not use Gun Club Road between I-70 and Mississippi Avenue as a means of access to DADS.

SC-15 PROHIBITION ON USE OF CCA-TREATED WOOD PRODUCTS

The use of any wood products pressure-treated with chromated copper arsenate (CCA) is prohibited. Examples of CCA-treated wood products include wood used in play structures, decks, picnic tables, landscaping timbers, fencing, patios, walkways and boardwalks.

SC- 16 WAIVER OF: PART 8 OF ARTICLE 20 OF TITLE 13, COLORADO REVISED STATUTES.

The Contractor specifically waives all the provisions of Part 8 of Article 20 of Title 13, Colorado Revised Statutes regarding defects in the Work under this Construction Contract.

SC-17 DEBARRED SUBCONTRACTORS PROHIBITED

The Contractor is prohibited from hiring any subcontractor currently debarred by the City in accordance with section 20-77 of the Denver Revised Municipal Code.

SC-18 ATTORNEY'S FEES

Colorado Revised Statute 38-26-107 requires that in the event any person or company files a verified statement of amounts due and unpaid in connection with a claim for labor and materials supplied on this project, the City shall withhold from payments to the Contractor sufficient funds to insure the payment of any such claims. Should the City and County of Denver be made a party to any lawsuit to enforce such unpaid claims or any lawsuit arising out of or relating to such withheld funds, the Contractor agrees to pay to the City its costs and a reasonable attorney's fee which cost shall be included as a Cost of the Work.

Because the City Attorney Staff does not bill the City for legal services on an hourly basis, the Contractor agrees a reasonable fee shall be computed at the rate of one hundred dollars per hour of City Attorney time.

SC 19: INSURANCE

General Condition 1601 is hereby deleted in its entirety and replaced with the following:

(1) **General Conditions:** Contractor agrees to secure, at or before the time of execution of this Agreement, the following insurance covering all operations, goods or services provided pursuant to this Agreement. Contractor shall keep the required insurance coverage in force at all times during the term of the Agreement, or any extension thereof, during any warranty period, and for three (3) years after termination of the Agreement. The required insurance shall be underwritten by an insurer licensed or authorized to do business in Colorado and rated by A.M. Best Company as "A-"VIII or better. Each policy shall contain a valid provision or endorsement requiring notification to the City in the event any of the required policies be canceled or non-renewed before the expiration date thereof. Such written notice shall be sent to the parties identified in the Notices section of this Agreement. Such notice shall reference the City contract number listed on the signature page of this Agreement. Said notice shall be sent thirty (30) days prior to such cancellation or non-renewal unless due to non-payment of premiums for which notice shall be sent ten (10) days prior. If such written notice is unavailable from the insurer, contractor shall provide written notice of cancellation, non-renewal and any reduction in coverage to the parties identified in the Notices section by certified mail, return receipt requested within three (3) business days of such notice by its insurer(s) and referencing the City's contract number. If any policy is in excess of a deductible or self-insured retention, the City must be notified by the Contractor. Contractor shall be responsible for the payment of any deductible or self-insured retention. The insurance coverages specified in this Agreement are the minimum requirements, and these requirements do not lessen or limit the liability of the Contractor. The Contractor shall maintain, at its own expense, any additional kinds or amounts of insurance that it may deem necessary to cover its obligations and liabilities under this Agreement.

(2) **Proof of Insurance:** Contractor shall provide a copy of this Agreement to its insurance agent or broker. Contractor may not commence services or work relating to the Agreement prior to placement of coverage. Contractor certifies

that the certificate of insurance attached as part of the Contract Documents, preferably an ACORD certificate, complies with all insurance requirements of this Agreement. The City requests that the City's contract number be referenced on the Certificate. The City's acceptance of a certificate of insurance or other proof of insurance that does not comply with all insurance requirements set forth in this Agreement shall not act as a waiver of Contractor's breach of this Agreement or of any of the City's rights or remedies under this Agreement. The City's Risk Management Office may require additional proof of insurance, including but not limited to policies and endorsements.

(3) Additional Insureds: For Commercial General Liability, Auto Liability and Excess Liability/Umbrella, Contractor and subcontractor's insurer(s) shall name the City and County of Denver, its elected and appointed officials, employees and volunteers as additional insured.

(4) Waiver of Subrogation: For all coverages, Contractor's insurer shall waive subrogation rights against the City.

(5) Subcontractors and Subconsultants: All subcontractors and subconsultants (including independent contractors, suppliers or other entities providing goods or services required by this Agreement) shall be subject to all of the requirements herein and shall procure and maintain the same coverages required of the Contractor. Contractor shall include all such subcontractors as additional insured under its policies (with the exception of Workers' Compensation) or shall ensure that all such subcontractors and subconsultants maintain the required coverages. Contractor agrees to provide proof of insurance for all such subcontractors and subconsultants upon request by the City.

(6) Workers' Compensation/Employer's Liability Insurance: Contractor shall maintain the coverage as required by statute for each work location and shall maintain Employer's Liability insurance with limits of $100,000 per occurrence for each bodily injury claim, $100,000 per occurrence for each bodily injury caused by disease claim, and $500,000 aggregate for all bodily injuries caused by disease claims. Contractor expressly represents to the City, as a material representation upon which the City is relying in entering into this Agreement, that none of the Contractor's officers or employees who may be eligible under any statute or law to reject Workers' Compensation Insurance shall effect such rejection during any part of the term of this Agreement, and that any such rejections previously effected, have been revoked as of the date Contractor executes this Agreement.

(7) Commercial General Liability: Contractor shall maintain a Commercial General Liability insurance policy with limits of $1,000,000 for each occurrence, $1,000,000 for each personal and advertising injury claim, $2,000,000 products and completed operations aggregate, and $2,000,000 policy aggregate.

(8) Business Automobile Liability: Contractor shall maintain Business Automobile

Liability with limits of $1,000,000 combined single limit applicable to all owned, hired and non-owned vehicles used in performing services under this Agreement

(9) Excess/Umbrella Liability: Contractor shall maintain excess liability limits of $2,000,000. Coverage must be written on a "follow form" or broader basis. Any combination of primary and excess coverage may be used to achieve required limits.

(10) Builders' Risk or Installation Floater: Contractor shall maintain limits equal to the completed value of the project. Coverage shall be written on an all risk, replacement cost basis including coverage for soft costs, flood and earth movement, if in a flood or quake zone, and, if applicable, equipment breakdown including testing. The City and County of Denver, Contractor, and sub-contractors shall be Additional Named Insureds under the policy. Policy shall remain in force until acceptance of the project by the City.

(11) Additional Provisions:

(a) For Commercial General Liability and Excess Liability, the policies must provide the following:

(i) That this Agreement is an Insured Contract under the policy;
(ii) Defense costs are in excess of policy limits;
(iii) A severability of interests or separation of insureds provision (no insured vs. insured exclusion); and
(iv) A provision that coverage is primary and non-contributory with other coverage or self-insurance maintained by the City.

(b) For claims-made coverage:

(i) The retroactive date must be on or before the contract date or the first date when any goods or services were provided to the City, whichever is earlier

(c) Contractor shall advise the City in the event any general aggregate or other aggregate limits are reduced below the required per occurrence limits. At their own expense, and where such general aggregate or other aggregate limits have been reduced below the required per occurrence limit, the Contractor will procure such per occurrence limits and furnish a new certificate of insurance showing such coverage is in force.

SC-20 DEFENSE AND INDEMNIFICATION

General Condition 1602, INDEMNIFICATION, is modified to read in full as follows:

DEFENSE AND INDEMNIFICATION

(a) To the fullest extent permitted by law, the Contractor hereby agrees to defend, indemnify, and hold harmless City, its appointed and elected officials, agents and employees against all liabilities, claims, judgments, suits or demands for damages to persons or property arising out of, resulting from, or related to the work performed under this Contract that are due to the negligence or fault of the Contractor or the Contractor's agents, representatives, subcontractors, or suppliers ("Claims"). This indemnity shall be interpreted in the broadest possible manner consistent with the applicable law to indemnify the City.

(b) Contractor's duty to defend and indemnify City shall arise at the time written notice of the Claim is first provided to City regardless of whether suit has been filed and even if Contractor is not named as a Defendant.

(c) Contractor will defend any and all Claims which may be brought or threatened against City and will pay on behalf of City any expenses incurred by reason of such Claims including, but not limited to, court costs and attorney fees incurred in defending and investigating such Claims or seeking to enforce this indemnity obligation. Such payments on behalf of City shall be in addition to any other legal remedies available to City and shall not be considered City's exclusive remedy.

(d) Insurance coverage requirements specified in this Contract shall in no way lessen or limit the liability of the Contractor under the terms of this indemnification obligation. The Contractor shall obtain, at its own expense, any additional insurance that it deems necessary for the City's protection.

(e) This defense and indemnification obligation shall survive the expiration or termination of this Contract.

SC-21 GREENPRINT DENVER REQUIREMENTS

In accordance with the City and County of Denver Executive Order 123: Greenprint Denver Office and Sustainability Policy (dated October 27, 2007), and the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) program, Contractor shall, wherever possible, recycle construction and demolition waste, and install building materials that contain recycled content. Non-hazardous solid waste that is eligible for reuse or recycling is not subject to the DADS disposal requirement defined in SC-14. The Contractor shall recycle and/or reuse construction and demolition waste and implement sustainable development practices on construction projects in compliance with any Project Requirements of the Better Denver Program Sustainability Form that are included in the Contract Documents.

At the Project Pre-Construction Meeting, the Contractor shall provide a written summary of how the Contractor intends to meet any applicable Project Requirement, and the type of documentation to be provided. The Contractor shall maintain and keep current documentation of the materials recycled or reused, organized in accordance with any applicable Closeout Form for Contractors provided in the Contract Documents for the duration of the Project. A copy of the completed Closeout Form, the quantity tabulation, and all supporting documentation for materials reused or recycled shall be delivered to the Project Manager as a submittal requirement of Final Acceptance.

SC-22 CITY AUDITOR AND MANAGER OF FINANCE

Section 211, City Auditor, of the General Contract Conditions, 1999 Edition, is amended to read in its entirety as follows:

211 CITY AUDITOR AND MANAGER OF FINANCE

The City Auditor, an independent elected official, reviews certified payrolls for compliance with prevailing wage requirements before payment is made to a Contractor. The City's Manager of Finance pays the Contractor for Work approved under the Contract.

SC-23 NO EMPLOYMENT OF ILLEGAL ALIENS TO PERFORM WORK UNDER THE AGREEMENT:

a. This Agreement is subject to Division 5 of Article IV of Chapter 20 of the Denver Revised Municipal Code, and any amendments (the "Certification Ordinance").

b. The Contractor certifies that:

(1) At the time of its execution of this Agreement, it does not knowingly employ or contract with an illegal alien who will perform work under this Agreement.

(2) It will participate in the E-Verify Program, as defined in § 8-17.5-101(3.7), C.R.S., to confirm the employment eligibility of all employees who are newly hired for employment to perform work under this Agreement.

c. The Contractor also agrees and represents that:

(1) It shall not knowingly employ or contract with an illegal alien to perform work under the Agreement.

(2) It shall not enter into a contract with a subconsultant or subcontractor that fails to certify to the Contractor that it shall not knowingly employ or contract with an illegal alien to perform work under the Agreement.

(3) It has confirmed the employment eligibility of all employees who are newly hired for employment to perform work under this Agreement, through participation in the E-Verify Program.

(4) It is prohibited from using the E-Verify Program procedures to undertake pre-employment screening of job applicants while performing its obligations under the Agreement, and that otherwise requires the Contractor to comply with any and all federal requirements related to use of the E-Verify Program including, by way of example, all program requirements related to employee notification and preservation of employee rights.

(5) If it obtains actual knowledge that a subconsultant or subcontractor performing work under the Agreement knowingly employs or contracts with an illegal alien, it will notify such subconsultant or subcontractor and the City within three (3) days. The Contractor will also then terminate such subconsultant or subcontractor if within three (3) days after such notice the subconsultant or subcontractor does not stop employing or contracting with the illegal alien, unless during such three-day period the subconsultant or subcontractor provides information to establish that the subconsultant or subcontractor has not knowingly employed or contracted with an illegal alien.

(6) It will comply with any reasonable request made in the course of an investigation by the Colorado Department of Labor and Employment under authority of § 8-17.5-102(5), C.R.S, or the City Auditor, under authority of D.R.M.C. 20-90.3.

d. The Contractor is liable for any violations as provided in the Certification Ordinance. If Contractor violates any provision of this section or the Certification Ordinance, the City may terminate this Agreement for a breach of the Agreement. If the Agreement is so terminated, the Contractor shall be liable for actual and consequential damages to the City. Any such termination of a contract due to a violation of this section or the Certification Ordinance may also, at the discretion of the City, constitute grounds for disqualifying Contractor from submitting bids or proposals for future contracts with the City.

SC-24 RETAINAGE:

Section 908.1, of the General Contract Conditions, 1999 Edition, is amended to read as follows:

.1 The City shall deduct and retain a total of five percent (5%) from the total amount of approved applications for payment, including Change Orders. The City may also deduct in addition to retainage as stated above, the additional amount(s) of any and all outstanding claims pursuant to C.R.S. §38-26-107 from each approved application for payment.

Bond No. SU1113382

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS

PERFORMANCE AND PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned ASH & WHITE CONSTRUCTION CO., 18 South Wilcox St., Suite 100, Castle Rock, CO 80104, a corporation organized and existing under and by virtue of the laws of the State of **COLORADO**, hereafter referred to as the "Contractor", and ARCH INSURANCE COMPANY, a corporation organized and existing under and by virtue of the laws of the State of **MISSOURI**, and authorized to transact business in the State of Colorado, as Surety, are held and firmly bound unto the CITY AND COUNTY OF DENVER, a municipal corporation of the State of Colorado, hereinafter referred to as the "City", in the penal sum of **Five Million Six Hundred Fifty-Six Thousand Dollars and No Cents($5,656,000.00)**, lawful money of the United States of America, for the payment of which sum, well and truly to be made, we bind ourselves and our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents;

THE CONDITION OF THE FOREGOING OBLIGATION IS SUCH THAT:

WHEREAS, the above bounden Contractor has entered into a written contract with the aforesaid City for furnishing all labor and tools, supplies, equipment, superintendence, materials and everything necessary for and required to do, perform and complete the construction of **CONTRACT NO. 201204517 WEST DENVER LIBRARY**, Denver, Colorado, and has bound itself to complete the project within the time or times specified or pay liquidated damages, all as designated, defined and described in the said Contract and Conditions thereof, and in accordance with the Plans and Technical Specifications therefore, a copy of said Contract being made a part hereof;

NOW, THEREFORE, if the said Contractor shall and will, in all particulars well and truly and faithfully observe, perform and abide by each and every Covenant, Condition and part of said Contract, and the Conditions, Technical Specifications, Plans, and other Contract Documents thereto attached, or by reference made a part thereof and any alterations in and additions thereto, according to the true intent and meaning in such case, then this obligation shall be and become null and void; otherwise, it shall remain in full force and effect;

PROVIDED FURTHER, that if the said Contractor shall satisfy all claims and demands incurred by the Contractor in the performance of said Contract, and shall fully indemnify and save harmless the City from all damages, claims, demands, expense and charge of every kind (including claims of patent infringement) arising from any act, omission, or neglect of said Contractor, its agents, or employees with relation to said work; and shall fully reimburse and repay to the City all costs, damages, and expenses which it may incur in making good any default based upon the failure of the Contractor to fulfill its obligation to furnish maintenance, repairs or replacements for the full guarantee period provided in the Contract Documents, then this obligation shall be null and void; otherwise it shall remain in full force and effect;

PROVIDED FURTHER, that if said Contractor shall at all times promptly make payments of all amounts lawfully due to all persons supplying or furnishing it or its subcontractors with labor and materials, rental machinery, tools or equipment used or performed in the prosecution of work provided for in the above Contract and that if the Contractor will indemnify and save harmless the City for the extent of any and all payments in connection with the carrying out of such Contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect;

PROVIDED FURTHER, that if the said Contractor fails to duly pay for any labor, materials, team hire, sustenance, provisions, provender, gasoline, lubricating oils, fuel oils, grease, coal, or any other supplies or materials used or consumed by said Contractor or its subcontractors in performance of the work contracted to be done, or fails to pay any person who supplies rental machinery, tools or equipment, all amounts due as the result of the use of such machinery, tools or equipment in the prosecution of the work, the Surety will pay the same in any amount not exceeding the amount of this obligation, together with interest as provided by law;

PROVIDED FURTHER, that the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract, or to contracts with others in connection with this project, or the work to be performed thereunder, or the Technical Specifications and Plans accompanying the same, shall in any way affect its obligation on this bond and it does hereby waive notice of any change, extension of time, alteration or addition to the terms of the Contract, or contracts, or to the work, or to the Technical Specifications and Plans.

IN WITNESS WHEREOF, said Contractor and said Surety have executed these presents as of this 15th day of June, 2012

Attest:

Secretary

ASH & WHITE CONSTRUCTION CO.
Contractor

By: _____
Vice President, Douglas E. Decker

ARCH INSURANCE CO.
Surety

By: Philip J. Monasch
Attorney-In-Fact, Philip J. Monasch

(Accompany this bond with Attorney-in-Fact's authority from the Surety to execute bond, certified to include the date of the bond).

APPROVED AS TO FORM:
Attorney for the City and County of Denver

By: _____
Assistant City Attorney

APPROVED FOR THE CITY AND COUNTY OF DENVER

By: _____
MAYOR

By: _____
MANAGER OF PUBLIC WORKS

IMA

1550 17th Street, Suite 600
Denver, CO 80202-1657
Phone 303.534.4567

AIC 0000014942

THIS POWER OF ATTORNEY IS NOT VALID UNLESS IT IS PRINTED ON BLUE BACKGROUND.

This Power of Attorney limits the acts of those named herein, and they have no authority to bind the Company except in the manner and to the extent herein stated. Not valid for Mortgage, Note, Loan, Letter of Credit, Bank Deposit, Currency Rate, Interest Rate or Residential Value Guarantees.

POWER OF ATTORNEY

Know All Persons By These Presents:

That the Arch Insurance Company, a corporation organized and existing under the laws of the State of Missouri, having its principal administrative office in Jersey City, New Jersey (hereinafter referred to as the "Company") does hereby appoint:

Bradley J. Jeffress, Jessica Talbot, Kristen L. McCormick, Michael Lischer, Jr., Nicole L. McCollam, Philip J. Monasch, Robert J. Reiter, Robert L. Cohen, Sarah Finn, Sheryll Shaw and Sue Wood of Denver, CO (EACH)

its true and lawful Attorney(s)in-Fact, to make, execute, seal, and deliver from the date of issuance of this power for and on its behalf as surety, and as its act and deed:

Any and all bonds, undertakings, recognizances and other surety obligations, in the penal sum not exceeding Ninety Million Dollars ($90,000,000.00).

This authority does not permit the same obligation to be split into two or more bonds In order to bring each such bond within the dollar limit of authority as set forth herein.

The execution of such bonds, undertakings, recognizances and other surety obligations in pursuance of these presents shall be as binding upon the said Company as fully and amply to all intents and purposes, as if the same had been duly executed and acknowledged by its regularly elected officers at its principal administrative office in Jersey City, New Jersey.

This Power of Attorney is executed by authority of resolutions adopted by unanimous consent of the Board of Directors of the Company on September 15, 2011, true and accurate copies of which are hereinafter set forth and are hereby certified to by the undersigned Secretary as being in full force and effect:

"VOTED, That the Chairman of the Board, the President, or the Executive Vice President, or any Senior Vice President, of the Surety Business Division, or their appointees designated in writing and filed with the Secretary, or the Secretary shall have the power and authority to appoint agents and attorneys-in-fact, and to authorize them subject to the limitations set forth in their respective powers of attorney, to execute on behalf of the Company, and attach the seal of the Company thereto, bonds, undertakings, recognizances and other surety obligations obligatory in the nature thereof, and any such officers of the Company may appoint agents for acceptance of process."

This Power of Attorney is signed, sealed and certified by facsimile under and by authority of the following resolution adopted by the unanimous consent of the Board of Directors of the Company on September 15, 2011:

VOTED, That the signature of the Chairman of the Board, the President, or the Executive Vice President, or any Senior Vice President, of the Surety Business Division, or their appointees designated in writing and filed with the Secretary, and the signature of the Secretary, the seal of the Company, and certifications by the Secretary, may be affixed by facsimile on any power of attorney or bond executed pursuant to the resolution adopted by the Board of Directors on September 15, 2011, and any such power so executed, sealed and certified with respect to any bond or undertaking to which it is attached, shall continue to be valid and binding upon the Company.

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 06/19/2012

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME:
IMA of Colorado, Inc. 1550 17th Street Suite 600 Denver, CO 80202 1-303-534-4567	PHONE (A/C, No, Ext): FAX (A/C, No): E-MAIL ADDRESS:

INSURED	INSURER(S) AFFORDING COVERAGE	NAIC #
White Construction Group Ltd. PO Box 97 18 S Wilcox St, Suite #100 Castle Rock, CO 80104-4005	INSURER A: WESTFIELD INS CO	24112
	INSURER B: PINNACOL ASSUR	41190
	INSURER C: ONEBEACON AMER INS CO	20621
	INSURER D:	
	INSURER E:	
	INSURER F:	

COVERAGES **CERTIFICATE NUMBER:** 27725370 **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	GENERAL LIABILITY			CMM5331712	08/01/11	08/01/12	EACH OCCURRENCE	$ 1,000,000
	X COMMERCIAL GENERAL LIABILITY						DAMAGE TO RENTED PREMISES (Ea occurrence)	$ 300,000
	CLAIMS-MADE X OCCUR						MED EXP (Any one person)	$ 10,000
	X PD Ded: $5,000						PERSONAL & ADV INJURY	$ 1,000,000
							GENERAL AGGREGATE	$ 2,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						PRODUCTS - COMP/OP AGG	$ 2,000,000
	POLICY X PRO-JECT X LOC							$
A	AUTOMOBILE LIABILITY			CMM5331712	08/01/11	08/01/12	COMBINED SINGLE LIMIT (Ea accident)	$ 1,000,000
	X ANY AUTO						BODILY INJURY (Per person)	$
	ALL OWNED AUTOS / SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	X HIRED AUTOS / X NON-OWNED AUTOS						PROPERTY DAMAGE (Per accident)	$
								$
A	X UMBRELLA LIAB X OCCUR			CMM5331712	08/01/11	08/01/12	EACH OCCURRENCE	$ 5,000,000
	EXCESS LIAB CLAIMS-MADE						AGGREGATE	$ 5,000,000
	DED RETENTION $ 0							$
B	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y/N			3497678	08/01/11	08/01/12	X WC STATU-TORY LIMITS / OTH-ER	
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? N (Mandatory in NH)	N/A					E.L. EACH ACCIDENT	$ 1,000,000
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$ 1,000,000
							E.L. DISEASE - POLICY LIMIT	$ 1,000,000
C	Builders Risk			7900062240003	08/01/11	08/01/12	Any 1 Loc - Frame	$2,500,000
	SPC Form $1,000 Ded.						All Other Limit	$8,000,000
	*Flood/Earthquake			*$3,000,000 Sub Limit	*$25,000	Deductible	Temp/Transit Lmt	$500,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

The City and County of Denver, its elected and appointed officials, employees and volunteers are named as Additional Insured with regards to the commercial General Liability Policy and the Business Automobile Liability Policy.

CERTIFICATE HOLDER

City and County of Denver
Department of Public Works

201 West Colfax, Dept. 611

Denver, CO 80202
USA

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

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Department of Public Works
Engineering Department

201 W. Colfax Avenue
Denver, CO 80202
www.denvergov.org/PublicWorks

DENVER
THE MILE HIGH CITY

PERFORMANCE AND PAYMENT BOND
SURETY AUTHORIZATION

FAX NUMBER: 720-913-3183
TELEPHONE NUMBER: 720-913-3267

Assistant City Attorney
201 W. Colfax Ave. Dept 1207
Denver, Colorado 80202

RE: **White Construction Group**

Contract No:	201204517
Project Name:	WEST DENVER LIBRARY
Contract Amount:	**$5,656,000.00**
Performance and Payment Bond No.:	**SU1113382**

Dear Assistant City Attorney,

The Performance and Payment Bonds covering the above captioned project were executed by this agency, through **Arch Insurance Company** insurance company, on **June 15**, 2012.

We hereby authorize the City and County of Denver, Department of Public Works, to date all bonds and powers of attorney to coincide with the date of the contract.

If you should have any additional questions or concerns, please don't hesitate to give me a call at **(303) 534-4567**.

Thank you.

Sincerely,

Philip J Monasch

Philip J. Monasch
Surety Account Manager
IMA, Inc.
1550 17th Street, Suite 600
Denver, CO 80202

311 for City Services
Denver gets it done!

IMA
1550 17th Street, Suite 600
Denver, CO 80202-1657
Phone 303.534.4567

Department of Public Works
Engineering Department

201 W. Colfax Avenue
Denver, CO 80202
www.denvergov.org/PublicWorks

DENVER
THE MILE HIGH CITY

NOTICE OF APPARENT LOW BIDDER
(SAMPLE)

Current Date

To:

Gentlemen:

The MANAGER OF PUBLIC WORKS has considered the Bids submitted on March 02, 2012 for work to be done and materials to be furnished in and for:

PROJECT No. 201204517 WEST DENVER LIBRARY

as set forth in detail in the Contract Documents for the City and County of Denver, Colorado. It appears that your Bid is fair, equitable, and to the best interest of the City and County; therefore, said Bid is hereby accepted at the bid price contained herein, subject to execution of the Contract Documents and your furnishing the items specified below, the total cost thereof (Contract Amount Written), (Contract Amount Numeric).

It will be necessary for you to appear forthwith at the office of the Department of Public Works, Engineering Division, Project Management Office, 201 W. Colfax Ave., Denver, Colorado 80202, to receive the said Contract Documents, execute the same and return them to the Department of Public Works, Finance and Administration, within the time limit set forth in the Bid Proposal.

In accordance with the requirements set forth in the Contract Documents, you are required to furnish the following documents:

a. Insurance Certificates: General Liability and Automotive Liability, Workman's Compensation and Employer Liability; or any other coverage required by the contract; and
b. One original plus four copies of the Power of Attorney relative to Performance and/or Payment Bond;

All construction Contracts made and entered into by the City and County of Denver are subject to Affirmative Action and Equal Opportunity Rules and Regulations, as adopted by the Manager of Public Works, and each contract requiring payment by the City of one-half million dollars ($500,000.00) or more shall first be approved by the City Council acting by ordinance and in accordance with Section 3.2.6 of the Charter of the City and County of Denver.

Prior to issuance of Notice to Proceed, all Equal Opportunity requirements must be completed. Additional information may be obtained by contacting the Director of Contract Compliance at (720-913-1700).

311 for City Services
Denver gets it done!

NOTICE OF APPARENT LOW BIDDER
(SAMPLE)

PROJECT NO. 201204517
Page 2

The Bid Security submitted with your Bid, will be returned upon execution of the Contract and furnishing of the Performance Bond. In the event you should fail to execute the Contract and to furnish the performance Bond within the time limit specified, said Bid Security will be retained by the City and County of Denver as liquidated damages, and not as a penalty for the delay and extra work caused thereby.

Dated at Denver, Colorado this _____ day of _____20___.

CITY AND COUNTY OF DENVER

By _____
Manager of Public Works

DENVER
THE MILE HIGH CITY

Department of Public Works
Engineering Department

201 W. Colfax Avenue
Denver, CO 80202
www.denvergov.org/PublicWorks

Current Date

NOTICE TO PROCEED
(SAMPLE)

Name
Company
Street
City/State/Zip

CONTRACT NO. 201204517, WEST DENVER LIBRARY

In accordance with General Contract Condition 302 of the Standard Specifications for Construction, General Contract Conditions, 1999 Edition, you are hereby authorized and directed to proceed on _____ with the work of constructing contract number 201204517, as set forth in detail in the contract documents for the City and County of Denver.

With a contract time of _____ calendar days, the project must be complete on or before _____.

If you have not already done so, you must submit your construction schedule, in accordance with General Contract Condition 306.2.B, to the Project Manager within 10 days. Additionally, you must submit your tax exempt certificate, and copies of your subcontractors' certificates, in accordance with General Contract Condition 322.5, to the Project Manager as soon as possible. Failure to submit these certificates will delay processing of payment applications.

Sincerely,

Lesley B. Thomas
City Engineer

cc:

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Department of Public Works
Engineering Department

201 W. Colfax Avenue
Denver, CO 80202
www.denvergov.org/PublicWorks

DENVER
THE MILE HIGH CITY

Certificate of Contract Release
(SAMPLE)

Date

Name
Company
Street
City/State/Zip

RE: Certificate of Contract Release for
201204517, WEST DENVER LIBRARY

Received this date of the City and County of Denver, as full and final payment of the cost of the improvements provided for in the foregoing contract, _____ dollars and _____ cents ($_____), in cash, being the remainder of the full amount accruing to the undersigned by virtue of said contract; said cash also covering and including full payment for the cost of all extra work and material furnished by the undersigned in the construction of said improvements, and all incidentals thereto, and the undersigned hereby releases said City and County of Denver from any and all claims or demands whatsoever, regardless of how denominated, growing out of said contract.

And these presents are to certify that all persons performing work upon or furnishing materials for said improvements under the foregoing contract have been paid in full and this payment to be made is the last or final payment.

_____

Contractor's Signature Date Signed

If there are any questions, please contact me by telephone at (720) 913-XXXX. Please return this document via facsimile at (720) 913-1805 and mail to original to the above address.

311 for City Services
Denver gets it done!

CITY AND COUNTY OF DENVER

STATE OF COLORADO

DENVER®
THE MILE HIGH CITY

DEPARTMENT OF PUBLIC WORKS / ENGINEERING DIVISION

PREVAILING WAGE RATES

Contract No. 201204517

WEST DENVER LIBRARY

February 1, 2012

DENVER
THE MILE HIGH CITY

Career Service Authority
Denver's Human Resource Agency

201 W. Colfax, Department 412
Denver, CO 80202
p: 720.913.5751
f: 720.913.5720
www.denvergov.org/csa

TO: All Users of the City of Denver Prevailing Wage Schedules

FROM: Meredith Creme, Associate Human Resource Professional

DATE: Friday January 20, 2012

SUBJECT: Latest Change to Prevailing Wage Schedules

Please be advised, prevailing wage rates for some building, heavy, and highway construction trades have not been updated by the United States Department of Labor (DOL) since March 1, 2002. The Career Service Authority Board, in their meeting held on April 21, 2011, approved the use of the attached supplemental wage rates until prevailing wage rates for these classifications of work are again published by the United States Department of Labor in accordance with the Davis-Bacon Act. The rates will be provided as a supplemental to the Davis-Bacon Heavy rates issued by CSA.

The effective date for this publication will be **Friday January 20, 2012** and applies to the City and County of Denver for **HEAVY CONSTRUCTION PROJECTS** in accordance with the Denver Revised Municipal Code, Section 20-76(c).

General Wage Decision No. CO120012
Superseded General Decision No. CO20100012

Modification No. 1
Publication Date: 01-13-2012
(10 pages)

Unless otherwise specified in this document, apprentices shall be permitted only if they are employed pursuant to, and individually registered in, a bona fide apprenticeship program registered with the U.S. Department. Of Labor (DOL). The employer and the individual apprentice must be registered in a program, which has received prior approval, by the DOL. Any employer, who employs an apprentice and is found to be in violation of this provision, shall be required to pay said apprentice the full journeyman scale.

For questions please call (720) 913-5009

Attachments as listed above.

311 for City Services
Denver gets it done!

General Decision Number: CO120012 01/13/2012 CO12

Superseded General Decision Number: CO20100012

State: Colorado

Construction Type: Heavy

Counties: Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, El Paso, Jefferson, Larimer, Mesa, Pueblo and Weld Counties in Colorado.

HEAVY CONSTRUCTION PROJECTS

Modification Number	Publication Date
0	01/06/2012
1	01/13/2012

ASBE0028-001 07/01/2010

	Rates	Fringes
Asbestos Workers/Insulator (Includes application of all insulating materials, protective coverings, coatings and finishings to all types of mechanical systems)	$ 30.23	11.53

BRCO0007-004 01/01/2011

ADAMS, ARAPAHOE, BOULDER, BROOMFIELD, DENVER, DOUGLAS AND JEFFERSON COUNTIES

	Rates	Fringes
BRICKLAYER	$ 22.13	9.89

BRCO0007-006 06/01/2011

EL PASO AND PUEBLO COUNTIES

	Rates	Fringes
BRICKLAYER	$ 21.97	9.88

ELEC0012-004 09/01/2011

PUEBLO COUNTY

	Rates	Fringes
ELECTRICIAN		
Electrical work where the cost is $150,000 or less	$ 24.25	11.83
Electrical work where the cost is over $150,000	$ 26.75	11.90

ELEC0068-001 06/01/2011

ADAMS, ARAPAHOE, BOULDER, BROOMFIELD, DENVER, DOUGLAS, JEFFERSON, LARIMER, AND WELD COUNTIES

	Rates	Fringes
ELECTRICIAN	$ 31.60	12.52

ELEC0111-001 09/01/2010

	Rates	Fringes
Line Construction:		
Cable Splicer	$ 28.65	13.75%+4.75
Equipment Operator-Underground	$ 25.06	12.75%+4.75
Groundman	$ 20.48	17.75%+4.75
Line Equipment Operator	$ 25.74	17.75%+4.75
Lineman and Welder	$ 35.81	20.75%+4.75

ELEC0113-002 06/01/2011

EL PASO COUNTY

	Rates	Fringes
ELECTRICIAN	$ 28.55	14.46

ELEC0969-002 06/01/2010

MESA COUNTY

	Rates	Fringes
ELECTRICIAN	$ 20.75	5.66

ENGI0009-001 05/01/2011

	Rates	Fringes
Power equipment operators:		
Blade: Finish	$ 23.97	9.22
Blade: Rough	$ 23.67	9.22
Bulldozer	$ 23.67	9.22
Cranes: 50 tons and under	$ 23.82	9.22
Cranes: 51 to 90 tons	$ 23.97	9.22
Cranes: 91 to 140 tons	$ 24.12	9.22
Cranes: 141 tons and over	$ 24.88	9.22
Forklift	$ 23.32	9.22
Mechanic	$ 25.97	9.22
Oiler	$ 22.97	9.22
Scraper: Single bowl under 40 cubic yards	$ 23.82	9.22
Scraper: Single bowl, including pups 40 cubic yards and over and tandem bowls	$ 23.97	9.22
Trackhoe	$ 23.82	9.22

IRON0024-003 07/01/2011

	Rates	Fringes

Ironworkers: Structural	$ 23.80	18.07

LABO0086-001 05/01/2009

	Rates	Fringes
Laborers:		
Pipelayer	$ 18.68	6.78

* PLUM0003-005 01/01/2012

ADAMS, ARAPAHOE, BOULDER, BROOMFIELD, DENVER, DOUGLAS, JEFFERSON, LARIMER AND WELD COUNTIES

	Rates	Fringes
PLUMBER	$ 32.68	11.44

PLUM0058-002 07/01/2011

EL PASO COUNTY

	Rates	Fringes
Plumbers and Pipefitters	$ 32.05	12.85

PLUM0058-008 07/01/2011

PUEBLO COUNTY

	Rates	Fringes
Plumbers and Pipefitters	$ 32.05	12.85

PLUM0145-002 07/01/2011

MESA COUNTY

	Rates	Fringes
Plumbers and Pipefitters	$ 35.17	11.05

PLUM0208-004 06/01/2011

ADAMS, ARAPAHOE, BOULDER, BROOMFIELD, DENVER, DOUGLAS, JEFFERSON, LARIMER AND WELD COUNTIES

	Rates	Fringes
PIPEFITTER	$ 32.61	11.26

SHEE0009-002 01/01/2011

	Rates	Fringes
Sheet metal worker	$ 31.66	10.98

SUCO2001-006 12/20/2001

	Rates	Fringes

BOILERMAKER	$ 17.60	
Carpenters:		
Form Building and Setting	$ 16.97	2.74
All Other Work	$ 15.14	3.37
Cement Mason/Concrete Finisher	$ 17.31	2.85
IRONWORKER, REINFORCING	$ 18.83	3.90
Laborers:		
Common	$ 11.22	2.92
Flagger	$ 8.91	3.80
Landscape	$ 12.56	3.21
Painters:		
Brush, Roller & Spray	$ 15.81	3.26
Power equipment operators:		
Backhoe	$ 16.36	2.48
Front End Loader	$ 17.24	3.23
Skid Loader	$ 15.37	4.41

TEAM0435-001 05/01/2000

	Rates	Fringes
Truck drivers:		
Pickup	$ 14.21	5.27
Tandem/Semi and Water	$ 14.93	5.27

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is union or non-union.

Union Identifiers

An identifier enclosed in dotted lines beginning with characters other than "SU" denotes that the union classification and rate have found to be prevailing for that classification. Example: PLUM0198-005 07/01/2011. The first four letters , PLUM, indicate the international union and the four-digit number, 0198, that follows indicates the local

union number or district council number where applicable , i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2011, following these characters is the effective date of the most current negotiated rate/collective bargaining agreement which would be July 1, 2011 in the above example.

Union prevailing wage rates will be updated to reflect any changes in the collective bargaining agreements governing the rate.

Non-Union Identifiers

Classifications listed under an "SU" identifier were derived from survey data by computing average rates and are not union rates; however, the data used in computing these rates may include both union and non-union data. Example: SULA2004-007 5/13/2010. SU indicates the rates are not union rates, LA indicates the State of Louisiana; 2004 is the year of the survey; and 007 is an internal number used in producing the wage determination. A 1993 or later date, 5/13/2010, indicates the classifications and rates under that identifier were issued as a General Wage Determination on that date.

Survey wage rates will remain in effect and will not change until a new survey is conducted.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator

(See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

Career Service Authority
Supplemental to the Davis-Bacon *HEAVY* Construction Projects rates
(Specific to the Denver Projects)
(Supp #73, Date: 01-20-2012)

Classification		Base	Fringe
Millwrights		$28.00	$10.00
Line Construction:			
	Lineman, Gas Fitter/Welder	$36.88	$9.55
	Line Eq Operator/Line Truck Crew	$25.74	$8.09
Power Equipment Operators (Tunnels Above and Below Ground, shafts and raises):			
	GROUP 1	$25.12	$10.81
	GROUP 2	$25.47	$10.85
	GROUP 3	$25.57	$10.86
	GROUP 4	$25.82	$10.88
	GROUP 5	$25.97	$10.90
	GROUP 6	$26.12	$10.91
	GROUP 7	$26.37	$10.94
Power Equipment Operators:			
	GROUP 1	$22.97	$10.60
	GROUP 2	$23.32	$10.63
	GROUP 3	$23.67	$10.67
	GROUP 4	$23.82	$10.68
	GROUP 5	$23.97	$10.70
	GROUP 6	$24.12	$10.71
	GROUP 7	$24.88	$10.79
Ironworkers (Ornamental)		$24.80	$10.03
Laborers:			
	GROUP 1	$17.68	$8.22
	GROUP 2	$18.18	$8.27
	GROUP 3	$21.59	$8.61
Laborers: (Tunnel)			
	GROUP 1	$18.53	$8.30
	GROUP 2	$18.63	$8.31
	GROUP 3	$19.73	$8.42
	GROUP 4	$21.59	$8.61
	GROUP 5	$19.68	$8.42
Laborers (Removal of Asbestos)		$21.03	$8.55
Truck Drivers:			
	GROUP 1	$18.42	$10.00
	GROUP 2	$19.14	$10.07
	GROUP 3	$19.48	$10.11
	GROUP 4	$20.01	$10.16
	GROUP 5	$20.66	$10.23
	GROUP 6	$21.46	$10.31

POWER EQUIPMENT OPERATOR CLASSIFICATIONS
(TUNNELS ABOVE AND BELOW GROUND, SHAFTS, AND RAISES):

GROUP 1 - Brakeman
GROUP 2 - Motorman
GROUP 3 - Compressor
GROUP 4 - Air Tractors; Grout Machine; Gunnite Machine; Jumbo Form
GROUP 5 - Concrete Placement Pumps; Mucking Machines and Front End Loaders, Underground, Slusher; Mine Hoist Operator; Mechanic
GROUP 6 - Mechanic Welder
GROUP 7 - Mole

NOTE: Any equipment listed below being used in tunnel work, below or above ground shall be paid not less than $2.00 per hour above the listed wage rates.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS:

GROUP 1 - Air compressor, brakeman, drill operator - smaller than Watson 2500 and similar, operators of 5 or more light plants, welding machines, generators, single unit conveyor, pumps, vacuum well point system, tractor, under 70 hp with or without attachments compressors, 360 C.F.M. or less.

GROUP 2 - Conveyor, handling **building** materials, ditch witch and similar trenching machine, haulage motor man, pugmill, portable screening plant with or without a spray bar, screening plants, with classifier.

GROUP 3 - Asphalt screed, asphalt plant, backfiller, bituminous spreader or laydown machine; cableway signalman, caisson drill, William MF, similar or larger; C.M.I. and similar, concrete batching plants, concrete finish machine, concrete gang saw on concrete paving, concrete mixer, less than 1 yd., concrete placement pumps, under 8 inches, distributors, bituminous surfaces dozer, drill, diamond or core, drill rigs, rotary, churn, or cable tool, elevating graders, elevator operator, equipment, lubricating and service engineer, grout machine, gunnite machine, hoist, 1 drum, horizontal directional drill operator, sandblasting machine, single unit protable crusher, with or without washer, tie tamper, wheel mounted, tractor, 70 hp and over with or without attahments, trenching machine operator, winch on truck.

GROUP 4 - Cable operated power shovels, draglines, clamshells, and backhoes, 5 cubic yards and under, concrete mixer over 1 cubic yard, concrete paver 34E or similar, concrete placement pumps, 8 inches and over, grade checker, hoist, 2 drums, hydraulic backhoe, 3/4 yds and over, loader, over 6 cubic yards, mechanic, mixer mobile, multiple unit portable crusher, with or without washer; piledriver, tractor with sideboom, roto- mill and similar, welder.

GROUP 5 - Cable operated power shovels, draglines, clamshells and backhoes over 5 cubic yards, caisson drill Watson 2500 similar or larger, hoist 3 drum or more, mechanic – welder (heavy-duty).

GROUP 6 - Cableway, derrick, quad nine push unit, wheel excavator, belt or elevating loader

GROUP 7 - tower cranes all types

LABORER CLASSIFICATIONS:

GROUP 1 - Janitors; Yardmen

GROUP 2 - including caissons to 8' carrying Reinforcing Rods; Dowel Bars; Fence Erectors; Fire Watchers on power plants and oilrefineries; Gabion Basket and Reno mattresses; Signaling, Metal Mesh; pipe plants and yards; Shrubs and flowers; Stake Caser; Traffic Control Devices; Tie Bars and Chairs in Concrete; Paving; Waterproofing Concrete; Air, Gas, Hydraulic Tools and Electrical Tool Operators; Barco Hammers; Cutting Torches; drill; diamond and core drills; Core, diamond, air track including but not limited to; Joy, Mustang, PR-143, 220 Gardner-**Denver**, Hydrosonic, and water blaster operator; Chuck Tender; Electric hammers; Jackhammers; Hydraulic Jacks; Tampers; Air Tampers; Boring Machines; Air Hydraulic Boring machines; Automatic Concrete Power Curbing

Machines; Concrete Processing Material; form setters; Highways, Streets, and Airports runways; Operators of concrete saws on pavement (other than gangsaws); Power operated Concrete Buggies; Hot Asphalt Labor; Asphalt Curb Machines; Paving Breakers; Transverse Concrete Conveyor Operator; Cofferdams; Boxtenders; Caisson 8' to 12'; Caisson Over 12'; Jackhammer Operators in Caissons over 12'; Labor applicable to Pipe coating or Wrapping; Pipe Wrappers, Plant and Yard; Relining Pipe; Hydroliner (a plastic may be used to waterproof); Pipelayer on Underground Bores; Sewer, Water, Gas, Oil and Telephone Conduit; Enamalers on Pipe, inside and out, Mechanical Grouters; Monitors; Jeep Holiday Detector Men; Pump Operators; Rakers; Vibrators; Hydro- broom, Mixer Man; Gunnite Nozzelmen; Shotcrete Operator; and chain saws, gas and electric; Sand Blaster; Licensed Powdermen; Powdermen and Blaster; Siphons; Signalmen; Dumpman/spotter; Grade Checker.

GROUP 3 - Plug and galleys in dams; Scalers; any work on or off Bridges 40' above the ground performed by Laborers working from a Bos'n Chair, Swing Stage, Life Belt, or Block and Tackle as a safety requirement.

TUNNEL LABORER CLASSIFICATIONS:

GROUP 1 - Outside Laborer - Above ground

GROUP 2 - Minimum Tunnel Laborer, Dry Houseman

GROUP 3 - Cable or Hose Tenders, Chuck Tenders, Concrete Laborers, Dumpmen, Whirley Pump Operators

GROUP 4 - Tenders on Shotcrete, Gunniting and Sand Blasting;
Tenders, core and Diamond Drills; Pot Tenders

GROUP 5 - Collapsible Form Movers and Setters; Miners; Machine Men and Bit Grinders; Nippers; Powdermen and Blasters; Reinforcing Steel Setters; Timbermen (steel or wood tunnel support, including the placement of sheeting when required); and all Cutting and Welding that is incidental to the Miner's work; Tunnel Liner Plate Setters; Vibrator Men, Internal and External; Unloading, stopping and starting of Moran Agitator Cars; Diamond
and Core Drill Operators; Shotcrete operator; Gunnite Nozzlemen; Sand Blaster; Pump Concrete Placement Men.

TRUCK DRIVER CLASSIFICATIONS:

GROUP 1 - Sweeper Truck, Flat Rack Single Axle and Manhaul, Shuttle Truck or Bus.

GROUP 2 - Dump Truck Driver to and including 6 cubic yards, Dump Truck Driver over 6 cubic yards to and including 14 cubic yards, Straddle Truck Driver, Liquid and Bulk Tankers Single Axle, Euclid Electric or Similar, Multipurpose Truck Specialty and Hoisting.

GROUP 3 - Truck Driver Snow Plow.

GROUP 4 - Cement Mixer Agitator Truck over 10 cubic yards to and including 15 cubic yards.

WELDERS: Receive rate prescribed for craft performing operation to which welding is incidental.

DENVER
THE MILE HIGH CITY

Career Service Authority
Denver's Human Resource Agency

201 W. Colfax, Department 412
Denver, CO 80202
p: 720.913.5751
f: 720.913.5720
www.denvergov.org/csa

TO: All Users of the City of Denver Prevailing Wage Schedules

FROM: Meredith Creme, Associate Human Resources Professional

DATE: Friday January 20, 2012

SUBJECT: Latest Change to Prevailing Wage Schedules

Please be advised, prevailing wage rates for some building, heavy, and highway construction trades have not been updated by the United States Department of Labor (DOL) since March 1, 2002. The Career Service Authority Board, in their meeting held on April 21, 2011, approved the use of the attached supplemental wage rates until prevailing wage rates for these classifications of work are again published by the United States Department of Labor in accordance with the Davis-Bacon Act. The rates will be provided as a supplemental to the Davis-Bacon Building rates issued by CSA.

The attached Prevailing Wage Schedule is effective as of **Friday January 20, 2012** and applies to the City and County of Denver for **BUILDING CONSTRUCTION PROJECTS** (does not include residential construction consisting of single family homes and apartments up to and including 4 stories) in accordance with the Denver Revised Municipal Code, Section 20-76(c).

General Wage Decision No. CO120004
Superseded General Decision No. CO20100004
Modification No. 1
Publication Date: 01-13-2012
(5 pages)

Unless otherwise specified in this document, apprentices shall be permitted only if they are employed pursuant to, and individually registered in, a bona fide apprenticeship program registered with the U.S. Department of Labor (DOL). The employer and the individual apprentice must be registered in a program, which has received prior approval, by the DOL. Any employer, who employs an apprentice and is found to be in violation of this provision, shall be required to pay said apprentice the full journeyman scale.

For questions call (720) 913-5009

Attachments as listed above.

General Decision Number: CO120004 01/13/2012 CO4

Superseded General Decision Number: CO20100004

State: Colorado

Construction Type: Building

County: Denver County in Colorado.

BUILDING CONSTRUCTION PROJECTS (does not include residential construction consisting of single family homes and apartments up to and including 4 stories)

Modification Number	Publication Date
0	01/06/2012
1	01/13/2012

ASBE0028-001 07/01/2010

	Rates	Fringes
Asbestos Workers/Insulator (Includes application of all insulating materials, protective coverings, coatings and finishings to all types of mechanical systems)	$ 30.23	11.53

BRCO0007-001 01/01/2011

	Rates	Fringes
BRICKLAYER	$ 22.13	9.89

BRCO0007-005 06/01/2011

	Rates	Fringes
TILE SETTER	$ 25.15	9.18

CARP0001-004 05/01/2009

	Rates	Fringes
Carpenters: Acoustical, Drywall Hanging/Framing and Metal Stud, Form Building/Setting	$ 26.60	8.89

CARP2834-001 05/01/2009

	Rates	Fringes
MILLWRIGHT	$ 27.60	10.65

ELEC0068-002 06/01/2011

	Rates	Fringes
ELECTRICIAN (Includes Low Voltage Wiring and Installation of Fire alarms, Security Systems, Telephones, Computers and Temperature Controls)	$ 31.60	12.52

ELEV0025-002 01/01/2011

	Rates	Fringes
Elevator Constructor	$ 38.19	21.79

FOOTNOTE:

a. Employer contributes 8% of basic hourly rate for over 5 years' service and 6% basic hourly rate for 6 months' to 5 years' service as Vacation Pay Credit.

PAID HOLIDAYS: New Year's Day; Memorial Day; Independence Day; Labor Day; Veterans Day; Thanksgiving Day; Friday after Thanksgiving Day; and Christmas Day.

ENGI0009-003 05/01/2011

	Rates	Fringes
Power equipment operator - crane		
141 tons and over	$ 24.88	9.22
50 tons and under	$ 23.82	9.22
51 to 90 tons	$ 23.97	9.22
91 to 140 tons	$ 24.12	9.22

IRON0024-001 07/01/2011

	Rates	Fringes
IRONWORKER, STRUCTURAL	$ 23.80	10.91

LABO0720-003 05/01/2009

	Rates	Fringes
Laborers:		
Concrete/Mason Tenders	$ 16.52	6.84

PAIN0079-002 08/01/2010

	Rates	Fringes
Drywall Finisher/Taper		

Hand	$ 18.69	6.11
Tool	$ 19.04	6.11
Painters:	$ 17.99	6.11
PAPERHANGER	$ 18.69	6.11

PAIN0930-001 07/01/2011

	Rates	Fringes
GLAZIER	$ 27.95	7.10

PLAS0577-001 05/01/2010

	Rates	Fringes
Cement Mason/Concrete Finisher	$ 24.60	10.10

* PLUM0003-001 01/01/2012

	Rates	Fringes
PLUMBER		
(Excluding HVAC work)	$ 32.68	11.44

PLUM0208-001 06/01/2011

	Rates	Fringes
PIPEFITTER		
(Including HVAC pipe)	$ 32.61	11.26

SFCO0669-001 04/01/2011

	Rates	Fringes
SPRINKLER FITTER	$ 32.76	16.90

SHEE0009-001 01/01/2011

	Rates	Fringes
Sheet metal worker		
(Includes HVAC duct and installation of HVAC systems)	$ 31.66	10.98

SUCO2001-011 12/20/2001

	Rates	Fringes
Carpenters:		
All Other Work	$ 16.12	2.84
Ironworkers:		
Reinforcing	$ 18.49	3.87
Laborers:		

Brick Finisher/Tender	$ 12.78	1.41
Common	$ 10.62	2.09
Power equipment operators:		
Mechanic	$ 18.48	

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

==========

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is union or non-union.

Union Identifiers

An identifier enclosed in dotted lines beginning with characters other than "SU" denotes that the union classification and rate have found to be prevailing for that classification. Example: PLUM0198-005 07/01/2011. The first four letters , PLUM, indicate the international union and the four-digit number, 0198, that follows indicates the local union number or district council number where applicable , i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2011, following these characters is the effective date of the most current negotiated rate/collective bargaining agreement which would be July 1, 2011 in the above example.

Union prevailing wage rates will be updated to reflect any changes in the collective bargaining agreements governing the rate.

Non-Union Identifiers

Classifications listed under an "SU" identifier were derived from survey data by computing average rates and are not union rates; however, the data used in computing these rates may include both union and non-union data. Example: SULA2004-007 5/13/2010. SU indicates the rates are not union rates, LA indicates the State of Louisiana; 2004 is the year of the

survey; and 007 is an internal number used in producing the wage determination. A 1993 or later date, 5/13/2010, indicates the classifications and rates under that identifier were issued as a General Wage Determination on that date.

Survey wage rates will remain in effect and will not change until a new survey is conducted.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative

Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

Career Service Authority
Supplemental to the Davis-Bacon *Building* Construction Project rates
(Specific to the Denver projects)
Supp #98, Date: 01-13-2011

Classification		Base	Fringe
Boilermakers		$30.97	$21.45
Power Equipment Operators (Concrete Mixers):			
	Less than 1 yd	$23.67	$10.67
	1 yd and over	$23.82	$10.68
	Drillers	$23.97	$10.70
	Loaders over 6 cu yd	$23.82	$10.68
	Oilers	$22.97	$10.70
Soft Floor Layers		$16.70	$9.81
Ironworkers (Ornamental)		$24.80	$10.03
Plasters		$24.60	$12.11
Plaster Tenders		$10.79	-
Laborers: Concrete Saw		$13.89	-
Power Equipment Operators:			
	Backhoe	$23.67	$10.67
	Loader up to and incl 6 cu yd	$23.67	$10.67
	Motor Grader	$23.97	$10.70
	Roller	$23.67	$10.67
Truck Drivers (Dump Trucks):			
	6 to 14 cu yds	$19.14	$10.07
	15 to 29 cu yds	$19.48	$10.11
	Flatbed	$19.14	$10.07
	Semi	$19.48	$10.11

- To determine the Tile Setters-Marble Mason-Terrazzo mechanic rates—Use Davis Bacon-Building rates adopted by the Career Service Board.
- To determine the Tile Finisher-Floor Grinder-Base Grinder—Use current Career Service Prevailing Wage Schedules.
- Caulkers—Receive rate prescribed for craft performing operation to which caulking is incidental .i.e. glazier, painter, brick layer, cement mason.
- Use the "Carpenters—All Other Work" rates published by the federal Davis Bacon rates for batt insulation, pre-stress concrete and tilt up concrete walls, Roofers (including foundation waterproofing).
- Use the "Laborer—Common", rates published by the federal Davis Bacon rates for General Housekeeping, Final Cleanup and Fence Installer.

DENVER
THE MILE HIGH CITY

Career Service Authority
Denver's Human Resource Agency

201 W. Colfax, Department 412
Denver, CO 80202
p: 720.913.5751
f: 720.913.5720
www.denvergov.org/csa

TO: All Users of the City of Denver Prevailing Wage Schedules

FROM: Meredith Creme, Associate Human Resource Professional

DATE: Friday January 13, 2012

SUBJECT: Latest Change to Prevailing Wage Schedules

Please be advised, prevailing wage rates for some building, heavy, and highway construction trades have not been updated by the United States Department of Labor (DOL) since March 1, 2002. The Career Service Authority Board, in their meeting held on April 21, 2011, approved the use of the attached supplemental wage rates until prevailing wage rates for these classifications of work are again published by the United States Department of Labor in accordance with the Davis-Bacon Act. The rates will be provided as a supplemental to the Davis-Bacon Highway rates issued by CSA.

The effective date for this publication is **Friday January 13, 2012** and applies to the City and County of Denver for **HIGHWAY CONSTRUCTION PROJECTS** in accordance with the Denver Revised Municipal Code, Section 20-76(c).

General Wage Decision No. CO120019
Superseded General Decision No. CO20100021
Modification No. 0
Publication Date: 01-06-2012
(11 pages)

Unless otherwise specified in this document, apprentices shall be permitted only if they are employed pursuant to, and individually registered in, a bona fide apprenticeship program registered with the U.S. Department. Of Labor (DOL). The employer and the individual apprentice must be registered in a program, which has received prior approval, by the DOL. Any employer, who employs an apprentice and is found to be in violation of this provision, shall be required to pay said apprentice the full journeyman scale.

For questions call (720) 913-5009

Attachments as listed above.

311 for City Services
Denver gets it done!

General Decision Number: CO120019 01/06/2012 CO19

Superseded General Decision Number: CO20100021

State: Colorado

Construction Type: Highway

Counties: Denver and Douglas Counties in Colorado.

HIGHWAY CONSTRUCTION PROJECTS

Modification Number	Publication Date
0	01/06/2012

CARP9901-008 10/01/2010

	Rates	Fringes
CARPENTER (Form Work Only)	$ 24.00	11.28

ELEC0068-016 03/01/2011

	Rates	Fringes
TRAFFIC SIGNALIZATION:		
Traffic Signal Installation		
Zone 1	$ 26.42	4.75%+8.68
Zone 2	$ 29.42	4.75%+8.68

TRAFFIC SIGNAL INSTALLER ZONE DEFINITIONS

Zone 1 shall be a 35 mile radius, measured from the following addresses in each of the following cities:
Colorado Springs - Nevada & Bijou
Denver - Ellsworth Avenue & Broadway
Ft. Collins - Prospect & College
Grand Junction - 12th & North Avenue
Pueblo - I-25 & Highway 50
All work outside of these areas shall be paid Zone 2 rates.

ENGI0009-008 05/01/2011

	Rates	Fringes
POWER EQUIPMENT OPERATOR:		
(3)-Hydraulic Backhoe (Wheel Mounted, under 3/4 yds), Hydraulic Backhoe (Backhoe/Loader combination), Drill Rig Caisson (smaller than Watson 2500 and similar), Loader (up to and including 6 cu. yd.)	$ 23.67	9.22
(3)-Loader (under 6 cu. yd.)		
Denver County	$ 23.67	9.22
(3)-Motor Grader (blade-rough)		
Douglas County	$ 23.67	9.22

(4)-Crane (50 tons and under), Scraper (single bowl, under 40 cu. yd)	$ 23.82	9.22
(4)-Loader (over 6 cu. yd) Denver County	$ 23.82	9.22
(5)-Drill Rig Caisson (Watson 2500 similar or larger), Crane (51-90 tons), Scraper (40 cu.yd and over),	$ 23.97	9.22
(5)-Motor Grader (blade-finish) Douglas County	$ 23.97	9.22
(6)-Crane (91-140 tons)	$ 24.12	9.22

SUCO2011-004 09/15/2011

	Rates	Fringes
CARPENTER (Excludes Form Work)	$ 19.27	5.08
CEMENT MASON/CONCRETE FINISHER		
Denver	$ 20.18	5.75
Douglas	$ 18.75	3.00
ELECTRICIAN (Excludes Traffic Signal Installation)	$ 35.13	6.83
FENCE ERECTOR (Excludes Link/Cyclone Fence Erection)	$ 13.02	3.20
GUARDRAIL INSTALLER	$ 12.89	3.20
HIGHWAY/PARKING LOT STRIPING:Painter		
Denver	$ 12.62	3.21
Douglas	$ 13.89	3.21
IRONWORKER, REINFORCING (Excludes Guardrail Installation)	$ 16.69	5.45
IRONWORKER, STRUCTURAL (Includes Link/Cyclone Fence Erection, Excludes Guardrail Installation)	$ 18.22	6.01
LABORER		
Asphalt Raker	$ 16.29	4.25
Asphalt Shoveler	$ 21.21	4.25
Asphalt Spreader	$ 18.58	4.65
Common or General		
Denver	$ 16.76	6.77
Douglas	$ 16.29	4.25
Concrete Saw (Hand Held)	$ 16.29	6.14
Landscape and Irrigation	$ 12.26	3.16
Mason Tender-Cement/Concrete		
Denver	$ 16.96	4.04
Douglas	$ 16.29	4.25
Pipelayer		

Denver	$ 13.55	2.41
Douglas	$ 16.30	2.18
Traffic Control (Flagger)	$ 9.55	3.05
Traffic Control (Sets Up/Moves Barrels, Cones, Install Signs, Arrow Boards and Place Stationary Flags)(Excludes Flaggers)	$ 12.43	3.22
PAINTER (Spray Only)	$ 16.99	2.87
POWER EQUIPMENT OPERATOR:		
Asphalt Laydown		
Denver	$ 22.67	8.72
Douglas	$ 23.67	8.47
Asphalt Paver		
Denver	$ 24.97	6.13
Douglas	$ 25.44	3.50
Asphalt Roller		
Denver	$ 23.13	7.55
Douglas	$ 23.63	6.43
Asphalt Spreader	$ 22.67	8.72
Backhoe/Trackhoe		
Douglas	$ 23.82	6.00
Bobcat/Skid Loader	$ 15.37	4.28
Boom	$ 22.67	8.72
Broom/Sweeper		
Denver	$ 22.47	8.72
Douglas	$ 22.96	8.22
Bulldozer	$ 26.90	5.59
Concrete Pump	$ 21.60	5.21
Drill		
Denver	$ 20.48	4.71
Douglas	$ 20.71	2.66
Forklift	$ 15.91	4.68
Grader/Blade		
Denver	$ 22.67	8.72
Guardrail/Post Driver	$ 16.07	4.41
Loader (Front End)		
Douglas	$ 21.67	8.22
Mechanic		
Denver	$ 22.89	8.72
Douglas	$ 23.88	8.22
Oiler		
Denver	$ 23.73	8.41
Douglas	$ 24.90	7.67
Roller/Compactor (Dirt and Grade Compaction)		
Denver	$ 20.30	5.51
Douglas	$ 22.78	4.86
Rotomill	$ 16.22	4.41
Screed		
Denver	$ 22.67	8.38
Douglas	$ 29.99	1.40
Tractor	$ 13.13	2.95
TRAFFIC SIGNALIZATION:		
Groundsman		
Denver	$ 17.90	3.41
Douglas	$ 18.67	7.17

TRUCK DRIVER		
Distributor		
Denver	$ 17.81	5.82
Douglas	$ 16.98	5.27
Dump Truck		
Denver	$ 15.27	5.27
Douglas	$ 16.39	5.27
Lowboy Truck	$ 17.25	5.27
Mechanic	$ 26.48	3.50
Multi-Purpose Specialty & Hoisting Truck		
Denver	$ 17.49	3.17
Douglas	$ 20.05	2.88
Pickup and Pilot Car		
Denver	$ 14.24	3.77
Douglas	$ 16.43	3.68
Semi/Trailer Truck	$ 18.39	4.13
Truck Mounted Attenuator	$ 12.43	3.22
Water Truck		
Denver	$ 26.27	5.27
Douglas	$ 19.46	2.58

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is union or non-union.

Union Identifiers

An identifier enclosed in dotted lines beginning with characters other than "SU" denotes that the union classification and rate have found to be prevailing for that classification. Example: PLUM0198-005 07/01/2011. The first four letters , PLUM, indicate the international union and the four-digit number, 0198, that follows indicates the local union number or district council number where applicable , i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2011, following these characters is the effective date of the most current negotiated rate/collective bargaining agreement which would be July 1, 2011 in the above example.

Union prevailing wage rates will be updated to reflect any changes in the collective bargaining agreements governing the rate.

Non-Union Identifiers

Classifications listed under an "SU" identifier were derived from survey data by computing average rates and are not union rates; however, the data used in computing these rates may include both union and non-union data. Example: SULA2004-007 5/13/2010. SU indicates the rates are not union rates, LA indicates the State of Louisiana; 2004 is the year of the survey; and 007 is an internal number used in producing the wage determination. A 1993 or later date, 5/13/2010, indicates the classifications and rates under that identifier were issued as a General Wage Determination on that date.

Survey wage rates will remain in effect and will not change until a new survey is conducted.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.

Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

Career Service Authority
Supplemental to the Davis-Bacon *HIGHWAY* Construction Projects rates
(Specific to the Denver Projects)
(Supp 35, Date: 01-13-2012)

Classification		Base	Fringe
Millwrights		$28.00	$10.00
Line Construction:			
	Lineman, Gas Fitter/Welder	$36.88	$9.55
	Line Eq Operator/Line Truck Crew	$25.74	$8.09
Power Equipment Operators (Tunnels Above and Below Ground, shafts and raises):			
	GROUP 1	$25.12	$10.81
	GROUP 2	$25.47	$10.85
	GROUP 3	$25.57	$10.86
	GROUP 4	$25.82	$10.88
	GROUP 5	$25.97	$10.90
	GROUP 6	$26.12	$10.91
	GROUP 7	$26.37	$10.94
Power Equipment Operators:			
	GROUP 1	$22.97	$10.60
	GROUP 2	$23.32	$10.63
	GROUP 3	$23.67	$10.67
	GROUP 4	$23.82	$10.68
	GROUP 5	$23.97	$10.70
	GROUP 6	$24.12	$10.71
	GROUP 7	$24.88	$10.79
Ironworkers (Ornamental)		$24.80	$10.03
Laborers (Removal of Asbestos)		$21.03	$8.55
Plumbers		$30.19	$13.55
Pipefitters		$30.45	$12.85
Truck Drivers:			
	GROUP 1	$18.42	$10.00
	GROUP 2	$19.14	$10.07
	GROUP 3	$19.48	$10.11
	GROUP 4	$20.01	$10.16
	GROUP 5	$20.66	$10.23
	GROUP 6	$21.46	$10.31

POWER EQUIPMENT OPERATOR CLASSIFICATIONS
(TUNNELS ABOVE AND BELOW GROUND, SHAFTS, AND RAISES):

GROUP 1 - Brakeman

GROUP 2 - Motorman

GROUP 3 - Compressor

GROUP 4 - Air Tractors; Grout Machine; Gunnite Machine; Jumbo Form

GROUP 5 - Concrete Placement Pumps; Mucking Machines and Front End Loaders, Underground, Slusher; Mine Hoist Operator; Mechanic

GROUP 6 - Mechanic Welder

GROUP 7 - Mole

NOTE: Any equipment listed below being used in tunnel work, below or above ground shall be paid not less than $2.00 per hour above the listed wage rates.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS:

GROUP 1 - Air compressor, brakeman, drill operator -smaller than Watson 2500 and similar, operators of 5 or more light plants, welding machines, generators, single unit conveyor, pumps, vacuum well point system, tractor, under 70 hp with or without attachments compressors, 360 C.F.M. or less

GROUP 2 - Conveyor, handling building materials, ditch witch and similar trenching machine, forklift, haulage motor man, pugmill, portable screening plant with or without a spray bar, screening plants, with classifier, self-propelled roller, rubber-tires under 5 tons.

GROUP 3 - asphalt plant, backfiller; cableway signalman; C.M.I. and similar, concrete batching plants, concrete finish machine, concrete gang saw on concrete paving, concrete mixer, less than 1 yd., under 8 inches, distributors, bituminous surfaces dozer, drill, diamond or core, elevating graders, elevator operator, lubricating and service engineer, grout machine, gunnite machine, hoist, 1 drum, horizontal directional drill operator, hydraulic backhoes; road stabilization machine, sandblasting Machine, single unit portable crusher, with or without washer, Tie tamper, wheel mounted, trenching machine operator, winch on truck.

GROUP 4 - Cable operated power shovels, draglines, clamshells, 5 cubic yards and under, concrete mixer over 1 Cubic yard, concrete pavers 34E or similar, grade Checker, hoist, 2 drums, mechanic, mixer mobile, Portable crusher, with or without washer; tractor with sideboom, roto-M ill and similar, welder.

GROUP 5 - Cable operated power shovels, draglines, clamshells and Backhoes over 5 cubic yards, caisson drill Watson 2500 similar or larger, motor grader blade-finish, hoist 3 drum or more.

GROUP 6 - Cableway, derrick, quad nine push unit, wheel excavator, belt or elevating loader.

GROUP 7 - tower cranes all types.

TRUCK DRIVER CLASSIFICATIONS:

GROUP 1 - Greasemen, Servicemen and Ambulance Drivers, Battery Men, Shuttle Truck or Bus, Flat Rack Tandem Axle.

GROUP 2 - Fork Lift Driver, Straddle Truck Driver, Lumber Carrier, Liquid and Bulk Tankers Single Axle, Combination, Euclid Electric or Similar, Specialty and Hoisting, Truck Drivers Fuel Truck, Grease Truck, Combination Fuel and Grease.

GROUP 3 - Truck Driver Snow Plow, Truck Driver Dump or Type Jumbo and similar type equipment.

GROUP 4 - Cement Mixer Agitator Truck over 10 cubic yards to and including 15 cubic yards, Tire Man, Cab Operated Distributor Truck Driver.

GROUP 5 - Heavy Duty Diesel Mechanic, Body Man, Welders or Combination Men.

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

DENVER
THE MILE HIGH CITY

TO: All Users of the City of Denver Prevailing Wage Schedules

FROM: Meredith Creme, CSA Compensation and Classification

DATE: December 1, 2011

SUBJECT: Latest Update to Prevailing Wage Schedules

Please find an attachment to this memorandum all of the current Career Service Prevailing Wage Schedules issued in accordance with the City and County of Denver's Revised Municipal Code, Section 20-76(c). This schedule does not include the Davis-Bacon rates. The Davis-Bacon wage rates will continue to be published separately as they are announced.

Modification No. 99
Publication Date: 12-2-2011
(5 pages)

Unless otherwise specified in this document, apprentices shall be permitted only if they are employed pursuant to, and individually registered in, a bona fide apprenticeship program registered with the U.S. Department of Labor. The employer and the individual apprentice must be registered in a program, which has received prior approval, by the U.S. Department of Labor. Any employer, who employs an apprentice and is found to be in violation of this provision, shall be required to pay said apprentice the full journeyman scale.

Questions call (720) 913-5722

Attachments as listed above.

APPLIANCE MECHANIC

Last Revision: 02-19-2009
Effective: 02-19-2009

Classification:	Base Wage	Fringes
Appliance Mechanic	$22.34/hour	$5.82/hour

Plus 10% shift differential for regularly scheduled hours worked between 6:00 p.m. and 6:00 a.m.

The Appliance Mechanic installs, services and repairs stoves, refrigerators, dishwashing machines, and other electrical household or commercial appliances, using hand tools, test equipment and following wiring diagrams and manufacturer's specifications. Responsibilities include: connects appliance to power source and test meters, such as wattmeter, ammeter, or voltmeter, observes readings on meters and graphic recorders, examines appliance during operating cycle to detect excess vibration, overheating, fluid leaks and loose parts, and disassembles appliances and examines mechanical and electrical parts. Additional duties include: traces electrical circuits, following diagram and locates shorts and grounds, using ohmmeter, calibrates timers, thermostats and adjusts contact points, and cleans and washes parts, using wire brush, buffer, and solvent to remove carbon, grease and dust. Replaces worn or defective parts, such as switches, pumps, bearings, transmissions, belts, gears, blowers and defective wiring, repairs and adjusts appliance motors, reassembles appliance, adjusts pulleys and lubricates moving parts, using hand tools and lubricating equipment.

Note: This position does not perform installations done at new construction.

BAGGAGE HANDLING SYSTEM MAINTENANCE

Last Revision: 10-22-2010
Effective: 10-21-2011

Classification:	Base Wage	Fringes
Entry-Support Mechanic	$15.26/hour	$5.35/hour
Machinery Maintenance Mechanic	$19.33/hour	$5.82/hour
Controls System Technician	$24.90/hour	$6.46/hour

Plus 10% shift differential for regularly scheduled hours worked between 6:00 p.m. and 6:00 a.m.

Entry Support Mechanic
Under direct supervision, assists the Machinery Maintenance Mechanic in maintaining the operational status of the baggage handling system. Duties include but are not limited to; assisting with adjustments with belt tracking, belt tension, and gearbox.

Machinery Maintenance Mechanic
Performs routine and basic adjustments of baggage handling system equipment including but not limited to, belt tracking, belt tension, and gearbox and bearing lubrication. Performs daily and periodic shift inspections, cleaning, and diagnostics of mechanical system components based on an established preventive maintenance program. Dismantles, repairs, and reassembles equipment or machines for stock replacement or to restore baggage handling system equipment to operational status. Preventive maintenance and overhauling machines includes, but is not limited to, motors, clutches, brakes, transporting telecars, bearings, drive belts, drive shafts, pulleys, gearboxes (speed reducers), and conveyor belting. Maintains daily turnover reports and hourly labor time sheets for warranty reimbursement and statistical tracking of repairs.

Controls System Technician
Performs a variety of functions such as installation, maintenance, and repair of devices which control and are controlled by the baggage handling system and related equipment. Such devices include, but are not

limited to, personal computers, programmable logic controllers and peripherals, motor control panels, photoelectric sensors, sync-pulse tachometers, laser and RF readers, linear induction motors and servo-drives. Troubleshoots and repairs all control system and electrical failures by applying comprehensive technical knowledge to solve problems by interpreting manufacturer manuals or similar documents. Work requires familiarity with the interrelationships of electro-mechanical devices.

Removes and replaces plug-in type boards and components. Aligns, replaces, and cleans photocells. Makes minor repairs of connectors, wiring and fuses on-site, and cleans and performs diagnostic routines of electrical and control system components. Performs scheduled routine maintenance on all control system components and reporting devices (including personal computers), based on recommended manufacturer practices. Uses a personal computer to diagnose and correct PLC and operating system software problems. Diagnoses, repairs and aligns laser array (baggage tag reader) and RF reader hardware and software.

Note: Incumbents must posses an Electrician's license when work warrants.

BUILDING ENGINEER

Last Revision: 07-15-2010
Effective: 07-21-2011

Classification:	Base Wage	Fringes
Building Engineer	$28.82/hour	$6.68/hour

This classification of work is responsible for operating, monitoring, maintaining/repairing the facilities mechanical systems to ensure peak performance of the systems. This includes performing P.M. and repair work of the building mechanical systems, inspecting, adjusting, and monitoring the building automation and life safety systems, contacting vendors and place order replacement parts, responding to customer service requests and performing maintenance/repairs I tenant or public spaces, performing routine P.M. i.e. light plumbing an electrical repairs, ballast lamp and tube replacement, operating mechanical systems both on site and via a remote laptop computer, maintaining inventory of spare parts and tools, painting and cleaning mechanical equipment and machine rooms, etc.

FUEL HANDLER SERIES

Last Revision: 10-22-2010
Effective: 10-21-2011

Classification:	Base Wage	Fringes
Fuel Distribution System Operator	$18.97/hour	$5.78/hour
Lead Fuel Distribution System Operator	$19.83/hour	$5.88/hour
Fuel Distribution System Mechanic	$23.46/hour	$6.30/hour
Lead Fuel Distribution System Mechanic	$24.53/hour	$6.42/hour

Plus 10% shift differential for hours worked between 6:00 p.m. and 6:00 a.m.

Fuel Distribution System Operator:

Receives, stores, transfers, and issues fuel. Performs various testing procedures and documentation on fuel samples. Gauges tanks for water, temperature and fuel levels. Performs temperature and gravity testing for correct weight of fuel. Checks pumping systems for correct operating pressure or unusual noises. Inspects fuel receiving, storage, and distribution facilities to detect leakage, corrosion, faulty fittings, and malfunction of mechanical units, meters, and gauges such as distribution lines, float gauges, piping valves, pumps, and roof sumps. Operates a 24-hour control center; operates various computer equipments

to determine potential equipment failure, leak and cathodic protection systems, pump failure, and emergency fuel shutoff systems. Monitors quality of fuel and drains excess condensation from fuel sumps and underground fuel pits. Inspects fuel tank farm for such items as leaks, low pressure, and unauthorized personnel. Performs general housekeeping and grounds maintenance for terminal, pipeline and dock areas, including fuel pits and valve vault cleaning and pump out activities. May connect lines, grounding wires, and loading and off loading arms of hoses to pipelines. May assist Fuel Distribution System Mechanics by preparing work areas. Maintains record of inspections, observations and test results.

Lead Fuel Distribution System Operator:

Performs lead duties such as making and approving work assignments and conducting on-the-job training as well as performing the various tasks performed by the Operator classification.

Fuel Distribution System Mechanic:

Maintains and repairs fuel storage and distribution systems, equipment and filtration systems, and differential pressure valves. Corrects leakage, corrosion, faulty fittings, and malfunction of mechanical units, meters, and gauges such as distribution lines, float gauges, piping valves, pumps, and roof sumps. Inspects electrical wiring, switches, and controls for safe-operating condition, grounding, and adjustment; may make minor repairs. Lubricates and repacks valves. Lubricates pumps, replaces gaskets, and corrects pumping equipment misalignment. May clean strainers and filters, service water separators, and check meters for correct delivery and calibration. Overhauls system components such as pressure regulating valves and excess valves. Disassembles, adjusts, aligns, and calibrates gauges and meters or replaces them. Removes and installs equipment such as filters and piping to modify system or repair and replace system component. Cleans fuel tanks and distribution lines. Removes corrosion and repaints surfaces. Overhauls vacuum and pressure vents, floating roof seals, hangers, and roof sumps. Some positions maintain fuel-servicing equipment such as hydrant and tanker trucks. Maintains record of inspections and repairs and other related paperwork as required.

Lead Fuel Distribution System Mechanic:

Performs lead duties such as making and approving work assignments and conducting on-the-job training as well as performing the various tasks performed by the Mechanic classification.

These classifications are recommended to be inclusive and to supersede any previously adopted classifications.

CUSTODIANS

Last Revision: 01-20-2011
Effective: 01-01-2012

Classification	Base Wage	Fringes
Custodian I	$12.33/hour	$3.69 SINGLE $5.17 2-PARTY $6.39 FAMILY
Custodian II	$12.68/hour	$3.74 SINGLE $5.23 2-PARTY $6.44 FAMILY

Benefits and Overtime

Parking	With valid receipt from approved parking lot, employees are reimbursed the actual monthly cost of parking.
RTD Bus Pass	Employer will provide employees with the Bus Pass or pay ($0.11) per hour for travel differential.
Shift Differential	2nd shift (2:30 p.m.-10:30 p.m.): $.50/hr 3rd shift (10:31 p.m.-6:30 a.m.): $1.00/hr.
Overtime	Time worked in excess of seven and one-half (7 ½) hours in one (1) day or in excess of thirty-seven and one-half (37 ½) hours in one week shall constitute overtime and shall be paid for at the rate of time and one-half (1 ½) at the employee's basic straight time hourly rate of pay.
Note	The Career Service Board in their public hearing on March 15, 2007 approved to amend prevailing wages paid to the Custodian as follows: "All contractors shall provide fringe benefits or cash equivalent at not less than the single rate amount. Contractors who offer health insurance shall provide an employer contribution to such insurance of not less than the 2-party or family rate for any employee who elects 2-party or family coverage. Contractors who offer such coverage will be reimbursed for their employer contributions at the above rates under any City contract incorporating this wage specification."

Position Descriptions:

Custodian I	Any employee performing general clean-up duties using equipment that does not require special training: i.e., dust mopping, damp mopping, vacuuming, emptying trash, spray cleaning, washing toilets, sinks, walls, cleaning chairs, etc.
Custodian II	Any employee performing specialized cleaning duties requiring technical training and the use of heavy and technical equipment, i.e., heavy machine operators floor strippers and waxers, carpet shampooers, spray buffing, re-lamping, mopping behind machines, high ladder work, chemical stripping and finishing of stainless steel.

FURNITURE MOVERS
(Moving, Storage and Cartage Workers)

Last Revision: 10-22-2010
Effective: 10-21-2011

Classification:	Base Wage	Fringes
Laborer/Helper	$17.36/hour	$5.59/hour
Driver/Packer	$17.43/hour	$5.60/hour
Lead Worker	$18.22/hour	$5.69/hour

LANDSIDE PARKING ELECTRONICS TECHNICIAN

Last Revision: 10-22-2010
Effective: 10-21-2011

Classification:	Base Wage	Fringes
Landside Parking Electronics Technician	$22.14/hour	$6.14/hour

Plus 10% shift differential for regularly scheduled hours worked between 6:00 p.m. and 6:00 a.m.

This classification of work installs, modifies, troubleshoots, repairs and maintains revenue control equipment at manned and unmanned parking entrance and exit gates. Replaces consumable items such as tickets, printer ribbons, and light bulbs. Replaces modules and related equipment as needed to repair existing equipment, modify applications, or resolve unusual problems. Troubleshoots, tests, diagnoses, calibrates, and performs field repairs. Performs preventive maintenance such as inspection, testing, cleaning, lubricating, adjusting and replacing of serviceable parts to prevent equipment failure for electromechanical control in order to minimize repair problems and meet manufacturers' specifications.

SIGN ERECTOR

Last Revision: 10-15-2009
Effective: 10-15-2010

Classification:	Base Wage	Fringes
Sign Erector	$20.19/hour	$3.80/hour

This classification of work erects, assembles, and/or maintains signs, sign structures and/or billboards using various tools. Erects pre-assembled illuminated signs on buildings or other structures according to sketches, drawings, or blueprints. Digs and fills holes, places poles. Bolts, screws. or nails sign panels to sign post or frame. Replaces or repairs damaged or worn signs. May use welding equipment when installing sign. This classification is not a licensed electrician and therefore cannot make connections to power sources (i.e., provide exit lighting).

TELEDATA TECHNICIAN

Last Revision: 07-15-2010
Effective: 07-22-2011

Classification:	Base Wage	Fringes
Teledata Technician	$32.69/hour	$7.36/hour

This classification of work is responsible for telephone installation, removal, relocation, problem resolution, cable maintenance and repair ; installs and maintains large programmable PBX systems (Panasonic 1, 2, & 3 line sets, ISDN 6504, 6508, 7504, 7505, 7506, 7507; Northstar stations and systems; Northern Telecom Option 11 system, Vodavi Executive sets and systems, AT&T system 75, Eagle sets and systems; 2/06, 4/10, 8/20, 10/30, 30/70 Merlin systems; 3/8, 6/16,12/24, and 24/48 Vodavi systems). Duties also include testing circuits, analyzing results, repairing and modifying circuits and equipment in a step by step XY all relay and/or electronic switch system. This classification of worker locates electrical, electronic, and mechanical failures in telephone switching and carrier equipment; repairs equipment by replacing defective parts by such procedures as setting clearances, adjusting spring tensions, wipers, relay contacts and other interrelated mechanisms ; installs or rearranges equipment frames and shelves, and such equipment as line finders, switch banks, selectors, connectors, repeaters, peg counters, restricting post cams, and various interrelated truck circuits. Workers resolve complex problems between exchange, both government and commercial and may direct, instruct, and assist lower level employees with their overall assignments.

TILE SETTER-MARBLE MASONS-TERRAZZO FINISHERS, FLOOR GRINDERS, AND BASE GRINDERS

Last Revision: 06-03-2010
Effective: 07-07-2011

Classification:	Base Wage	Fringes
Finisher (Tile-Marble-Terrazzo)	$18.10 /hour	$9.33/hr

Effective May 1, 2008, Local Union 7 of Colorado combined three classes of Finishers, Floor Grinders, and Base Grinders into Finisher using one pay schedule.

Journeymen Rates for the Tile Setter classification of work (Tile Setter, Marble Mason, and Terrazzo Worker) are provided by the Davis-Bacon Act.

TRANSIT TECHNICIANS

Last Revision: 02-17-2011
Effective: 01-01-2012

Classification:	Base Wage	Fringes
Transit Technician - Entry	$22.21/hour	$6.15/hour
Transit Technician - Senior	$24.28/hour	$6.39/hour
Transit Technician - Lead	$25.38/hour	$6.52/hour
Elevator Mechanic/Repairer	$39.34/hour	$27.41/hour (< 5 yrs service) $28.19/hour (> 5 yrs service)

In addition, Shift differentials of eight percent (8%) of the employee's straight time pay rate for the second shift and ten percent (10%) for the third shift for straight time work regularly scheduled providing lore that (50%) of the employee's work occurred on such shift.

Transit Technician-Entry: Associates in this position will be given instruction by on-the-job and/or classroom training to perform corrective and preventive maintenance, inspections, repairs, and adjustments to all systems, subsystems, and components of an electronic, mechanical, electro/mechanical, hydraulic, and pneumatic nature. This classification of workers may assist with routine preventive maintenance, inspection, and adjustment. Tasks and procedures are well established and require close supervision. Incumbents will follow the direction of higher level personnel in preventive or corrective maintenance phases of work. Most tasks will be of an apprentice nature and will require close supervision. Incumbents will progress to the journey level after one year as a Transit Technician-Entry.

Transit Technician-Senior: This is a full performance level class performing various corrective and preventive maintenance, inspections, repairs, and adjustments to all systems, subsystems, and components of an electronic, mechanical, electro-mechanical, hydraulic, and pneumatic nature; monitors the transit system via a central computer system to make automated adjustments in the operation and maintenance of the transit system.

Transit Technician-Lead: Performs lead technical duties such as making work assignments and conducting on-the-job informal training as well as performing various tasks involved with the operation and maintenance of the transit system. The Lead Transit Technician is the specialist in terms of hands-on diagnosis and troubleshooting various problems that may arise on the transit system.

23210-Elevator Repairer: The SCA-Directory of Occupations describes, Elevator Repairer as, "repairs and maintains "Automated People Movers" and like named devices used in the transportation of people and materials including, but not limited to elevators, escalators, dumbwaiters, and moving walkways to meet safety regulations and building codes. This worker trouble shoots and determines causes of trouble in brakes, electrical motors, switches, signal and control systems, using computers, test lamps, voltmeters, ammeters, and oscilloscopes, disassembles defective units and repairs or replaces parts such as electrical door locks, cables, electrical wiring and faulty safety devices installs push button control systems, complete control systems, and other devices to modernize automated people mover systems, and cleans and lubricates bearing and other parts to minimize friction."

TREE TRIMMERS

Last Revision: 10-15-2009
Effective: 10-15-2010

Classification:	Base Wage	Fringes
Tree Trimmer	$16.77/hour	$2.48/hour

This classification of work trims, removes, and applies insecticides to trees and shrubbery including trimming dead, diseased, or broken limbs from trees utilizing rope and saddle, chain, handsaw and other related equipment common to the care of trees and shrubs. Removes limbs, branches and other litter from the work area, observes safety rules, inspects and identifies tree diseases and insects of the area distinguishing beneficial insects and environmental stress, takes samples form diseased or insect infested trees for lab analysis, operates a wide variety of heavy and power equipment in trimming and removing trees and shrubbery i.e. mobile aerial tower unit, tandem trucks, loaders, chipper, etc., maintains all equipments.

WINDOW CLEANERS

Last Revision: 02-04-2010
Effective: 01-20-2011

Classification:	Base Wage	Fringes
Window Cleaner	$20.80 /hour	$6.51/hr (Single) $8.24/hr (2-Party) $9.01/hr (Family)

Benefits/Overtime

Parking	With valid monthly parking receipt from approved parking lot, employees are reimbursed for the cost of parking. The employer shall reimburse employees for parking expenses from other parking lots up to the amount reimbursed for DIA Employee Parking Lot upon the submission of a monthly parking receipt. Only (1) one receipt per month.
Shift Differential	$0.75 per hour for employees assigned to 3rd shift (11:00 p.m. to 7:00 a.m.)
Overtime	One and one-half (1½) times the basic rate of pay in excess of 7.5 hours worked per day or 37.5 hours worked per week.
Lead Work	$1.25 per hour above highest paid employee under supervision
High Work	$1.75 per hour (21 feet or more from ground (base) to top of surface/structure being cleaned)
Training	$0.25 per hour
ECOPASS	Employer will provide employees with the ECOPASS
Note:	The Career Service Board in their public hearing on April 3, 2008, approved to amend prevailing wages paid to the Window Cleaners as follows: "All contractors shall provide fringe benefits or cash equivalent at not less than the single rate amount. Contractors who offer health insurance shall provide an employer contribution to such insurance of not less than the 2-party or family rate for any employee who elects 2-party or family coverage. Contractors who offer such coverage will be reimbursed for their employer contributions at the above rates under any City contract incorporating this wage specification."

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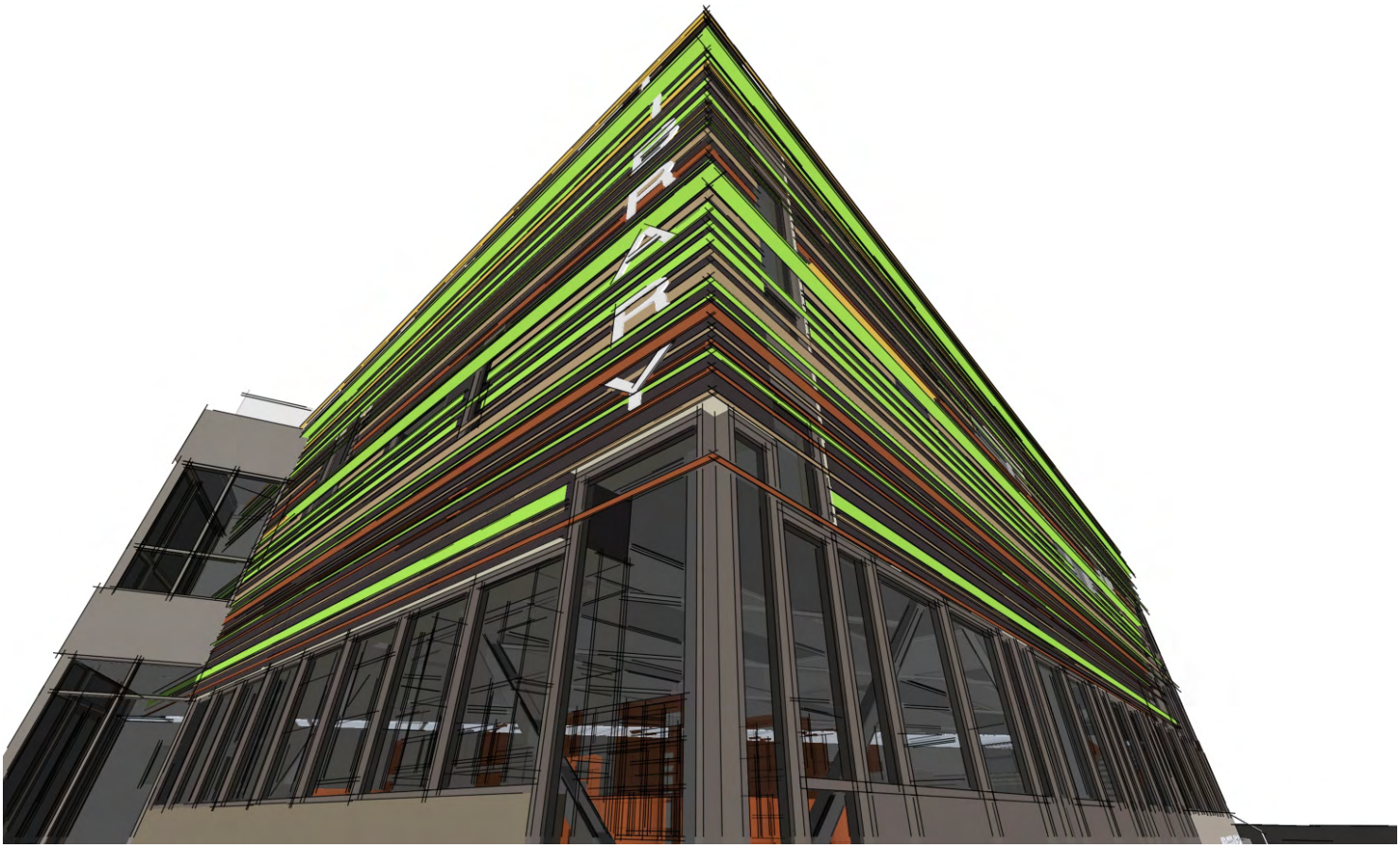

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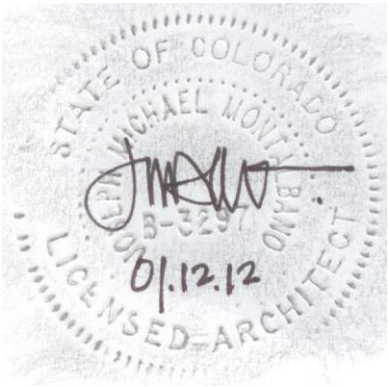

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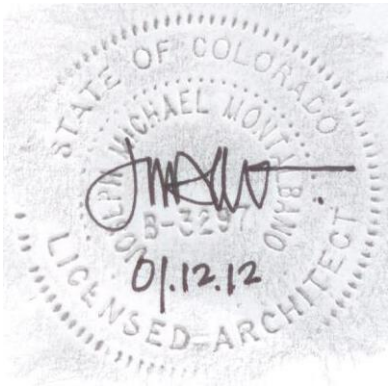

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ACURA
ENGINEERING

5235 S. 39th Street • Phoenix, AZ 85040
1500 W. Hampden Avenue • Building 3, Suite K • Sheridan, CO 80110

August 8, 2011

Mr. Joseph Montalbano
Studiotrope Design Collective
2942 Welton Street
Denver, Colorado 80205

Subject: West Denver Branch Library
SE Corner of West Colfax Avenue
and Irving Street
Denver, Colorado
Acura Project No. C11-0021G

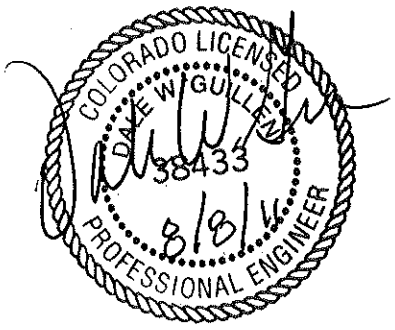
Dear Mr. Montalbano:

Acura Engineering Colorado, LLC (Acura) is pleased to submit this Geotechnical Investigation Report for the subject project. The purpose of this study was to provide geotechnical recommendations for the design and construction of the subject parcel.

If you have questions regarding the contents of this report, or require additional information, please get in contact with us at 303.799.8378.

Sincerely,

ACURA ENGINEERING COLORADO, LLC



Eric Pickerill, P.G.
Project Geologist

Reviewed by,
Dale W. Guillen, P.E.
Project Engineer

EWP:dwg

Encl: Report

cc: 3 sent (emailed)

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1.0 SUMMARY

Our test borings generally encountered fill material consisting of silty clays underlain by weathered claystone bedrock. With the exception of B-3 located in the center of the proposed building which encountered a squeegee backfill material to a depth of 12 feet underlain by clay overlying claystone bedrock. These conditions extended to the approximate 45 foot termination depths in our five building borings. Groundwater was encountered at depths ranging between 15 and 17 feet at the time of drilling. Groundwater was measured on July 22, 2011 at depths ranging from 11 feet to 13 feet.

Based on the subsurface conditions encountered, the laboratory tests, and our analyses, both straight shaft drilled pier foundations and screw pile foundation systems are appropriate for supporting the proposed commercial development. Recommendations for drilled pier design and construction considerations are presented in the report. The criteria for designing the screw pile foundation are included in the pier section.

The "Slab Performance Risk" associated with the silty clays and weathered bedrock encountered is "Low to Moderate". We recommend the owner use a structural slab system due to the severe inconsistencies and potential swelling nature of the subsurface soils combined with the localized consolidation risk of some deeper fills consisting mainly of ":squeegee" material. Alternately, a slab-on grade floor can be considered, provided the owner is willing to accept the risk. If slab-on-grade construction is planned, we recommend the owner consider over-excavation and replacement of onsite soils with imported structural fill material. We have provided recommendations for these options as presented in the report.

We have prepared this "Summary" solely to provide a general overview of the subject project. Do not rely on this "Summary" for purposes except that for which it was prepared. Rely only on the full report, which follows for specific information regarding our findings, recommendations and other concerns.

2.0 PROJECT INFORMATION

2.1 Scope of Work

This report presents the results of our Geotechnical Investigation Report for the New West Denver Branch Library to be located at the Southeast corner of West Colfax Avenue and Irving Street in Denver, Colorado. It is our understanding that a previous environmental survey was completed for the site. Acura engineering has received a copy of the environmental assessment, and several locations were identified as having strong petroliferous odors during drilling. As such it may be advantageous to limit the quantities of materials exported from the site, minimization of exports was considered in the preparation of this report.

This current investigation was performed in general accordance with the scope of work presented in our Proposal No. P10-050 dated June 20, 2010. In general, the scope of this investigation included:

1. Conduct a subsurface investigation consisting of drilling five borings to depths of approximately 30 to 40 feet below the existing ground surface in proposed building areas. An additional boring was performed in the surface parking area. Samples of subsurface materials encountered were obtained at regular intervals during drilling.

2. Conduct soil laboratory tests on selected samples of the subsurface materials recovered.

3. Evaluate and summarize the field and laboratory data obtained.
4. Prepare a Geotechnical Investigation Report summarizing the work performed and the results of our analysis for the subject project.

The samples recovered were visually inspected, and various soil laboratory tests were performed to evaluate the physical and mechanical properties of the material recovered.

The data obtained from our subsurface investigation, the results of the laboratory tests, the results of our analysis, in conjunction with our observations made at the site, and past experience with similar soils under similar loading conditions, were analyzed in order to reach the conclusions and recommendations presented in this report.

2.2 Site Location

The proposed building is located at the Southeast corner of the intersection of West Colfax Ave. and Irving Street in a rarely used parking lot. The foot print of the addition is located in an area currently being used as an asphalt parking lot. The proposed Building is bordered on all sides by asphalt parking with a few buried utilities within the proposed footprint of the building. Additionally several monitoring wells were spotted in the vicinity of the proposed building. The site is currently a developed parcel with no significant irrigated landscaping. The proposed site is generally a flat area.

2.3 Proposed Development

We anticipate the proposed development will consist of a two story building with adjacent surface parking. Light to Moderate building loads are anticipated.

3.0 SITE CONDITIONS

The property consists of a roughly square shaped parcel that encompasses approximately 2 acres of land.

The property is developed and covered with asphalt with sparse landscaping consisting of grasses and trees. The site is relatively flat, gently sloping down from the west to the east and southeast. The area surrounding the site consists of commercial and residential development.

4.0 FIELD INVESTIGATION

Our field exploration consisted of drilling six test borings on July 20, 2011 at the approximate locations shown on Plate 1. The test borings were drilled to depths of approximately 9 to 45 feet below the existing ground surface using a truck-mounted, rotary drilling rig.

The drilling rig was equipped with 4-inch outside-diameter, solid-stem continuous-flight augers. The augers were used to advance the boreholes and samples were obtained using a 2-inch, inside-diameter modified California sampler. The sampler was driven using a standard hammer weighing 140 pounds falling a distance of 30 inches.

The sampler was first seated into the bottom of the borehole, and then driven 12 inches. The number of blows required to advance the sampler 12 inches, or a fraction thereof, constitutes a penetration test and is similar to the Standard Penetration Test (American Society for Testing and Materials ASTM D1586). The penetration tests, when properly evaluated, provide an index to the soil strength and density of the material tested. The penetration test results are shown on the individual Exploratory Boring Logs in Appendix A.

5.0 SUBSURFACE CONDITIONS

5.1 Subsurface Investigation

5.1.1 General

Our test borings generally encountered natural silty clay and sandy clays underlain by weathered claystone bedrock. These conditions extended to the approximate 9 to 45-foot termination depths in the borings. Claystone bedrock was encountered in our borings at depths of about 18 to 35 feet below the ground surface.

Groundwater was encountered at depths ranging between 15 and 17 feet at the time of drilling in the building borings B-1 through B-5. Groundwater was not encountered in P-1 at the time of drilling. Groundwater was measured on July 22, 2011 at depths between 11 and 13 feet in borings B-1 through B-5.

Subsurface material samples recovered during the investigation program for the subject project were visually classified in the laboratory by the Project Geologist. Selected samples were subjected to a testing program, which

included the following tests: Moisture Content and Dry Density, Atterberg Limits, Swell/Consolidation, Gradation, Percent Fines, and Water Soluble Sulfate.

We have prepared individual Exploratory Boring Logs describing the subsurface materials and conditions encountered. The Legend and Notes necessary to interpret our Exploratory Boring Logs are presented directly following the Exploratory Boring Logs in Appendix A. A summary of the laboratory test results is summarized in Appendix B.

Each of the subsurface materials we encountered and groundwater conditions are described in the following subsections.

5.1.2 Silty Clay Fills

Silty clay fills were encountered in the borings from the ground surface to depths between 8 to 11 feet below the ground surface. The clay was yellowish brown to dark brown in color, and slightly moist to moist. According to ASTM D2487, this material generally classifies as CH or CL.

Samples of the clay exhibited 0.2 percent swell when inundated with water under an initial surcharge loading of 300 psf. One sample of the clay exhibited 0.8 percent swell when inundated with water under an initial surcharge loading of 500 psf. Samples of the clay fills encountered indicated percent passing the No. 200 sieve (Percent Fines) of approximately 30 to 60

percent. Atterberg Limit tests of clay samples indicated Liquid Limits of 42 to 47 and Plasticity Indices of 24 to 28. Borings B-3 and B-4 encountered layers of squeegee inter bedded in the silty clay fills to varying depths up to 12 feet.

5.1.3 Natural Clay

Natural silty clays were encountered beneath the silty clay fills to depths between 18 to 37 feet below the ground surface. The clay was yellowish brown to dark brown in color, occasionally grey, and slightly moist to moist. According to ASTM D2487, this material generally classifies as CH or CL. A blue grey layer of sandy clay typically caps the groundwater and has a distinct petroliferous odor.

Samples of the clays encountered indicated percent passing the No. 200 sieve (Percent Fines) between 49 to 61 percent. Atterberg Limit tests of the natural clay samples indicated Liquid Limits of 34 to 41 and Plasticity Indices of 17 to 22.

5.1.3 Weathered Bedrock

Weathered claystone bedrock was encountered beneath the natural silty clays in all borings except B-3 and P-1 at depths of approximately 18 to 37 feet. The bedrock extended to the termination depths of the borings. The weathered bedrock was hard, moist, and dark brown to brown..

Samples of the claystone bedrock encountered indicated percent passing the No. 200 sieve (Percent Fines) of approximately 49 to 82 percent. Atterberg Limit tests of claystone bedrock samples indicated Liquid Limits of 47 to 56 and Plasticity Indices of 28 to 34. According to ASTM D2487, this material generally classifies as CH.

5.1.4 Groundwater

Groundwater was encountered at depths ranging between 15 and 17 feet at the time of drilling in the building borings B-1 through B-5. Groundwater was not encountered in P-1 at the time of drilling. Groundwater was measured on July 22, 2011 at depths between 11 and 13 feet in borings B-1 through B-5.

Some variations in the groundwater level may be experienced in the future. The magnitude of the variation will largely depend upon the duration and intensity of precipitation, temperature, and the surface and subsurface drainage characteristics of the surrounding area.

6.0 FOUNDATION RECOMMENDATIONS

6.1 Discussion

The site is relatively flat and we do not anticipate significant site grading will be performed. The surrounding area is commercial and residential development. We anticipate a two story building with no basement will be constructed on this lot with light to moderate foundation loads.

Laboratory testing of the silty clays encountered in the borings exhibited a low potential for swell, but with great variabily in fill characteristics and quality across the area. Weathered bedrock was encountered in our borings at depths of 18 to 37 feet below the ground surface. Groundwater was measured at depths of 11 to 13 feet below the ground surface across the site.

Based upon the information obtained during our field investigation, laboratory testing, and our analyses, the soils at the site are considered suitable to support the proposed building using either a screw pile (helical) foundation system or a straight shaft drilled pier foundation system. The option of a shallow foundation system was evaluated but was eliminated due to several factors. Including the existence of vastly variable fill depths, types and general fill conditions, as well as the identification of a squeegee fill of depths of at least 12 feet in the center of the building footprint, most likely an underground tank removal. These existing conditions and the likely possibility of additional undetected conditions all resulted in the removal of shallow foundations as a viable option at this site. With the presence of potentially contaminated soils and deep squeegee fills which can be extremely difficult to install drilled piers in a screw pile foundation system maybe preferred at the site.

6.2 Straight-Shaft Drilled Pier Foundation

The proposed building could be founded on straight-shaft drilled pier foundations.

Straight-shaft piers should be drilled into weathered bedrock and designed as follows:

1) Piers should have a minimum length of at least 30 feet. Piers should penetrate a minimum of 10 feet into relatively unweathered bedrock.

2) Piers should be designed for a minimum dead load of 20,000 psf based on the pier cross-sectional area to concentrate the dead load on the piers. If the dead load pressure cannot be achieved, we recommend increasing the minimum pier lengths and bedrock penetration values to compensate for the minimum dead load deficiency.

3) Piers should be designed for an allowable end bearing pressure of 25,000 psf with a skin friction of 2,500 psf for the portion of the pier in the relatively unweathered bedrock.

4) Based on the results of our subsurface explorations and review of available literature (2006 International Building Code, Table No. 1613.5.2), in our opinion, a site classification "C" may be used for this project.

5) A modulus of subgrade reaction of 500 lbs/in can be used in the silty clays and a modulus of subgrade reaction of 2000 lbs./in. can be used for the portion of the pier in bedrock.

6) Skin friction should be neglected for the upper 10 feet of the piers in fill or overburden soils. If bedrock is encountered during foundation excavation, skin friction should be neglected for that portion of the piers in the upper three feet of the bedrock below the foundation walls or grade beams.

7) Where there will be tension loads or uplift on the piers, the tension loads should be resisted by skin friction of the bedrock. The skin friction values provided in item 3 above can be used to calculate uplift capacity.

8) Piers should be adequately reinforced their full length. Reinforcement should extend well into grade beams and walls. A minimum steel to pier ratio of 0.005 based on cross sectional area of pier is recommended. More reinforcement may be required from structural considerations.

9) The minimum pier diameter will depend on the length to diameter ratio (L/D). We recommend the L/D not exceed 30. A minimum diameter of 18 inches is recommended due to groundwater.

10) A minimum 4-inch continuous void space should be provided beneath foundation walls to concentrate the dead loads of the structure on the piers.

11) Four shear rings should be installed at the lower portion of all piers. We recommend provision of shear rings, which extend about 3 inches beyond the pier shaft to increase the load transfer through skin friction. These shear rings should be placed about 2 feet on center for the lower 8 feet of the pier in bedrock.

12) Pier excavations should be cleaned of loose material prior to concrete placement. Once the proper depth is achieved, the auger should be placed in the bottom of the hole and several high-speed revolutions should be made to clean the bottom. Loose cuttings should not remain in the bottom of the excavations prior to concrete placement.

13) Concrete should be onsite and ready during drilling of piers. Concrete should be placed immediately after pier observations and measurements are made, and reinforcement is set within the hole. Groundwater was encountered during our investigation and may be encountered during pier installation. Pier holes should not remain "open" overnight.

14) Concrete to be placed in the piers should have a slump of four to six inches. If more than three inches of water are present in the bottom of the pier excavation, de-watering will be required prior to concrete placement using a pump or tremie.

15) If casing the pier holes is required, we recommend the contractor use a casing with an inside diameter (I.D.) of the correct pier dimension, to meet the diameter as determined by the structural engineer and according to the set of plans and specifications. **The need for casing should be anticipated.**

16) We recommend piers be placed a minimum center-to-center spacing of at least three pier diameters. Piers spaced closer than recommended will be subject to group action with lower individual end bearing and side shear values. For the final design, the exact geometry of the pier group would need to be considered.

17) Some movement of drilled pier foundations should be anticipated to mobilize skin friction. We estimate movement will be on the order of 1/8 to 1/4 inch. Differential movement between adjacent piers may equal to total movement.

18) Installation of drilled piers should be observed by a member of Acura Engineering to identify and confirm the subsurface conditions are consistent with those encountered in our borings.

6.3 Screw Pile Foundation

With both the potentially contaminated soils at the site combined with the difficult caisson installation conditions a "Screw Pile" foundation system may be optimal for this site. If a screw pile foundation system is chosen we can provide contact information for a specialist in the area who can design the screw piles using structure loads provided by the structural engineer and data presented in this report. It is our recommendation that the given the extreme difference in the depth to bedrock at the site that a minimum of two load tests be performed at the site, one in the northern portion of the building and one in the southern portion.

7.0 FLOOR SLAB RECOMMENDATIONS

7.1 Slab Performance Risk

"Slab Performance Risk" has been defined as follows by a publication entitled "Guideline for Slab Performance Risk Evaluation and Residential Basement Floor System Recommendations (Denver Metropolitan Area)" dated December 1996 by the Colorado Association of Geotechnical Engineers. This criteria is also helpful for evaluating slab performance for non-residential buildings.

Slab Performance Risk Category	Swell Index (%) (500 psf Surcharge)	Swell Index (%) (1,000 psf Surcharge)
Low	0 to <3	0 to <2
Moderate	3 to <5	2 to <4
High	5 to <8	4 to <6
Very High	≥8	≥6

Based on the laboratory test results and the classifications shown in the above table, the Slab Performance Risk associated with the on-site silty clays and clayey sands is "Low".

Though the Slab Performance Risk associated with the clays tested is considered Low, the owner should realize that if slabs-on-grade are constructed, he is accepting a certain risk of slab movement if the soils experience an increase in moisture content.

It is possible potential heaves in unconditioned soils may result in the moderate range or greater which could influence the floor slab. Due to the inconsistent nature of the fills and depths of fills we recommend the use of a structural floor system with a minimum of a 12 inch void space.

7.2 Structural Slab

The owner should consider construction of floors as structural slabs. This method of construction has the least risk for slab construction where expansive and varying materials are present because the floor slabs are structurally supported and isolated from the underlying materials. The floor is supported on grade beams and piers, the same as the main structure. A minimum 12-inch "void" or crawl space should be maintained beneath the floor system to prevent heaving of slabs and damage to interior partitions.

The subgrade beneath a structural floor system should be graded so that water will not pond on it, or should be provided with a drainage system. We recommend use

of perimeter and underslab drains in conjunction with a sump pump to eliminate the potential for groundwater to collect and potentially affect foundation elements.

7.3 Slabs-On-Grade

If the owner understands and accepts the risks of potential movement with construction of a slab-on-grade, we have provided construction recommendations below. We believe the potential for movement is Low to Moderate and slabs should not be supported directly on the unconditioned sandy clays, or weathered claystone bedrock due to the swell potential and existence of abundant uncontrolled fill areas. This risk of movement could be reduced by over-excavation and replacement of 3 feet of the onsite soils with moisture conditioned, imported structural cap as discussed below.

7.3.1 Slab Construction

If the owner understands and accepts the risks of potential movement with construction of a slab-on-grade floor, we have provided construction recommendations below. We believe the potential for movement is Moderate to High and slabs should not be supported directly on the clays, sands and weathered claystone bedrock. This risk of movement could be reduced by over-excavation and replacement of 3 feet of the onsite soils with structural fill.

The actual slab movements that will occur on a particular project site are very difficult, if not impossible, to predict accurately because these movements depend on loads, evapo-transpiration cycles, surface and subsurface drainage, consolidation characteristics, swell index, swell pressures and soil suction values. The actual time of year during which the slab-on-grade is constructed has been found to have a large influence on future slab-on-grade movements.

Slab heaves or settlements are normally defined in terms of "total" and "differential" movement. "Total" movement refers to the maximum amount of heave or settlement that the slab may experience as a whole. "Differential" movement refers to unequal heave or settlement that different points of the same slab may experience, sometimes over relatively short horizontal distances. Differential movements are arbitrarily determined to be one-half of the total movement in soils exhibiting Moderate Slab Performance Risk. Greater differential movements can occur in areas where expansive soils have been encountered and where the natural soils abruptly transition to fill material.

Our analysis indicates interior floor slabs constructed as slabs-on-grade supported on existing sands and clays could result in "total" movement of approximately 2 to 4-inches with "differential" movement on the order of the total movement.

Over-excavation and replacement of 3 feet of the natural soils below proposed structural elements with imported structural fill on geo-grid could reduce the potential for movement. Structural fill beneath the new floor slab, if desired, should be selected, moisture conditioned, and compacted as recommended in this report. Onsite materials should be moisture conditioned and compacted as described in Section 8 of the report.

7.3.2 Construction Recommendations

1) We recommend that the measures outlined in the following paragraphs be followed to reduce potential damage to floor slabs, should wetting of the subsurface soils occur: Design and construct the floor slab to move independently of bearing members (floating slab construction). Provide slip joints around exterior walls and interior columns to allow free vertical movement of the slabs.

2) Frequent control joints should be provided at spacings (typically at about 10 feet) in the floor slab to reduce problems with shrinkage and cracking according to ACI specifications. Floor slabs should be adequately reinforced.

3) Slabs can be placed directly on imported structural fill. The need for a vapor barrier will depend on the sensitivity of floor coverings to moisture, but may be desired to reduce odor emission through the concrete over time.

4) Provided gravel is desired below the slab, a layer of 4 to 6 inches should be used. The gravel layer below the floor slab can be included in the over-excavation depth.

5) Over-excavation and replacement of 3 feet of onsite soils with moisture conditioned, compacted structural fill with a layer of geogrid at the base of the fill may reduce the potential for movement of the slab-on-grade. Structural fill requirements are included in section 8 of this report. Moisture conditioning of imported materials should be performed in accordance with Section 8.0 of our soils report.

6) Plumbing passing through slabs should be isolated from the slabs and provided with flexible connections to allow for

movement. Under-slab plumbing should be avoided if possible and should be brought above the slab as soon as possible.

7) If slab-bearing partitions are used, they should be designed and constructed to allow for movement. A minimum of 2 inches of void space should be maintained below or above partitions. If the void is provided at the top of partitions, the connections between the interior, slab-supported partitions and exterior foundation supported walls should allow for differential movement.

8) Where mechanical equipment and HVAC equipment are supported on slabs, we recommend provision of a flexible connection between the furnace and ductwork with a minimum of 3 inches of vertical movement.

9) Structural fill should consist of an inherently non-expansive, sand or gravel material with a maximum particle size of 3 inches or less. Structural fill and compaction requirements for this material are defined in Section 8.0 of the report.

10) A sub fill drainage layer consisting of 6" of ¾" crushed gravel with perforated rigid PVC piping providing drainage away from the center of the excavation. PVC piping should be burrito wrapped with filter fabric to prevent fines from clogging the drain system. It is our recommendation that perimeter cleanouts be included to assist in future cleaning of the system. Under drains should connect to a the storm water system. This system is in place to intercept potential saturation "the bathtub effect" of the structural fill it is not anticipated that groundwater levels will rise to this level, however it may be advisable to consult with your environmental representative regarding the potential for discharging contaminated water into the public system and monitoring options.

8.0 EARTHWORK RECOMMENDATIONS

8.1 General

Fill material shall be placed in uniform horizontal layers (lifts) not exceeding 8 inches before compacting to the required density and before successive layers are placed. If the contractor's equipment is not capable of properly moisture conditioning and compacting 8-inch lifts, then the lift thickness shall be reduced until satisfactory results are achieved.

Weathered claystone bedrock should not be re-used in the building footprint and should be wasted in landscaping areas if possible. It is not anticipated that claysone bedrock will be present in any of the excavations during construction, especially if the screw pile foundation system is selected. **We recommend that Acura observe the fill operations and test the fill material during placement in order to help reduce future potential problems.**

Fill material should not be placed on frozen ground. Vegetation, roots, topsoil, the existing fill materials, and other deleterious material to depth of approximately 1 foot below any excavation should be removed before new fill material is placed.

8.2 On-Site Soils

On-site natural sands and clays and can be used as fill provided the material does not contain cobbles or construction debris larger than 3 inches in diameter. Fill to be placed should be moisture treated to within 2 percent of optimum moisture content (OMC) for sand fill and from OMC to 3 percent above OMC for clay and weathered

bedrock as use as fill materials. We recommend fill to be placed below floor slabs and in parking lots and drive lanes be compacted to 95% of Standard Proctor (ASTM D 698) dry density or greater for clay materials. Sandy materials placed in these areas should be compacted to 95% of Modified proctor (ASTM D 1557) dry density or greater. Compaction in landscape areas should be 85% or greater.

8.3 Structural Fill

Structural fill should consist of sand or gravel material with a maximum particle size of 3 inches or less. In addition, this material shall have a liquid limit less than 30 and a plasticity index of 15 or less. Structural fill should also have a percent fine between 15 to 30 percent passing the No. 200 sieve. Structural fill should be moisture conditioned to within 2 percent of OMC and compacted to at least 95 percent of Standard Proctor (ASTM D698) dry density.

We did not encounter material of this nature onsite. If you anticipate use of structural fill for construction, it will likely need to be imported.

9.0 EXCAVATION CONSIDERATIONS

9.1 Excavatability

In our opinion, the materials encountered at this site may be excavated with conventional mechanical excavating equipment. Our borings did not encounter "buried" foundation elements or other structures or debris, however our borings did encounter a likely tank infill area with a non-cohesive "squeegee" type material, these materials when encountered during excavation activities should be removed

and replaced per the fill recommendations included in this section with material similar to or better than that currently found on site.

9.2 Re-Use of On-Site Soils

Excavated sands and clays may be re-used onsite as general fill materials. Weathered Claystone Bedrock should not be used in structural areas of this site, however it is suitable for use in landscaping areas. Debris materials such as brick, wood, concrete, and abandoned utility lines, if encountered, should be removed from structural areas when encountered in excavations and either wasted from the site or placed in landscaped areas.

9.3 Excavation Side Slopes

Temporary excavations should comply with OSHA and other applicable safety recommendations. In our opinion, OSHA defined Type B and C soils will be encountered in the soils at this site. As a result, OSHA recommends maximum allowable unbraced temporary excavation slopes of 1:1(H:V) for Type B and 1.5:1(H:V) for Type C should be anticipated for excavations less than 20 feet deep.

We recommend a minimum of 10 feet of clearance between the top of excavation slopes and soil stockpiles or heavy equipment. If braced excavations are to be used, they should be reviewed and designed by a structural engineer familiar with the design of bracing systems.

9.4 Construction Dewatering

In our opinion, excavations at this site will not require dewatering efforts due to groundwater. Groundwater was encountered at depths of approximately 15 to 17 feet below the ground surface in our borings and should not influence excavations at this site. However, temporary use of pumps may be necessary during construction to alleviate water collecting within the trenches. The contractor will need to evaluate the need and pumping requirements necessary. Foundations will likely be affected by groundwater if a drilled caisson foundation is selected, groundwater will not affect the installation of screw piles. Refer to section 6 for recommendations.

10.0 CONCRETE

Concrete in contact with soils can be subject to attack by sulfates. Two water soluble sulfate tests were performed to determine whether the sandy lean clays are corrosive to concrete. Test results indicate a soluble sulfate concentration of 0.02 percent. According to the American Concrete Institute, the soluble sulfate exposure in the sandy clays is negligible. For this level of sulfate exposure, Type I or Type II cement is suitable for use.

11.0 SURFACE AND SUBSURFACE DRAINAGE RECOMMENDATIONS

11.1 Surface Drainage

Proper surface drainage should be maintained at this site during and after completion of construction operations.

We recommend the following surface drainage provisions for the subject project:

A) The ground surface adjacent to buildings should be sloped to promote rapid run-off of surface water. We recommend a minimum slope of six inches in the first five horizontal feet for landscaped or graveled areas. These slopes should be maintained during the service life of buildings.

B) Landscaping should be limited around building areas to either xeri-scaping, landscaping gravel, or plants with low moisture requirements. Irrigation should be minimal and limited to maintain plants.

C) roof drains should discharge directly to the storm water system.

D) Ponding of water should not be allowed immediately adjacent to buildings.

Some variations in the groundwater level may be experienced in the future. The magnitude of the variation will largely depend upon the duration and intensity of precipitation, temperature and the surface and subsurface drainage characteristics of the surrounding area.

11.2 Subsurface Drainage

We anticipate site development will consist of a two story building with no basement construction. Groundwater was encountered in our borings during our investigation and will not likely develop at a level, which will influence foundations and potentially floor slabs. We recommend that you include a sub-base drainage system below the structural fill tied to a suitable outlet.

The sub-base drainage system should consist typically of 4-inch minimum diameter perforated PVC "rigid" pipe in continuous 6" deep layer of free draining gravel. The free draining gravel layer should be continuous across the base of the over-excavation, and should grade towards away from the center of the building, The pipe

should be wrapped in a geosynthetic fabric to prevent fine soils from clogging the system in the future. The pipe should drain by gravity to a suitable all-weather outlet or to a properly designed sump system. The free draining gravel layer should be separated from the structural fill layer by a geogrid capable of filtering the structural fill from the free draining gravel, or a grogrid/grofabriccombination.

12.0 LATERAL EARTH PRESSURES

We understand no basement construction is anticipated. Foundation walls that retain earth are dependent upon the height of the wall, backfill configuration and backfill type. We assume that these walls will be designed to be rigid (unyielding), and not free to rotate. The on-site sandy clays are considered to be suitable for use as wall backfill provided they are properly moisture conditioned and placed in accordance with section 8 of this report. We recommend the walls be designed to resist an equivalent fluid density of 60 pcf. This pressure does not include allowances for surcharge loads such as adjacent foundations, sloping backfill, vehicle traffic, or excessive hydrostatic pressure.

For design of site retaining walls we recommend a passive pressure of 250 psf per foot of wall height. A coefficient of friction of 0.3 can be used for contact between the soil surface and concrete.

Development of groundwater is not likely. As a precautionary measure, we recommend that a drainage collection system (drains or geosynthetic drains) be included in this design in order that hydrostatic pressures be reduced or eliminated.

13.0 PAVEMENT RECOMMENDATIONS

This is a preliminary pavement design only. A final pavement design will be required after final grading of the site is completed. These preliminary recommendations are based off existing soil conditions at existing elevations while considering potential improvements to the subgrades during scarification and recompaction.

13.1 MGPEC Pavement Design Standards and Construction Specifications

The test holes were laid out by the Acura Engineering in general accordance with MGPEC requirements within the alignments of parking lot areas. Laboratory testing was performed on individual sample.

The existing material, sandy clays encountered at this site generally classify as A-7-6 soils according to AASHTO. The existing sandy clays exhibited low swells up to 0.8% when inundated with water under a surcharge pressure of 300 psf.

According to Table 5.2.1 in Chapter 5 of the MGPEC Pavement Design Standards and Construction Specifications Manual 2001/2003 version, onsite soils samples of the pavement subgrade will require scarification and moisture of to a depth of one foot.

13.2 Preliminary Pavement Design Recommendations

Based on anticipated traffic loadings based on the size of the building and anticipated parking lot use a preliminary pavement evaluation indicated that pavement depths in the following table maybe anticipated.

Roadway	Full Depth Asphalt HMAP (inches)	Portland Cement Concrete (inches)
Drive Lanes	7	6.5
Surface Parking	5.5	5.5

Please note that these are preliminary depths and may be subject to modification as site conditions change.

14.0 PAVEMENT SUBGRADE RECOMMENDATIONS

At the time of our investigation, our borings were located within the proposed surface parking alignment. The subgrade soils encountered within our borings consisted of sandy clays to the depth drilled.

Prior to final pavement design the pavement subgrade soils should be over excavated, moisture treated and compacted to a depth of 1 foot below the pavement section. Compaction and moisture conditioning should meet the guidelines below.

Moisture and compaction specifications as defined in Section 3.4.2 Construction Methods from the MCPEC Design Standards & Construction Specifications Manual, indicate the subgrade materials below all pavement sections be moisture conditioned to within optimum to 2 percent above optimum for AASHTO defined A-6 and A-7 soils and compacted to at least 95% of AASHTO T99. All other AASHTO defined soil types should be moisture conditioned to within 2 percent of optimum and compacted to at least 95% of AASHTO T180. These specifications are defined in Section 3.4.2 Construction Methods from the MCPEC Design Standards & Construction Specifications Manual.

If needed, additional fill material shall be placed in uniform horizontal layers (lifts) not exceeding 8 inches before compacting to the required density and before successive layers are placed. If the contractor's equipment is not capable of properly moisture conditioning and compacting 8-inch lifts, then the lift thickness shall be reduced until satisfactory results are achieved. Fill material should not be placed on frozen ground. All other MGPEC specifications should be followed.

We recommend that Acura Engineering observe fill operations and test the fill material during placement in order to help reduce future potential problems.

15.0 LIMITATIONS OF STUDY

Our report entitled "Geotechnical Investigation and Preliminary Pavement Design Report, West Denver Branch Library" has been prepared exclusively for Concrete Express, Inc., its engineers, and contractors for the purpose of design and construction of the proposed Parking facilities and associated bus lanes. No other engineer, consultant, or contractor shall be entitled to rely on information, conclusions or recommendations presented in this document without the prior written approval of Acura Engineering Colorado, LLC.

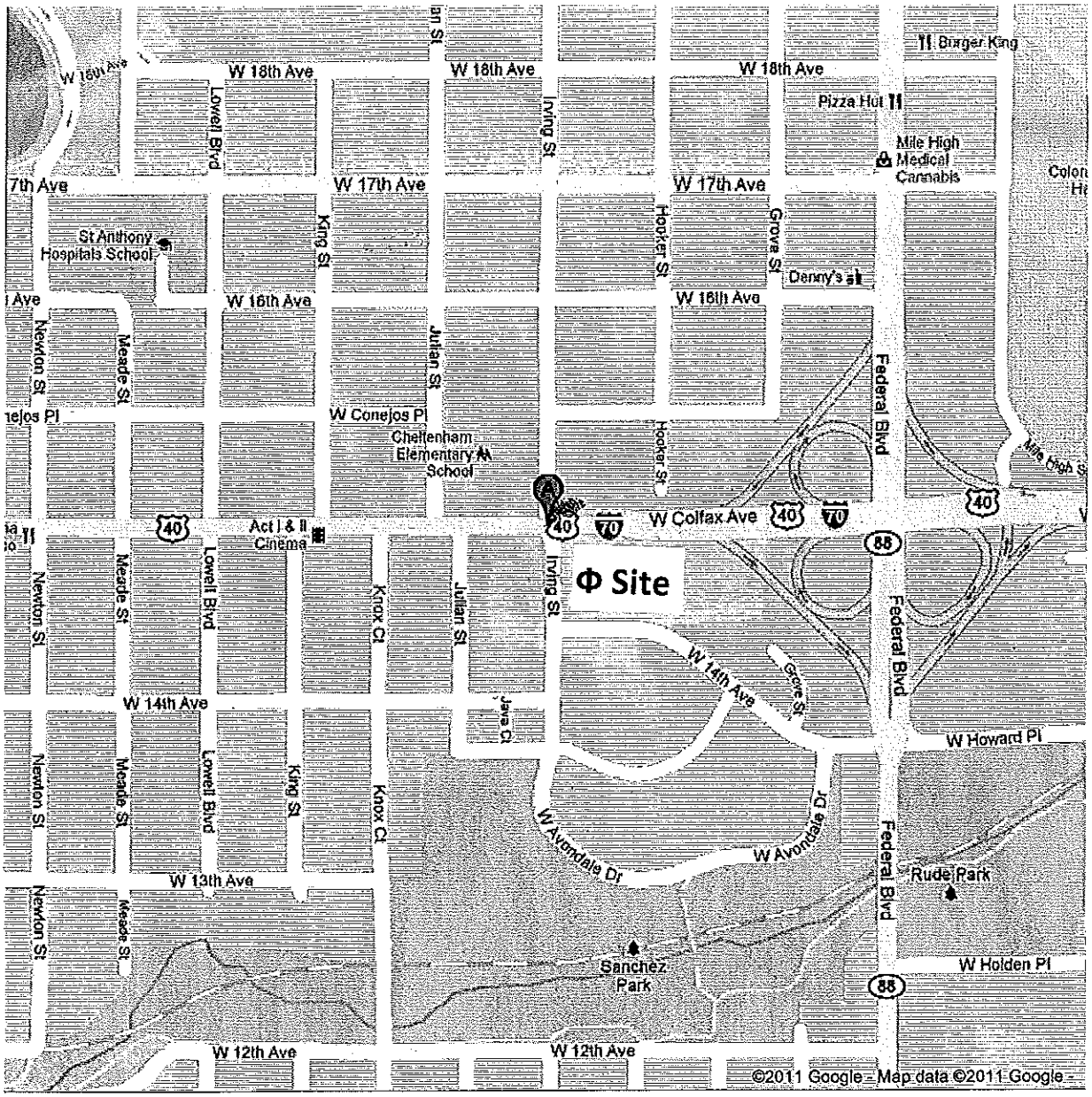
In subsurface investigations, it is necessary to assume that subsurface conditions do not change greatly from those indicated by our exploratory borings. This report does not reflect variations, which may occur between our exploratory borings.

Our Scope of Services for this project did not include research, testing, or assessment relative to past or present contamination of the site by source. If such contamination were present, it is very likely that the exploration and testing conducted for this report would not reveal its existence. If the Owner is concerned about the potential for such contamination, additional studies should be undertaken. We are available to discuss the scope of such studies with you.

In this report, we have presented judgments based partly on our understanding of the proposed construction and partly on the data we have obtained. This report meets professional standards expected for reports of this type in this area. Our company is not responsible for the conclusions, opinions or recommendations made by others based on the data we have presented.

Appendix A

Exploratory Boring Logs and Legend and Notes



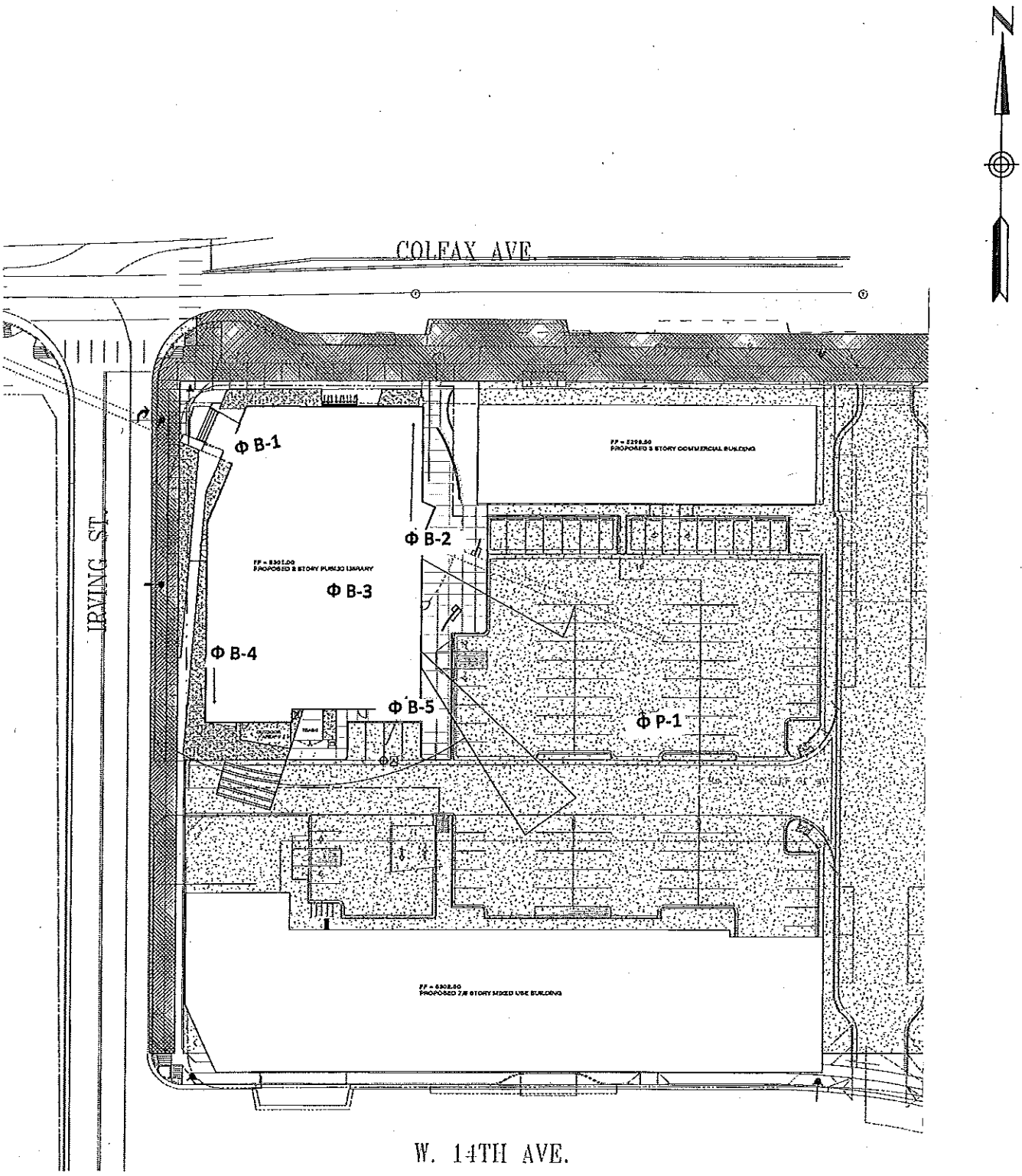
SITE LOCATION MAP

West Denver Branch Library
SE Corner Irving St. & West Cofax Ave.
Denver, Colorado

ACURA ENGINEERING

SHERIDAN, COLORADO 80110

DRAWN BY: EWP	SCALE: NTS	
CHECKED BY: DG		
DATE: 8/6/11	ACURA PROJECT NO. C11-0021G	FIG. NO. 1



BORING LOCATION PLAN

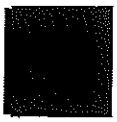
West Denver Branch library
SE Corner Irving St. & West Colfax Ave.
Denver, Colorado

ACURA ENGINEERING

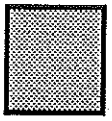
SHERIDAN, COLORADO 80110

DRAWN BY: EWP	Scale: NTS	
CHECKED BY: DG		
DATE: 08/6/11	ACURA PROJECT NO. C11-0021G	FIG. NO. 2

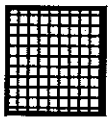
LEGEND (FOR ACURA BORINGS)



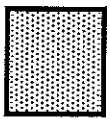
Asphalt pavement



Silty Clay fill, soft, moist, poorly consolidated



Squeegee fill-well rounded poorly sorted gravel, non-cohesive



Natural silty clay fill, firm, slightly moist to moist

Claystone, silty, moist, very firm to hard, various colors

GROUNDWATER: Measured at the time indicated on the logs

NOTES (FOR ACURA LOGS)

1) The test borings were drilled at night on July 20, 2011 with a drill rig equipped with a four (4)-inch outside diameter, continuous flight augers.

2) Blow counts of 5/7 indicates that 12 total blows (or the number of blows indicated) of a 140 pound hammer falling 30 inches were required to drive the sampler 12 inches (5 for the first 6 inches and 7 for the second 6 inches)

3) Blow counts of 50 for 11' indicate that 50 blow of a 140 pound hammer falling 30 inches were required to drive the sampler 11" (or the distance indicated).

4) The boring logs show subsurface conditions at the date and approximate locations indicated and it is not warranteed that they are representative of subsurface conditions at other locations and times. The stratification lines represent the approximate boundaries between the soil types; in-situ the transition between materials may be gradual.

LEGEND AND NOTES

West Denver Branch Library
SE Corner Irving St. & West Colfax Ave.
Denver, Colorado

ACURA ENGINEERING

SHERIDAN, COLORADO 80110

DRAWN BY: EWP
CHECKED BY: DG
DATE: 08/6/11

KEY

ACURA PROJECT NO. C11-0021G

FIG. NO. 3

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EXPLORATORY BORING LOG

Boring No. B-1
Sheet 1 of 1

Logged by	Eric Pickerill	**Project No.**	C11-0021G
Driller	O'Dell Drilling	**Project Name**	West Denver Library Branch
Auger/Core Type	4" continuous flight auger	**Location**	SE Corner of W. Colfax Ave. & Irving Street
Special Requirements		**Date Started**	07/20/11 — **Date Completed** 07/20/11
Boring Elevation (ft.)		**Depth to WEATHERED BEDROCK (ft.)**	27'
Total Boring Depth (ft.)	35'	**Depth to GROUND WATER (ft.)**	15' @ completion of drilling
Weather	V. Hot, Sunny, Clear, Calm	**Depth to GROUND WATER (ft.)**	11' at 2 days after

Depth (ft.)	Blow Count N per 6" (or as indicated)	Sample Type (1)	Percent Recovery	LAB TEST RESULTS: % Moisture	Dry Density (pcf)	% Passing #200 Sieve	Liquid Limit (%)	Plasticity Index (%)	Swell Index (%) / psf	SOIL CLASSIFICATION: USCS	Symbol	DESCRIPTION
0	Asphalt											Asphalt 4" Thick
	3/4	CA	90	21.1	103.8							Brown Silty Clay fill, moist soft
	1/2	CA	80									
5												
	5/9	CA	80	25.0	100.1	81.9	56	34		CH		
10												
15												
	3/6	CA										
20												
25												
30	50 for 12"	CA				48.5	47	28		SC		
35	50 for 8"	CA										
												Bottom of Boring

(1) SS = Split Spoon CA = California Spoon ST = Shelby Tube BS = Bag Sample RS=Ring Sampler

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EXPLORATORY BORING LOG

Boring No. B-2
Sheet 1 of 1

Logged by	Eric Pickerill	**Project No.**	C11-0021G
Driller	O'Dell Drilling	**Project Name**	West Denver Library Branch
Auger/Core Type	4" continuous flight auger	**Location**	SE Corner of W. Colfax Ave. & Irving Street
Special Requirements		**Date Started**	07/20/11 — **Date Completed** 07/20/11
Boring Elevation (ft.)		**Depth to WEATHERED BEDROCK (ft.)**	18'
Total Boring Depth (ft.)	30'	**Depth to GROUND WATER (ft.)**	16' @ completion of drilling
Weather	V. Hot, Sunny, Clear, Calm	**Depth to GROUND WATER (ft.)**	12' at 2 days after

Depth (ft.)	Blow Count N per 6" (or as indicated)	Sample Type (1)	Percent Recovery	LAB TEST RESULTS: % Moisture	Dry Density (pcf)	% Passing #200 Sieve	Liquid Limit (%)	Plasticity Index (%)	Swell Index (%) / psf	SOIL CLASSIFICATION: USCS	Symbol	DESCRIPTION
0	Asphalt											Concrete 4.5" Thick
	3/4	CA	90									
	5/9	CA	80	19.1	107.9	60.3	47	28		CL		
5												
	5/8	CA	80									
10												
	3/5	CA	90	24.1	103	59.1	38	21				
15												
	50 for 11"	CA										
20												
	18/24	CA										
25												
30	50 for 12"	CA										
												Bottom of Boring
35												

REMARKS / ADDITIONAL NOTES:

(1) SS = Split Spoon CA = California Spoon ST = Shelby Tube BS = Bag Sample RS=Ring Sampler

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ACURA ENGINEERING

EXPLORATORY BORING LOG

Boring No. B-3
Sheet 1 of 1

Logged by	Eric Pickerill	**Project No.**	C11-0021G
Driller	O'Dell Drilling	**Project Name**	West Denver Library Branch
Auger/Core Type	4" continuous flight auger	**Location**	SE Corner of W. Colfax Ave. & Irving Street
Special Requirements		**Date Started**	07/20/11 — **Date Completed** 07/20/11
Boring Elevation (ft.)		**Depth to WEATHERED BEDROCK (ft.)**	NA
Total Boring Depth (ft.)	20'	**Depth to GROUND WATER (ft.)**	16' @ completion of drilling
Weather	V. Hot, Sunny, Clear, Calm	**Depth to GROUND WATER (ft.)**	12' at 2 days after

Depth (ft.)	Blow Count N per 6" (or as indicated)	Sample Type (1)	Percent Recovery	LAB TEST RESULTS: % Moisture	Dry Density (pcf)	% Passing #200 Sieve	Liquid Limit (%)	Plasticity Index (%)	Swell Index (%) / psf	SOIL CLASSIFICATION: USCS	Symbol	DESCRIPTION
0	Asphalt											Concrete 4" Thick
	4/7	CA	90			29.3						
		CA	80									
5												
	4/2/2	SS	80									
10												
	4/7	CA	80	25.6	96							
15												
	4/9	CA										
20												Bottom of Boring
25												REMARKS / ADDITIONAL NOTES:
30												
35												

(1) SS = Split Spoon CA = California Spoon ST = Shelby Tube BS = Bag Sample RS=Ring Sampler

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ACURA ENGINEERING

EXPLORATORY BORING LOG

Boring No. B-4
Sheet 1 of 2

Logged by	Eric Pickerill	**Project No.**	C11-0021G
Driller	O'Dell Drilling	**Project Name**	West Denver Library Branch
Auger/Core Type	4" continuous flight auger	**Location**	SE Corner of W. Colfax Ave. & Irving Street
Special Requirements		**Date Started**	07/20/11 — **Date Completed** 07/20/11
Boring Elevation (ft.)		**Depth to WEATHERED BEDROCK (ft.)**	35'
Total Boring Depth (ft.)	40'	**Depth to GROUND WATER (ft.)**	17' @ completion of drilling
Weather	V. Hot, Sunny, Clear, Calm	**Depth to GROUND WATER (ft.)**	13' at 2 days after

Depth (ft.)	Blow Count N per 6" (or as indicated)	Sample Type (1)	Percent Recovery	LAB TEST RESULTS: % Moisture	Dry Density (pcf)	% Passing #200 Sieve	Liquid Limit (%)	Plasticity Index (%)	Swell Index (%) / psf	SOIL CLASSIFICATION: USCS	Symbol	DESCRIPTION
0	Asphalt											Asphalt 4" Thick
	2/2	CA	90									
	4/7	CA	80	11.8	123.9	29.9	42	24		SC		
5												
	2/4	CA	40									
10												
	3/5	CA	80									
15												
	4/5	CA		23.2	104	61.9	41	22		CL		
20												
25	5/6	CA										
30		CA										
35	6/16	CA										
												Bottom of Boring

(1) SS = Split Spoon CA = California Spoon ST = Shelby Tube BS = Bag Sample RS=Ring Sampler

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EXPLORATORY BORING LOG

Boring No. B-4
Sheet 2 of 2

Logged by	Eric Pickerill	**Project No.**	C11-0021G
Driller	O'Dell Drilling	**Project Name**	West Denver Library Branch
Auger/Core Type	4" continuous flight auger	**Location**	SE Corner of W. Colfax Ave. & Irving Street
Special Requirements		**Date Started**	07/20/11 — **Date Completed** 07/20/11
Boring Elevation (ft.)		**Depth to WEATHERED BEDROCK (ft.)**	35'
Total Boring Depth (ft.)	40'	**Depth to GROUND WATER (ft.)**	17' @ completion of drilling
Weather	V. Hot, Sunny, Clear, Calm	**Depth to GROUND WATER (ft.)**	13' at 2 days after

Depth (ft.)	Blow Count N per 6" (or as indicated)	Sample Type (1)	Percent Recovery	LAB TEST RESULTS: % Moisture	Dry Density (pcf)	% Passing #200 Sieve	Liquid Limit (%)	Plasticity Index (%)	Swell Index (%) / psf	SOIL CLASSIFICATION: USCS	Symbol	DESCRIPTION
35	6/16	CA										
40	50 for 11"	CA										Bottom of Boring
45												REMARKS / ADDITIONAL NOTES:
50												
55												
60												

(1) SS = Split Spoon CA = California Spoon ST = Shelby Tube BS = Bag Sample RS=Ring Sampler

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EXPLORATORY BORING LOG

Boring No. B-5
Sheet 1 of 2

Logged by	Eric Pickerill	**Project No.**	C11-0021G
Driller	O'Dell Drilling	**Project Name**	West Denver Library Branch
Auger/Core Type	4" continuous flight auger	**Location**	SE Corner of W. Colfax Ave. & Irving Street
Special Requirements		**Date Started**	07/20/11 — **Date Completed** 07/20/11
Boring Elevation (ft.)		**Depth to WEATHERED BEDROCK (ft.)**	37'
Total Boring Depth (ft.)	45	**Depth to GROUND WATER (ft.)**	16' @ completion of drilling
Weather	V. Hot, Sunny, Clear, Calm	**Depth to GROUND WATER (ft.)**	12' at 2 days after

Depth (ft.)	Blow Count N per 6" (or as indicated)	Sample Type (1)	Percent Recovery	LAB TEST RESULTS: % Moisture	Dry Density (pcf)	% Passing #200 Sieve	Liquid Limit (%)	Plasticity Index (%)	Swell Index (%) / psf	SOIL CLASSIFICATION: USCS	Symbol	DESCRIPTION
0	Asphalt											Asphalt 3.5" Thick
	5/9	CA	90									
	7/10	CA	80									
5												
	6/6	CA	80	23.1	97.4	54.6	47	27		CL		
10												
	5/10	CA										
15												
	4/9	CA										
20												
	6/10	CA		21.1	110	49.8	34	17				
25												
30												
35	6/14	CA										
												Bottom of Boring

(1) SS = Split Spoon CA = California Spoon ST = Shelby Tube BS = Bag Sample RS=Ring Sampler

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EXPLORATORY BORING LOG

Boring No. B-5
Sheet 2 of 2

Logged by	Eric Pickerill	**Project No.**	C11-0021G
Driller	O'Dell Drilling	**Project Name**	West Denver Library Branch
Auger/Core Type	4" continuous flight auger	**Location**	SE Corner of W. Colfax Ave. & Irving Street
Special Requirements		**Date Started**	07/20/11 — **Date Completed** 07/20/11
Boring Elevation (ft.)		**Depth to WEATHERED BEDROCK (ft.)**	37'
Total Boring Depth (ft.)	45	**Depth to GROUND WATER (ft.)**	16' @ completion of drilling
Weather	V. Hot, Sunny, Clear, Calm	**Depth to GROUND WATER (ft.)**	12' at 2 days after

Depth (ft.)	Blow Count N per 6" (or as indicated)	Sample Type (1)	Percent Recovery	LAB TEST RESULTS: % Moisture	Dry Density (pcf)	% Passing #200 Sieve	Liquid Limit (%)	Plasticity Index (%)	Swell Index (%) / psf	SOIL CLASSIFICATION: USCS	Symbol	DESCRIPTION
35	6/14	CA										
	50 for 12"	CA		19.8	109	62.8	52	29		CH		
40												Bottom of Boring
45												REMARKS / ADDITIONAL NOTES:
50												
55												
60												

(1) SS = Split Spoon CA = California Spoon ST = Shelby Tube BS = Bag Sample RS=Ring Sampler

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EXPLORATORY BORING LOG

Boring No. P-1
Sheet 1 of 1

Logged by	Eric Pickerill	**Project No.**	C11-0021G
Driller	O'Dell Drilling	**Project Name**	West Denver Library Branch
Auger/Core Type	4" continuous flight auger	**Location**	SE Corner of W. Colfax Ave. & Irving Street
Special Requirements		**Date Started**	07/20/11 — **Date Completed** 07/20/11
Boring Elevation (ft.)		**Depth to WEATHERED BEDROCK (ft.)**	NA
Total Boring Depth (ft.)	9'	**Depth to GROUND WATER (ft.)**	NA @ completion of drilling
Weather	V Hot, Sunny, Calm	**Depth to GROUND WATER (ft.)**	NA at 2 days after

Depth (ft.)	Blow Count N per 6" (or as indicated)	Sample Type (1)	Percent Recovery	LAB TEST RESULTS: % Moisture	Dry Density (pcf)	% Passing #200 Sieve	Liquid Limit (%)	Plasticity Index (%)	Swell Index (%) / psf	SOIL CLASSIFICATION: USCS	Symbol	DESCRIPTION
0	Asphalt											Concrete 3.5" Thick
	7/11	CA								CL		Brown Silty clay, moist, firm
5	6/8	CA										
10												Bottom of Boring
15												
20												
25												
30												
35												

REMARKS / ADDITIONAL NOTES:

(1) SS = Split Spoon CA = California Spoon ST = Shelby Tube BS = Bag Sample RS=Ring Sampler

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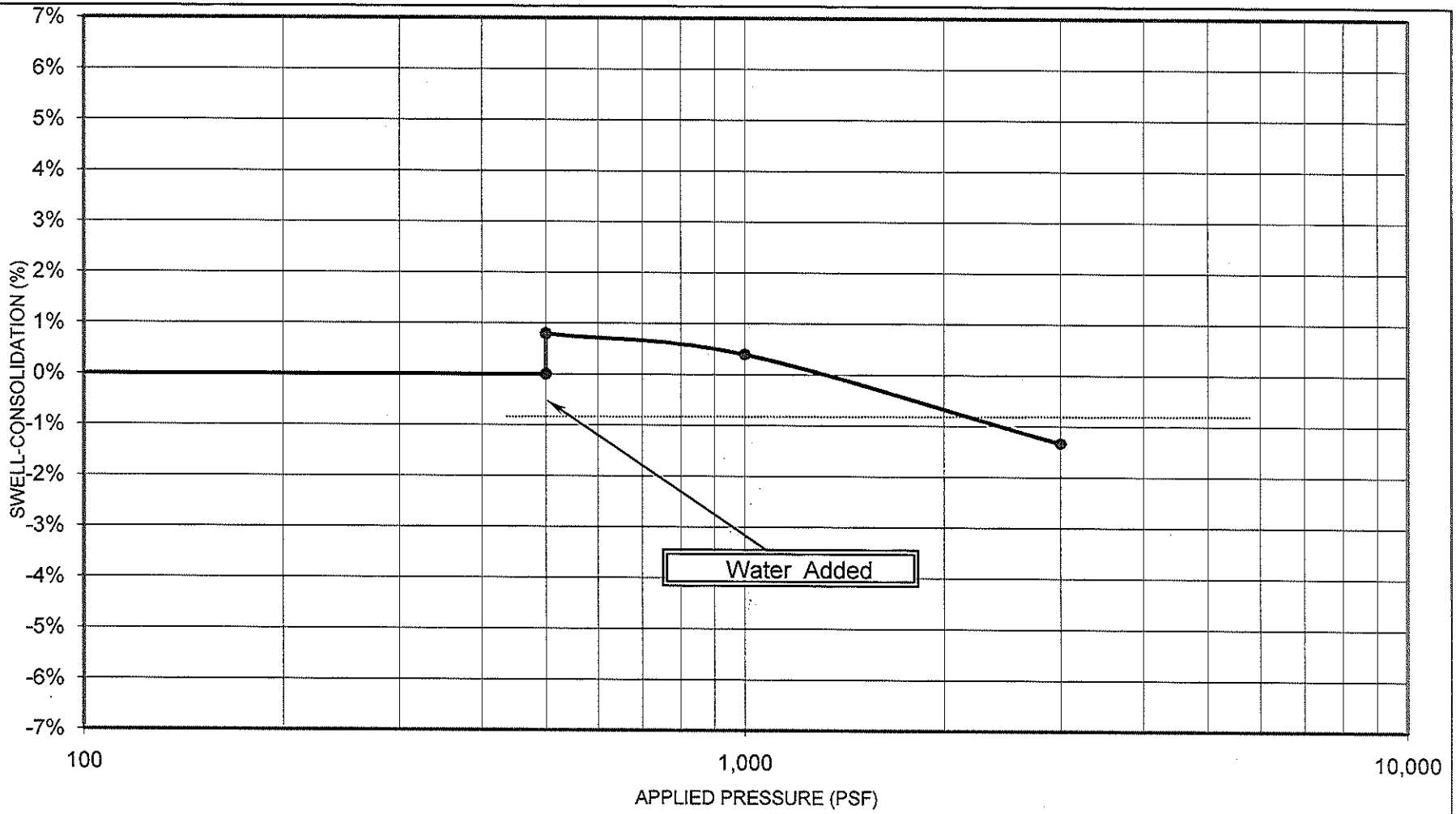
Appendix B

Laboratory Test Results and Table I



SOIL DESCRIPTION
Brown Fat Clay, Little Sand (CH)

SAMPLE NO.	DEPTH (FEET)	SAMPLE TYPE	DRY DENSITY (PCF)	MOISTURE CONTENT	SWELL @ CONFINING PRESSURE (PSF)	LOAD BACK (SWELL) PRESSURE (PSF
B-1	9'	CA	99.2	25.0%	0.00%	NA

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SWELL/CONSOLIDATION TEST

DRAWN BY: ES
CHECKED BY: EP
DATE: 7/30/11

ACURA PROJECT NO.: C11-0021G

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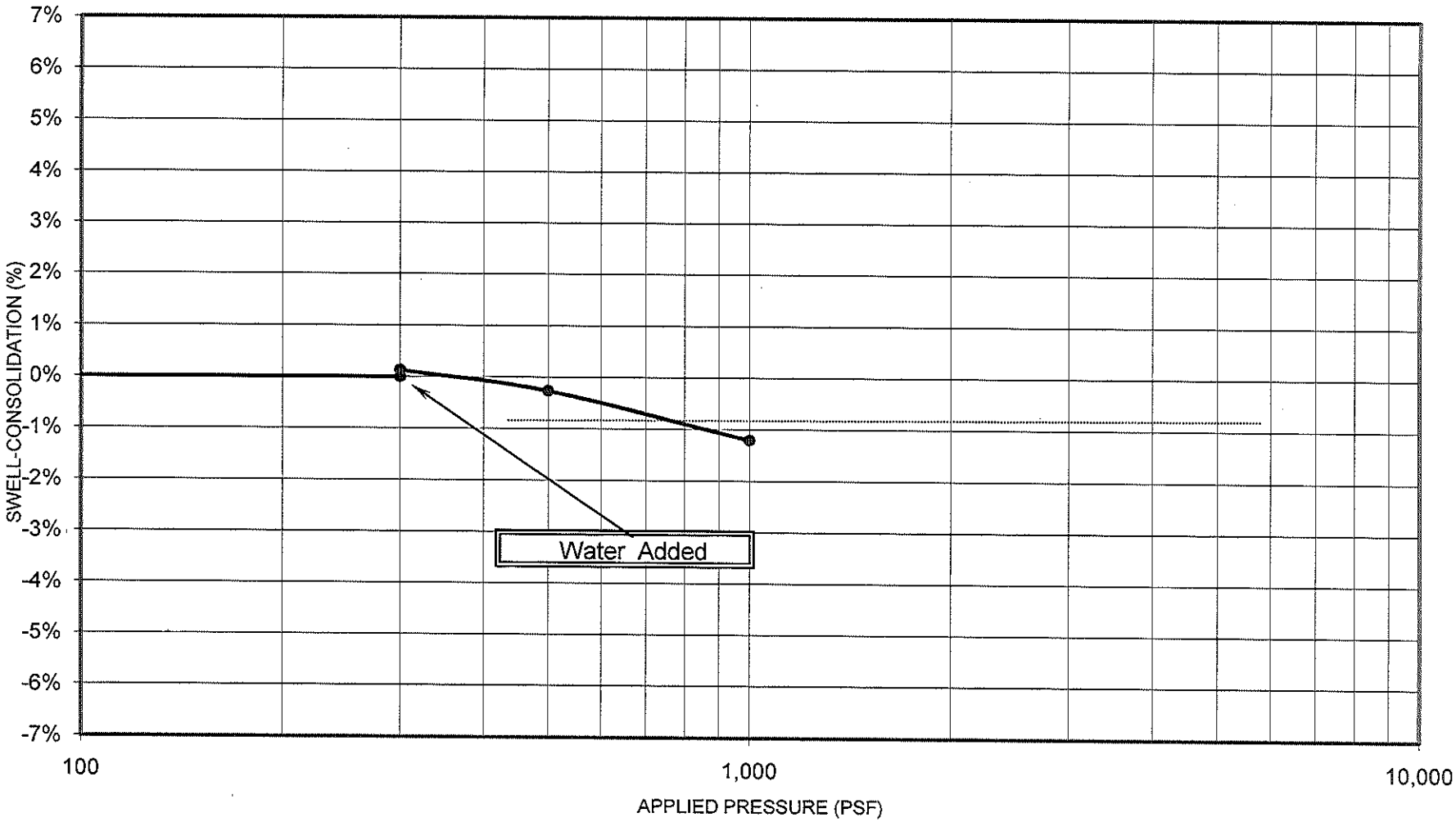

SOIL DESCRIPTION
Brown Lean Clay and Sand, Trace Gravel (CL)

SAMPLE NO.	DEPTH (FEET)	SAMPLE TYPE	DRY DENSITY (PCF)	MOISTURE CONTENT	SWELL @ CONFINING PRESSURE (PSF)	LOAD BACK (SWELL) PRESSURE (PSF
B-2	4'	CA	107.7	19.1%	0.00%	NA

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SWELL/CONSOLIDATION TEST

DRAWN BY: ES
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ACURA PROJECT NO.: C11-0021G

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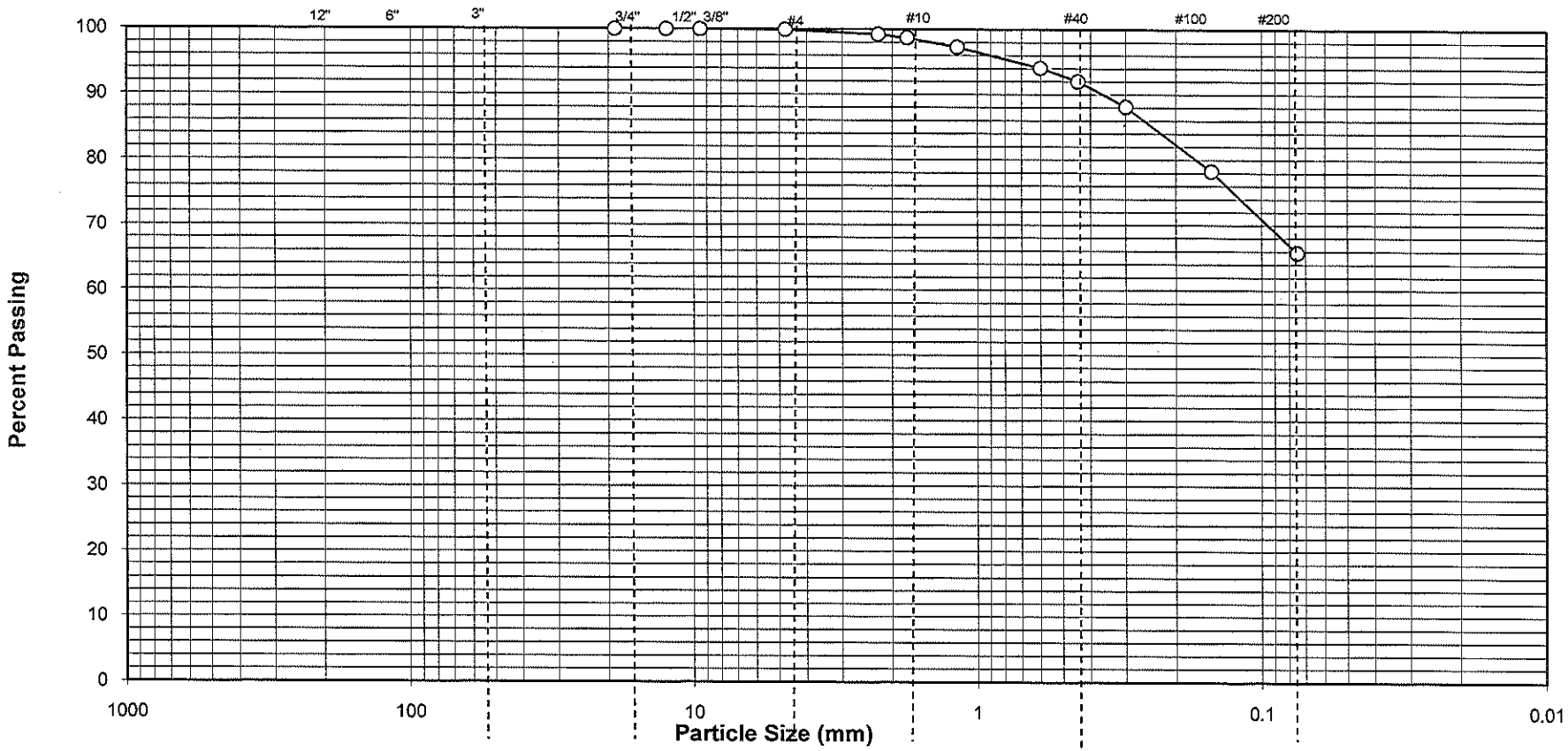

Boulders	Cobbles	Gravel		Sand			Silt and Clay
		Coarse	Fine	Coarse	Medium	Fine	

SOIL DESCRIPTION						
Brown, Trace Gray Lean Clay, Some Sand (CL)						
SAMPLE ID.	**SAMPLE LOCATION**	**SAMPLE TYPE**	**COBBLES (%)**	**GRAVEL (%)**	**SAND (%)**	**SILT CLAY (%)**
B-1	2'	CA	0	0	34	65.8

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GRAIN-SIZE DISTRIBUTION CURVE

DRAWN BY:
CHECKED BY: WSG
DATE: 7/29/2011

PROJECT NO.: C11-0021G

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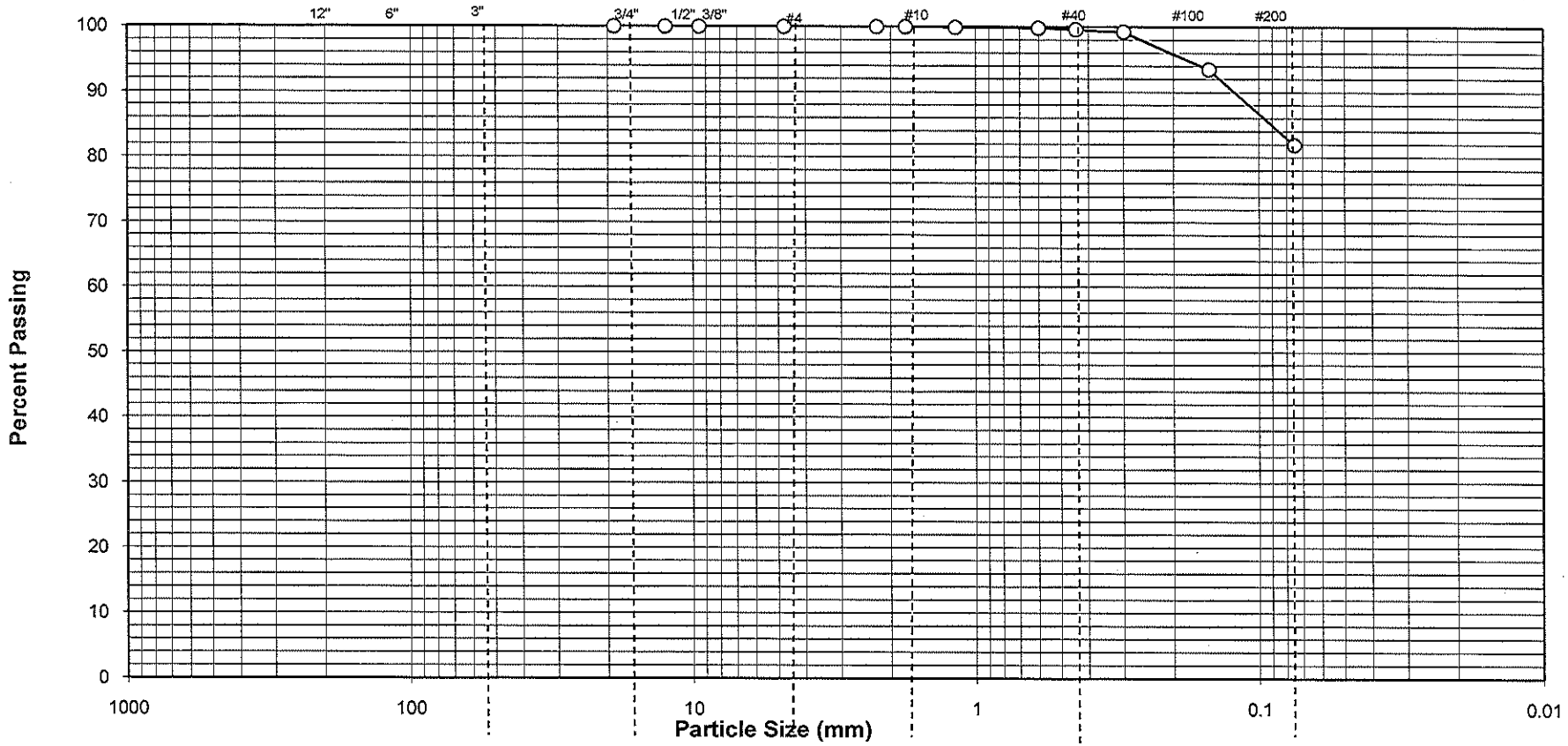

Boulders	Cobbles	Gravel		Sand			Silt and Clay
		Coarse	Fine	Coarse	Medium	Fine	

SOIL DESCRIPTION						
Brown Fat Clay, Little Sand (CH)						
SAMPLE ID.	**SAMPLE LOCATION**	**SAMPLE TYPE**	**COBBLES (%)**	**GRAVEL (%)**	**SAND (%)**	**SILT CLAY (%)**
B-1	9'	CA	0	0	18	81.9

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GRAIN-SIZE DISTRIBUTION CURVE

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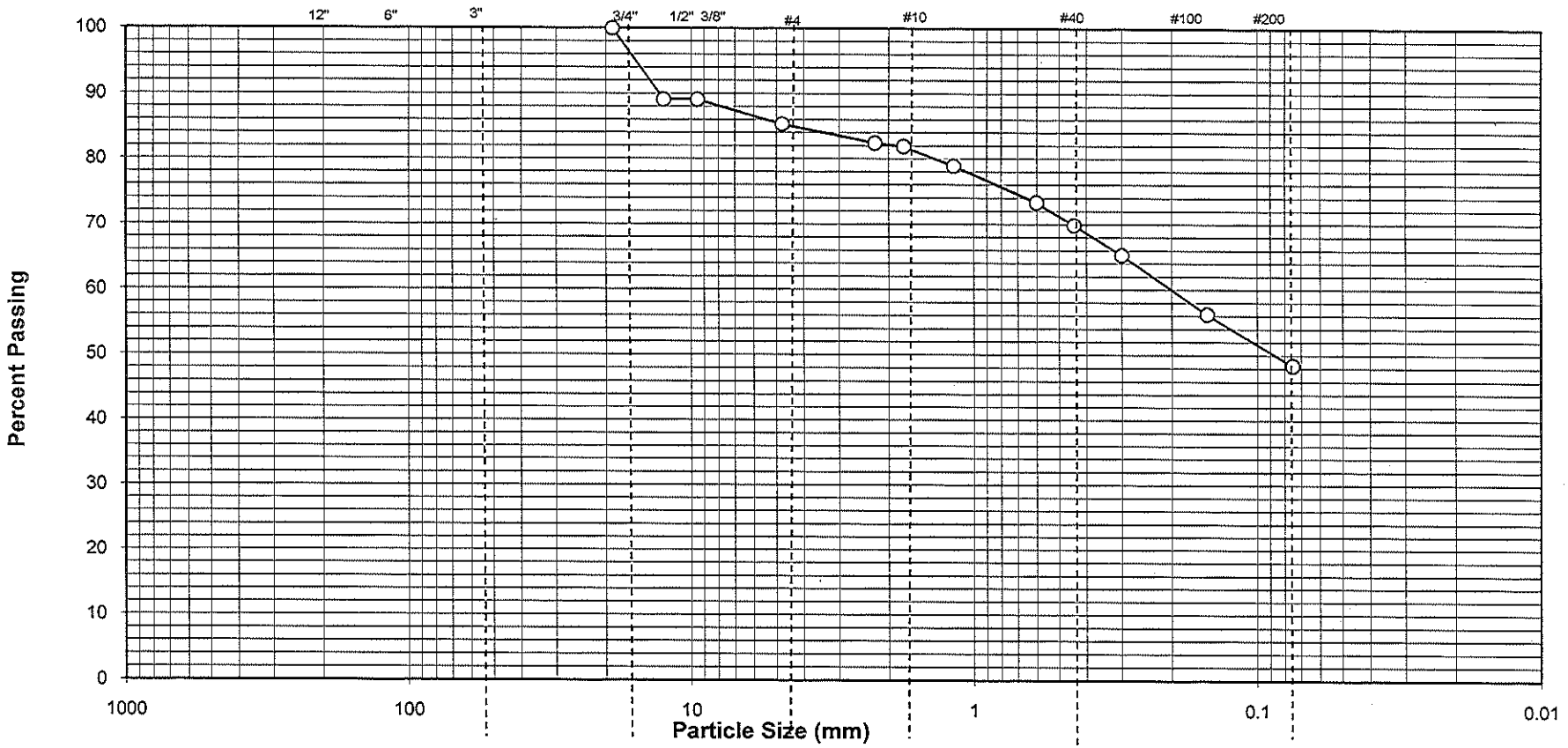

Boulders	Cobbles	Gravel		Sand			Silt and Clay
		Coarse	Fine	Coarse	Medium	Fine	

SOIL DESCRIPTION						
Brown Clayey Sand, Little Gravel (SC)						
SAMPLE ID.	**SAMPLE LOCATION**	**SAMPLE TYPE**	**COBBLES (%)**	**GRAVEL (%)**	**SAND (%)**	**SILT CLAY (%)**
B-1	29'	CA	0	15	37	48.5

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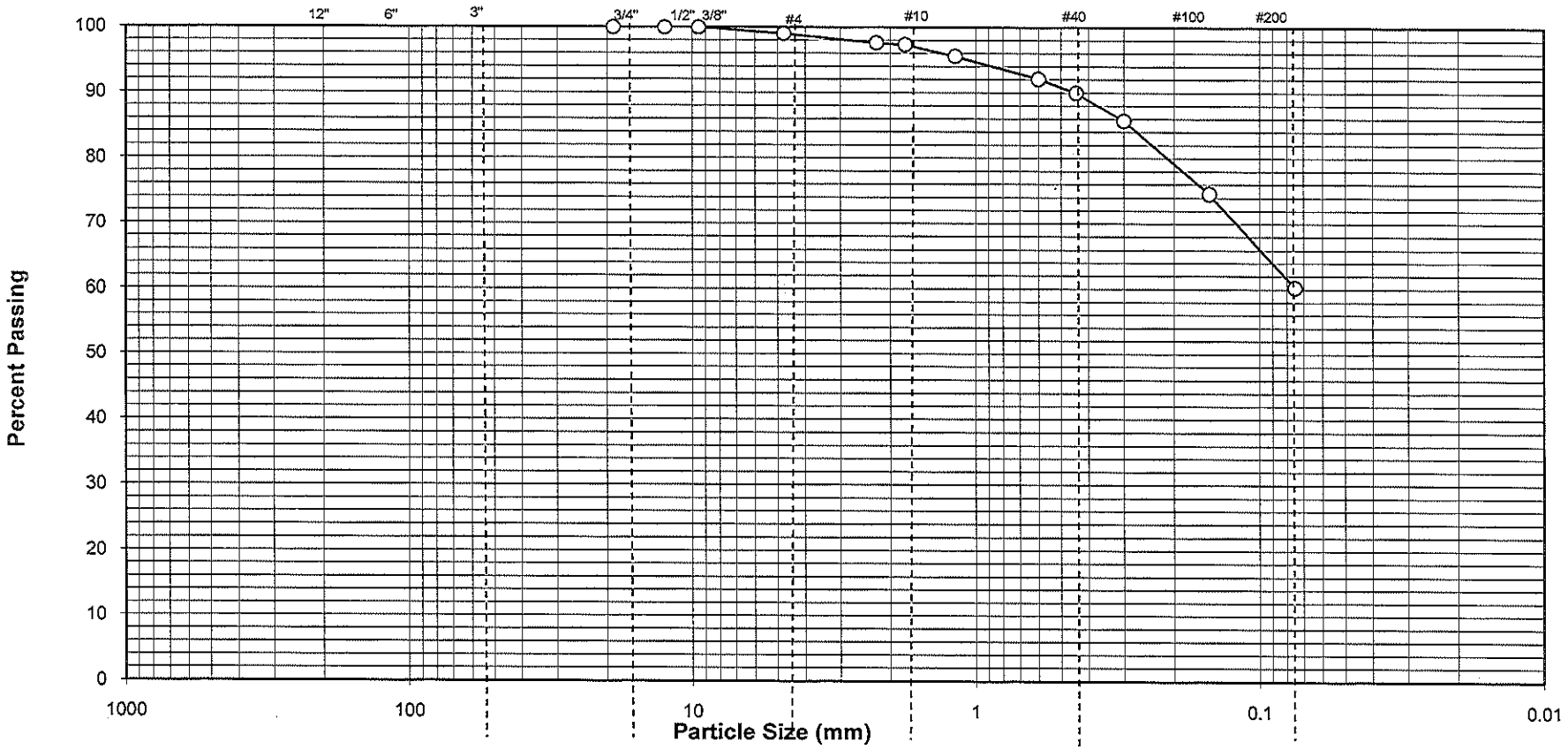

Boulders	Cobbles	Gravel		Sand			Silt and Clay
		Coarse	Fine	Coarse	Medium	Fine	

SOIL DESCRIPTION						
Brown Lean Clay and Sand, Trace Gravel (CL)						
SAMPLE ID.	**SAMPLE LOCATION**	**SAMPLE TYPE**	**COBBLES (%)**	**GRAVEL (%)**	**SAND (%)**	**SILT CLAY (%)**
B-2	4'	CA	0	1	39	60.3

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GRAIN-SIZE DISTRIBUTION CURVE

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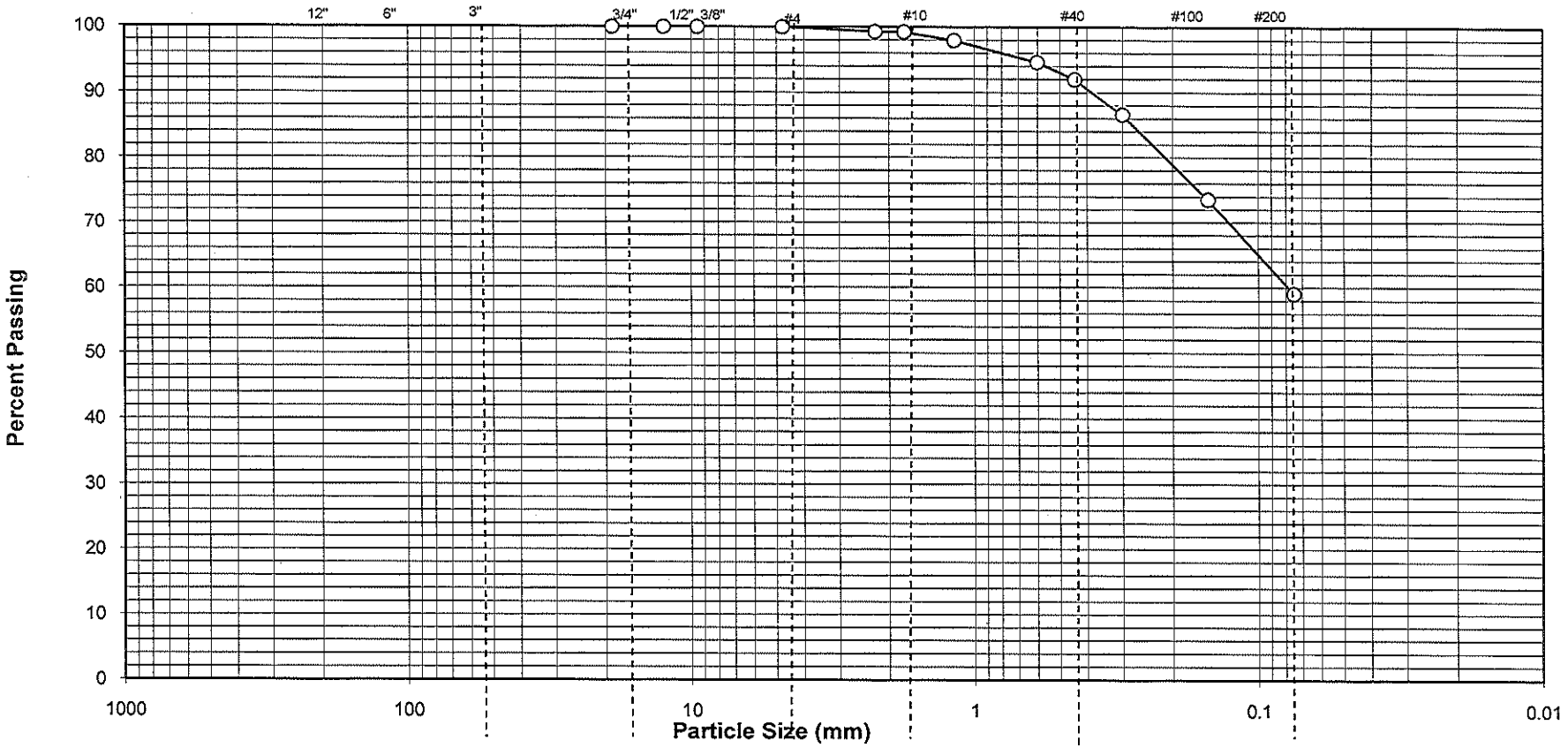

Boulders	Cobbles	Gravel		Sand			Silt and Clay
		Coarse	Fine	Coarse	Medium	Fine	

SOIL DESCRIPTION						
Brown and Gray Lean Clay and Sand (CL)						
SAMPLE ID.	SAMPLE LOCATION	SAMPLE TYPE	COBBLES (%)	GRAVEL (%)	SAND (%)	SILT CLAY (%)
B-2	14'	CA	0	0	41	59.1

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GRAIN-SIZE DISTRIBUTION CURVE

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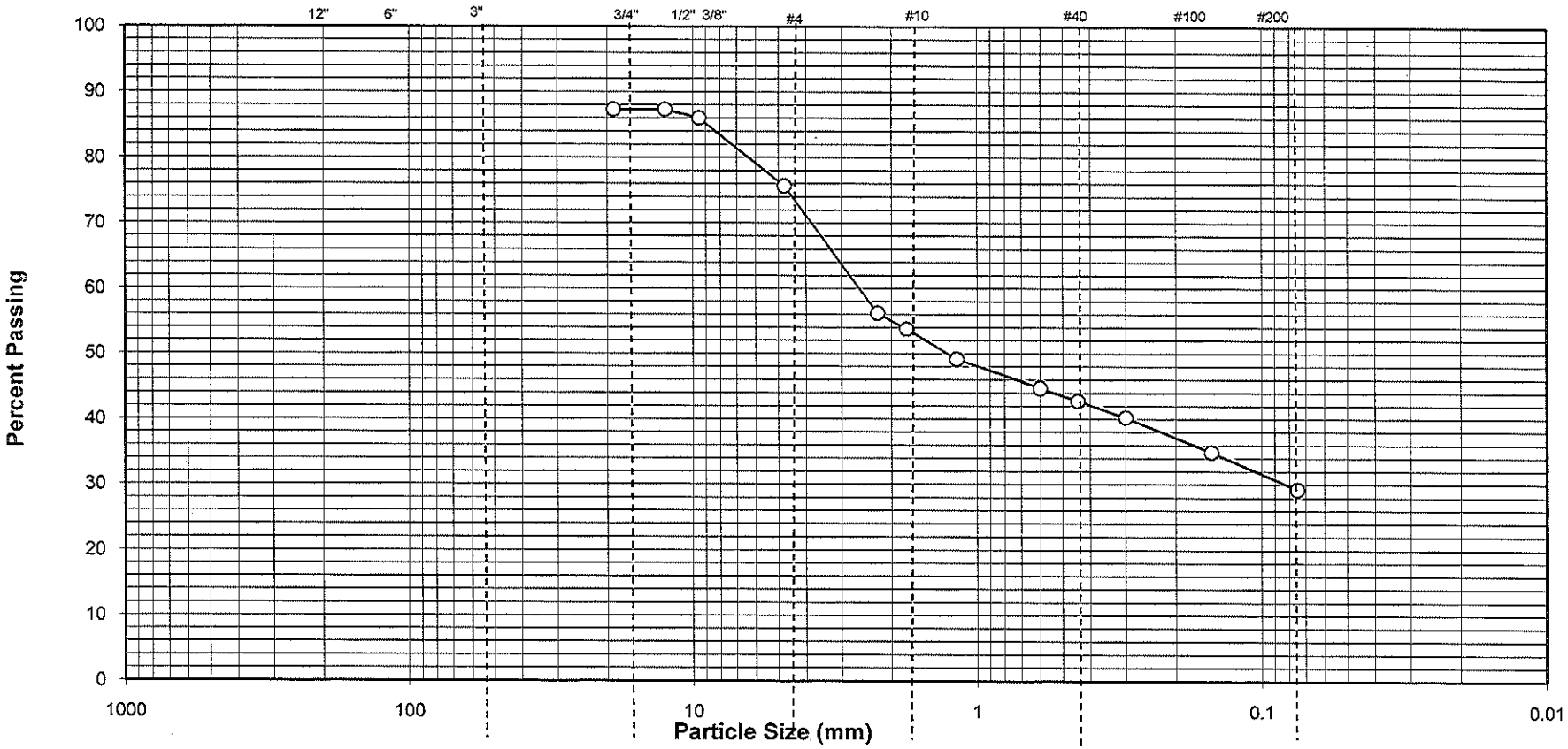

Boulders	Cobbles	Gravel		Sand			Silt and Clay
		Coarse	Fine	Coarse	Medium	Fine	

SOIL DESCRIPTION						
Brown Clayey Sand, some F/C Gravel (SC-SM)						
SAMPLE ID.	**SAMPLE LOCATION**	**SAMPLE TYPE**	**COBBLES (%)**	**GRAVEL (%)**	**SAND (%)**	**SILT CLAY (%)**
B-3	2'	CA	0	24	46	29.3

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GRAIN-SIZE DISTRIBUTION CURVE

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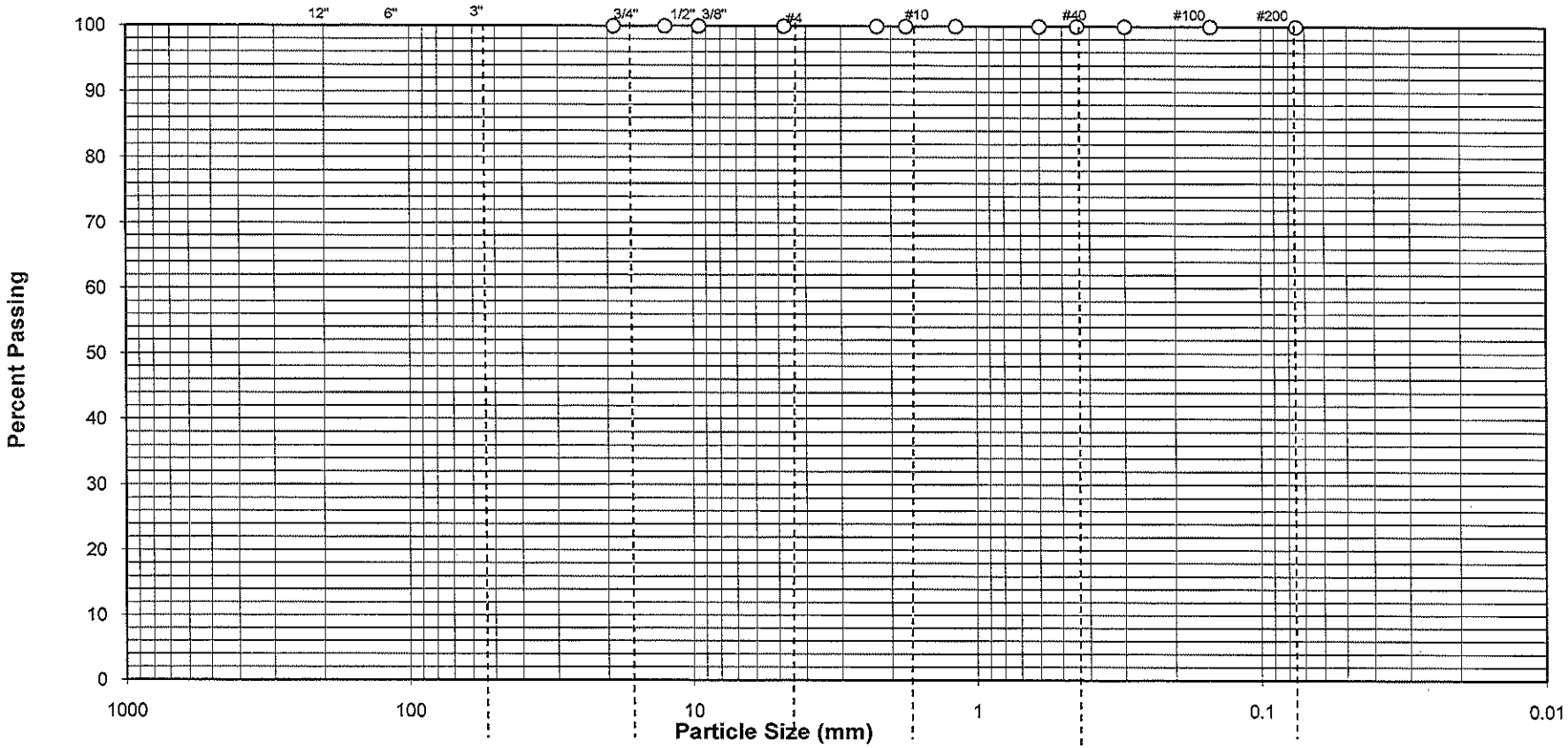

Boulders	Cobbles	Gravel		Sand			Silt and Clay
		Coarse	Fine	Coarse	Medium	Fine	

SOIL DESCRIPTION						
Brown and Gray Lean Clay, Trace Sand and Fine Gravel (CL) (Petroleum Odor)						
SAMPLE ID.	**SAMPLE LOCATION**	**SAMPLE TYPE**	**COBBLES (%)**	**GRAVEL (%)**	**SAND (%)**	**SILT CLAY (%)**
B-3	14'	CA	0	0	0	100.0

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GRAIN-SIZE DISTRIBUTION CURVE

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PROJECT NO.: C11-0021G

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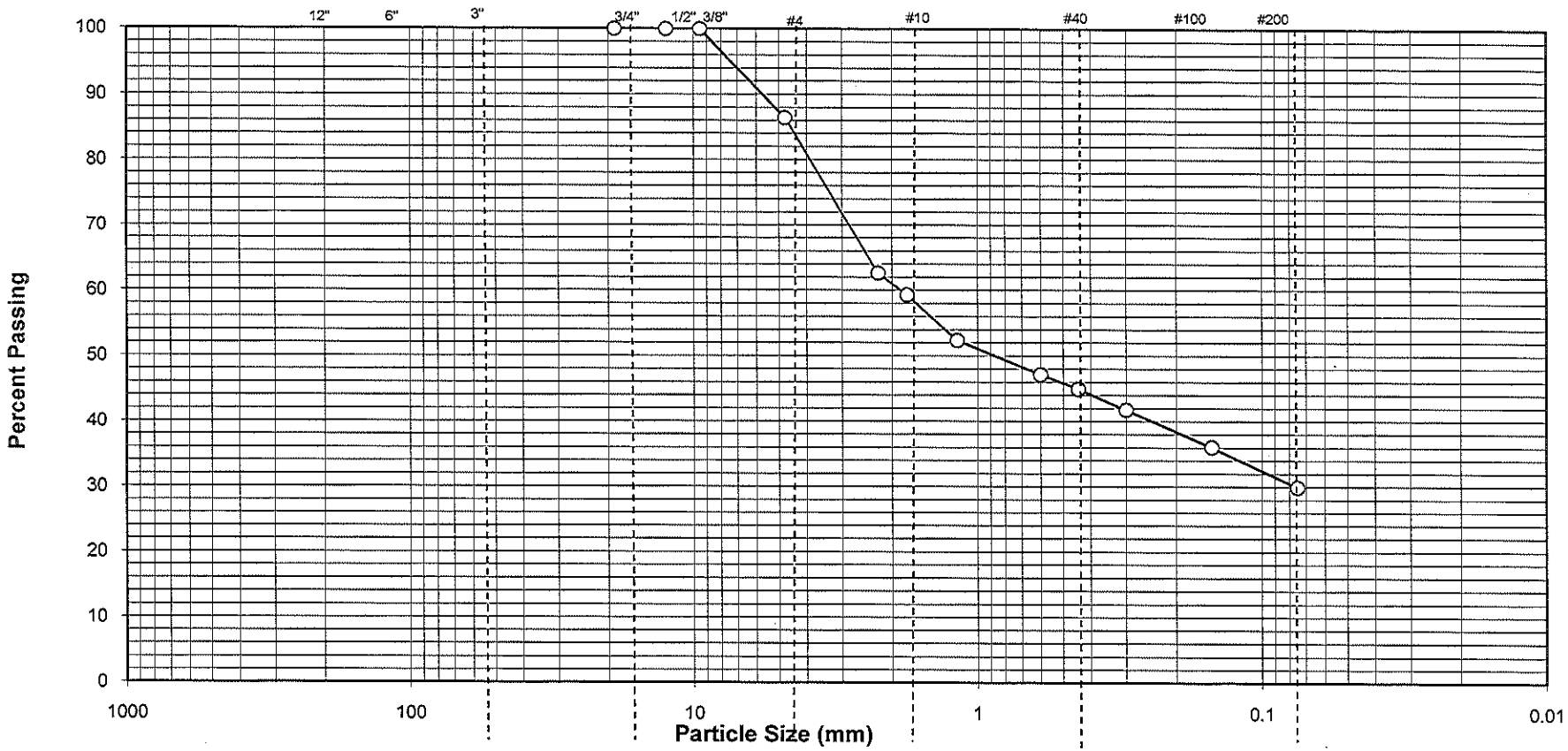

SOIL DESCRIPTION						
Brown Clayey Sand, Little Fine Gravel (SC)						
SAMPLE ID.	**SAMPLE LOCATION**	**SAMPLE TYPE**	**COBBLES (%)**	**GRAVEL (%)**	**SAND (%)**	**SILT CLAY (%)**
B-4	4'	CA	0	14	57	29.9

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GRAIN-SIZE DISTRIBUTION CURVE

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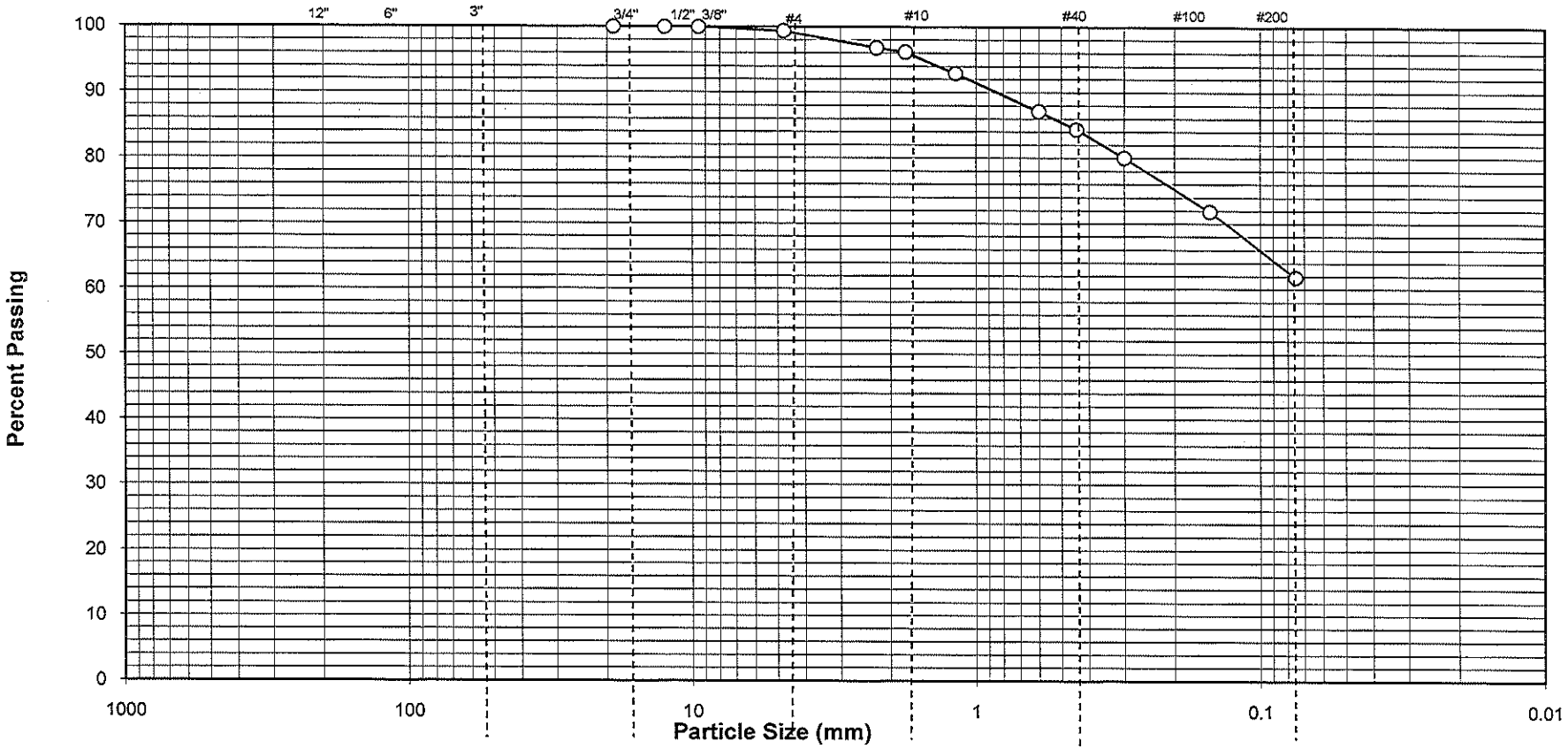

Boulders	Cobbles	Gravel		Sand			Silt and Clay
		Coarse	Fine	Coarse	Medium	Fine	

SOIL DESCRIPTION						
Brown Lean Clay and Sand, Trace Fine Gravel (CL)						
SAMPLE ID.	**SAMPLE LOCATION**	**SAMPLE TYPE**	**COBBLES (%)**	**GRAVEL (%)**	**SAND (%)**	**SILT CLAY (%)**
B-4	19'	CA	0	1	38	61.9

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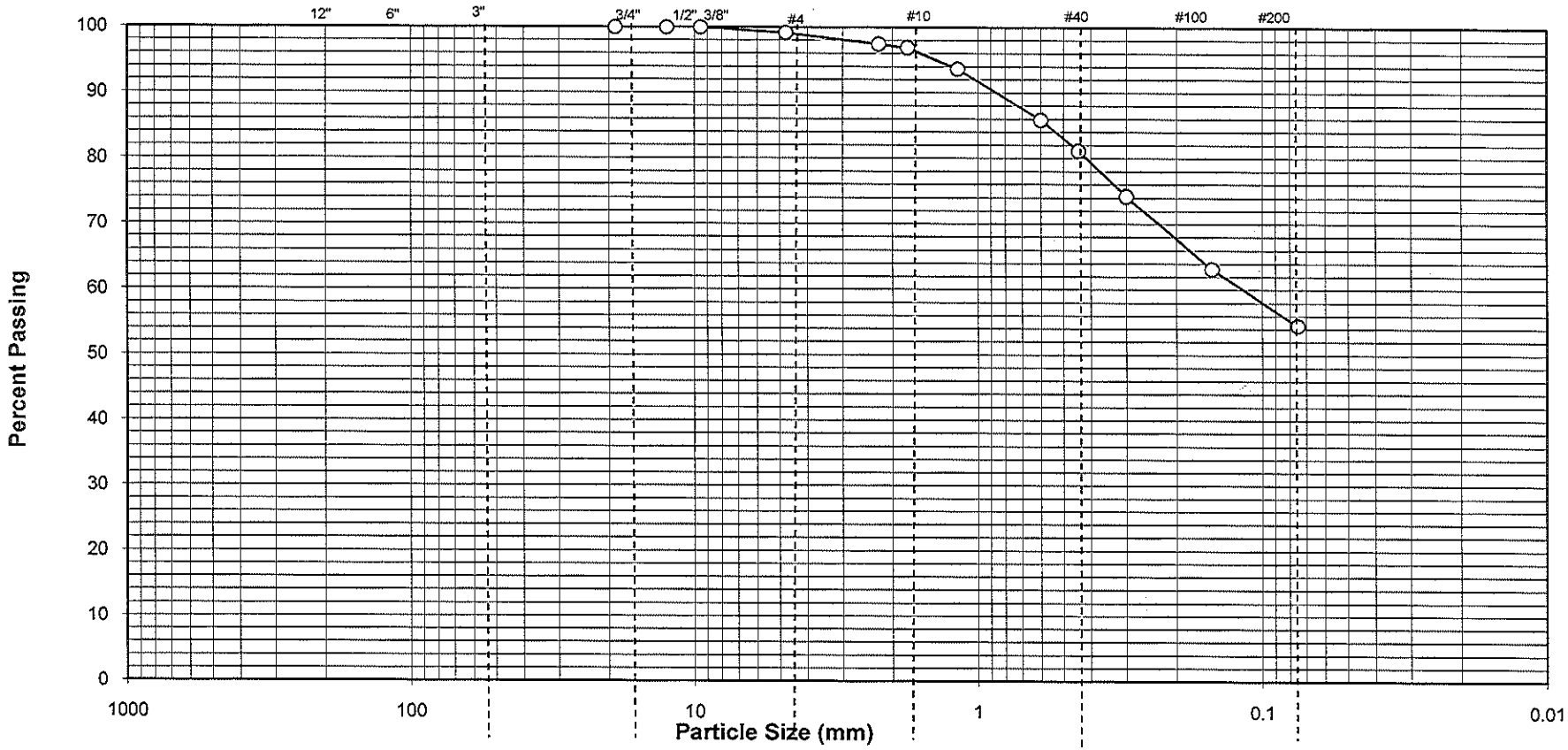

SOIL DESCRIPTION						
Brown and Gray Lean Clay and Sand, Trace Fine Gravel (CL)						
SAMPLE ID.	SAMPLE LOCATION	SAMPLE TYPE	COBBLES (%)	GRAVEL (%)	SAND (%)	SILT CLAY (%)
B-5	9'	CA	0	1	45	54.6

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GRAIN-SIZE DISTRIBUTION CURVE

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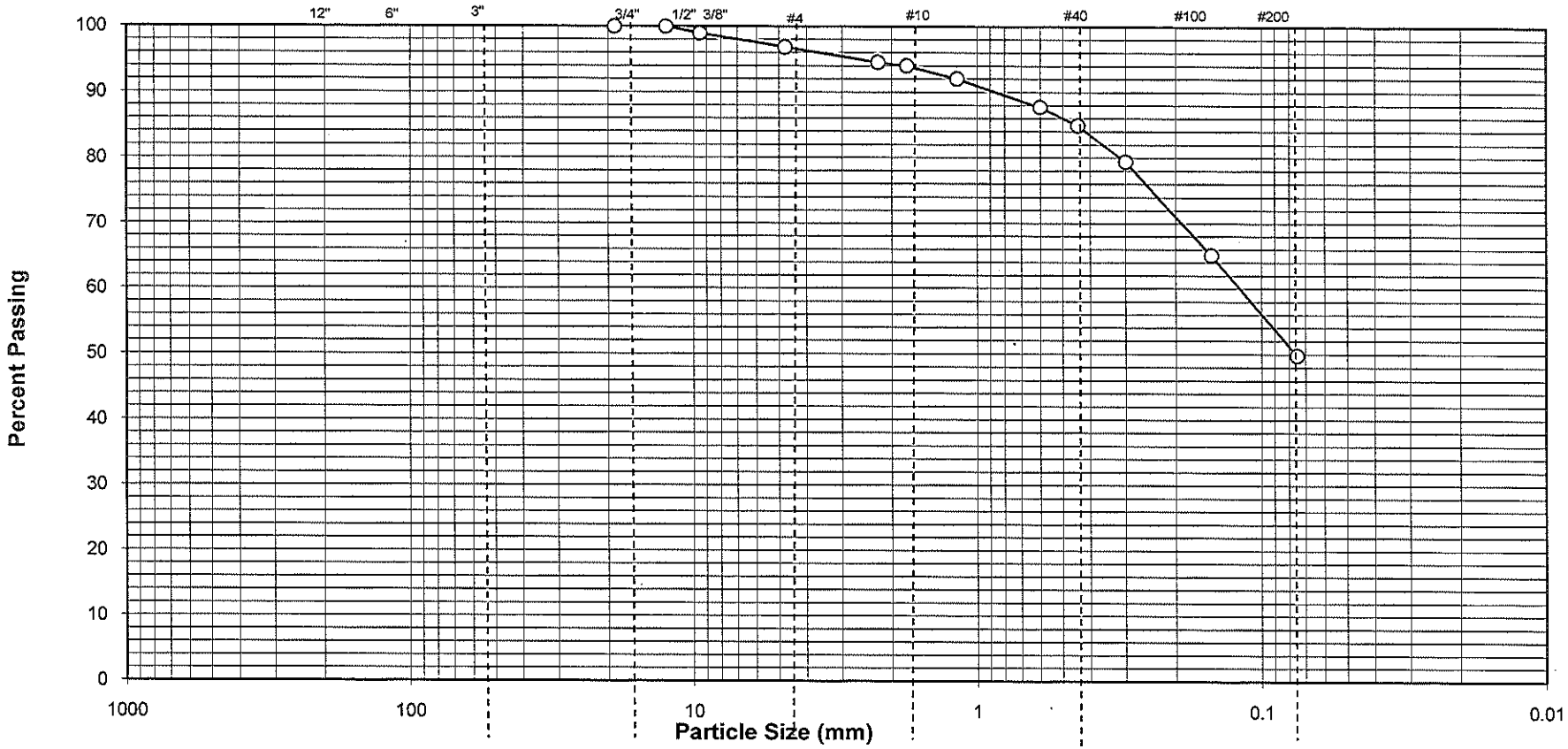

SOIL DESCRIPTION						
Brown Clayey Sand, Trace F/M Gravel (SC)						
SAMPLE ID.	**SAMPLE LOCATION**	**SAMPLE TYPE**	**COBBLES (%)**	**GRAVEL (%)**	**SAND (%)**	**SILT CLAY (%)**
B-5	24'	CA	0	3	47	49.8

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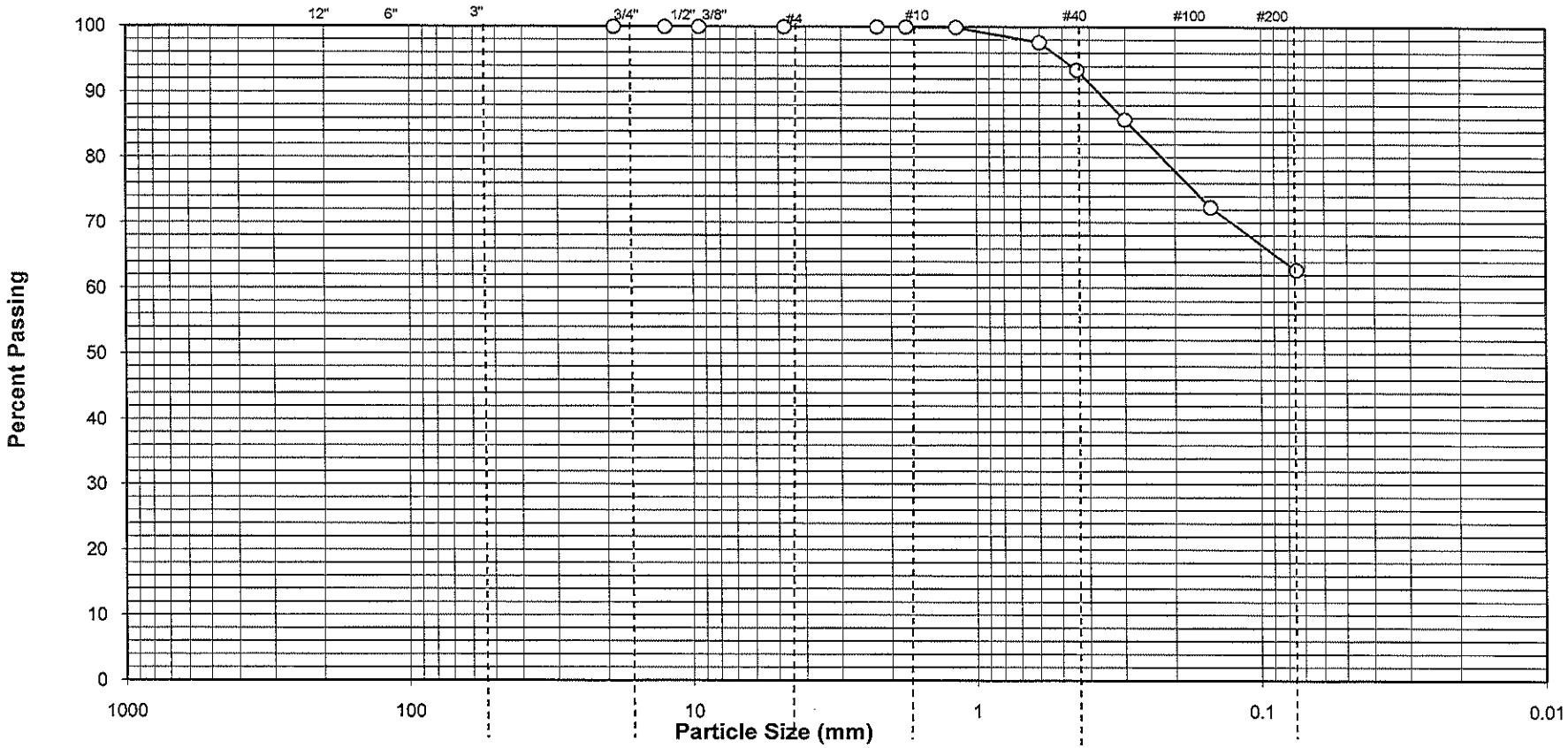

SOIL DESCRIPTION						
Grayish Brown Fat Clay and Sand (CH)						
SAMPLE ID.	SAMPLE LOCATION	SAMPLE TYPE	COBBLES (%)	GRAVEL (%)	SAND (%)	SILT CLAY (%)
B-5	39'	CA	0	0	37	62.8

ACURA ENGINEERING
SHERIDAN, COLORADO 80110

GRAIN-SIZE DISTRIBUTION CURVE

DRAWN BY:
CHECKED BY: WSG
DATE: 7/29/2011

PROJECT NO.: C11-0021G

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Appendix C

Pavement Construction Guidelines for Flexible and Rigid Pavements

GUIDELINE FOR FLEXIBLE PAVEMENT CONSTRUCTION RECOMMENDATIONS

Experience has shown that construction methods can have a significant effect on the life and serviceability of a pavement system. We recommend the proposed pavement be constructed in the following manner:

1) The subgrade should be stripped of organic matter, scarified, moisture conditioned, and compacted. AASHTO defined A-6 and A-7 soils should be moisture conditioned to between OMC to 2 percent above OMC and compacted to within at least 95 percent of standard Proctor maximum dry density (AASHTO T99). All other AASHTO defined soils should be moisture conditioned to within 2 percent below to 2 percent above OMC and compacted to within at least 95 percent of standard Proctor maximum dry density (AASHTO T180) as per section 3.4.2 of MGPEC Construction Design Manual.

2) Utility trenches and all subsequently placed fill should be properly compacted and tested prior to paving. As a minimum, fill should be compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D698A).

3) After final subgrade elevation has been achieved and the subgrade compacted, the area should be proof-rolled with a heavy pneumatic-tired vehicle (ie. a loaded ten-wheel dump truck). Subgrade that is pumping or deforming excessively should be scarified, evaluated for additional moisture conditioning, and then re-compacted.

4) If areas of soft or wet subgrade are encountered, the material should be excavated and replaced with properly compacted structural fill. Where excessively soft, yielding subgrade is encountered, we recommend the excavation be observed by a representative of our office.

5) Aggregate base course should be placed in thin, loose lifts; moisture conditioned to within 2 percent of OMC; and compacted to at least 95 percent of 95 percent of modified Proctor maximum dry density (ASTM D1557).

6) Asphaltic concrete should be hot, plant-mixed material compacted to at least MGPEC Specifications. The maximum compacted lift should be 3.0 inches and joints should be staggered.

7) The subgrade preparation and the placement and compaction of all pavement material should be observed by a member of Acura Engineering. Compaction criteria should be met prior to placement of the next paving lift. The additional requirements of the City and County of Denver should apply.

GUIDELINE FOR RIGID PAVEMENT CONSTRUCTION RECOMMENDATIONS

Rigid pavement sections are not as sensitive to subgrade support characteristics as flexible pavement. Due to strength of the concrete, wheel loads from traffic are distributed over a large area and the resulting subgrade stresses area relatively low. The critical factors affecting the performance of a rigid pavement are the strength and quality of the concrete and the uniformity of the subgrade. We recommend subgrade preparation and construction of the rigid pavement section be completed in accordance with the following recommendations:

1) Natural soils should be stripped of organic matter, scarified, moisture conditioned, and compacted. We recommend the top 12 inches of the subgrade be moisture conditioned. AASHTO A-6 and A-7 soils defined soils should be moisture conditioned to between OMC to 2 percent above OMC and compacted to within at least 95 percent of standard Proctor maximum dry density (AASHTO T99). All other AASHTO defined soils should be moisture conditioned to within 2 percent below to 2 percent above OMC and compacted to within at least 95 percent of standard Proctor maximum dry density (AASHTO T180) as per MGPEC Construction Design Manual. Moisture conditioning and compaction specifications also apply where additional fill is necessary to bring the subgrade to grade.

2) The resulting subgrade should be checked for uniformity and all soft or yielding materials should be replaced prior to paving. Concrete should not be placed on soft, spongy, frozen or otherwise unsuitable subgrade.

3) The subgrade should be kept moist prior to paving.

4) Curing procedures should protect the concrete against moisture loss, rapid temperature change, freezing and mechanical injury for at least 3 days after placement. Traffic should not be allowed on the pavement for at least one week.

5) We recommend application of a pigmented, liquid membrane curing compound applied per the recommendations of the manufacturer.

6) Construction joints, including longitudinal and transverse joints, should be formed during construction or should be sawed shortly after concrete has begun to set, but prior to uncontrolled cracking.

7) Construction control and observation should be carried out during subgrade preparation and paving procedures. Concrete should be carefully monitored for quality control. The additional requirements of Lakewood and Jefferson County should apply.

This design section is based on a 20-year design life period. Experience in the Denver area indicates overlays are not necessary for the design period. Maintenance associated with cracking due to heave should be anticipated. To avoid problems associated with scaling and continue gaining strength, we recommend de-icing salts not be used for the first year after placement.

ACURA
ENGINEERING

5235 S. 39th Street • Phoenix, AZ 85040
1500 W. Hampden Avenue • Building 3, Suite K • Sheridan, CO 80110

September 29, 2011

Mr. Joseph Montalbano
Studiotrope Design Collective
2942 Welton Street
Denver, Colorado 80205

Subject: West Denver Branch Library Geotechnical Report Response
SE Corner of West Colfax Avenue
and Irving Street
Denver, Colorado
Acura Project No. C11-0021G

Dear Mr. Montalbano:

It has been requested by the structural engineer to place the perimeter drains half way up the grade beam at the high end of the drain. It was explained that this modification was necessary in order to tie into existing outlet structures. While this is not the typical design for perimeter drains we understand the need to design this buildings system in this manner and we approve of its design for this building.

Routing of the perimeter drain under the building is up to the design team, as a geotechnical engineer I would advise against the potential introduction of water beneath the building wherever possible, but if there is no alterative then there is no alternative. Proper sloping and cleanouts are very advisable in these situations.

The city has also questioned the need for the drains for this building. Perimeter drains are a current standard of practice in the Denver Area, as they have proven themselves to be very cheap insurance against saturated soils from a multitude of sources both natural and man caused. The final decision to install the perimeter drains rests with the building owners, but as a local standard of care for foundation design in the Denver area we will not remove their recommendation from our report.

The 10% slope away from the buildings is a recommendation adopted by CAGE (Colorado Association of Geotechnical Engineers) to provide a natural sheeting of water away from the building. If site grading requires less than 10% we recommend the use of impervious soil covers.

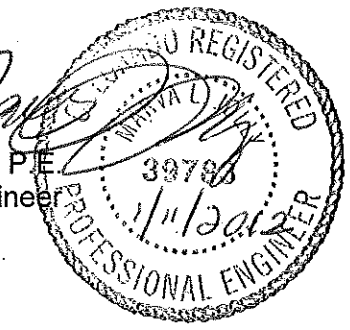
If you have questions regarding the contents of this report, or require additional information, please get in contact with us at 303.799.8378.

Sincerely,

ACURA ENGINEERING COLORADO, LLC

Eric Pickerill, P.G.
Project Geologist

Marva Jolly, P.E.
Project Engineer



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ACURA
ENGINEERING

5235 S. 39th Street • Phoenix, AZ 85040
1500 W. Hampden Avenue • Building 3, Suite K • Sheridan, CO 80110

September 8, 2011

Mr. Joseph Montalbano
Studiotrope Design Collective
2942 Welton Street
Denver, Colorado 80205

Subject: West Denver Branch Library Geotechnical Report Addendum
SE Corner of West Colfax Avenue
and Irving Street
Denver, Colorado
Acura Project No. C11-0021G

Dear Mr. Montalbano:

This addendum modifies the Geotechnical Investigation Report, dated August 8, 2011, prepared by Acura Engineering for the subject project. The purpose of this addendum is to address the necessity of using geofabric under the fills, and the elimination of the sub drains under the structural fill.

The structural fill subdrain maybe eliminated provided the owners understand that in the event of a saturating event (i.e broken pipe) beneath the building there is a significant risk of damage to the buildings foundation system.

The idea of using a geotextile was initially proposed by the structural engineer in order to reduce the required depth of sub excavation and structural fill. The inclusion of the geotextile could not significantly reduce the depth of structural fills a the site which are primarily driven by the varied fill conditions at the site. The original proposal later changed to a geofabric whose primary function was to act as a filter keeping the underslab drain system and vapor venting system free of fine particles. With the elimination of the sub drains from beneath the slab the geofabric is no longer necessary.

If you have questions regarding the contents of this report, or require additional information, please get in contact with us at 303.799.8378.

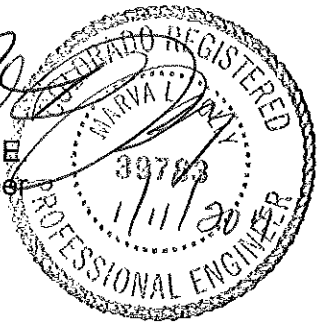
Sincerely,

ACURA ENGINEERING COLORADO, LLC

Eric Pickerill, P.G.
Project Geologist

2 Copies Sent
emailed

Marva Jolly, P.E.
Project Engineer



ACURA
ENGINEERING

5235 S. 39th Street • Phoenix, AZ 85040
1500 W. Hampden Avenue • Building 3, Suite K • Sheridan, CO 80110

December 14, 2011

Mr. Joseph Montalbano
Studiotrope Design Collective
2942 Welton Street
Denver, Colorado 80205

Subject: West Denver Branch Library Geotechnical Report Addendum
SE Corner of West Colfax Avenue
and Irving Street
Denver, Colorado
Acura Project No. C11-0021G

Dear Mr. Montalbano:

The need for sub-fill drains has been re-evaluated and the existing water conditions combined with the porosity of the existing soils allowed us to eliminate the requirement for sub-fill drains. By removing the sub fill drains the requirement for a 6" gravel bed at the base of the sub-base fill has also been eliminated.

Additionally a requirement for geo-grid fabric was included in the original geotech report. The purpose of the geo-grid was to provide stability for the sub-base drain as well as a vapor venting system which was originally to be placed with the sub-base drain. The geo-grid is no longer necessary.

As stated above the need for a sub-base drain was re-evaluated and determined to be unnecessary based on existing conditions, provided the following two conditions are met. First prior to placing structural fill the sub-base must be generally graded towards the perimeter drain. Secondly the slope of the sub-base should be graded in the direction of the lowest perimeter drain.

The elimination of the sub-base drains will not adversely affect the performance of the foundation system.

Finally, the void space provided either above or below partition walls can be reduced from 2 inches to 1 inch. This is based on the differential movements provided in the soils report.

If you have questions regarding the contents of this addendum, or require additional information, please get in contact with us at 303.799.8378.

Sincerely,

ACURA ENGINEERING COLORADO, LLC

Eric Pickerill, P.G.
Project Geologist

Marva Jolly, P.E.
Project Engineer

2 Copies Mailed
emailed

DIVISION 1 – GENERAL REQUIREMENTS

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work specified in this contract consists of furnishing all management, supervision, labor, materials, tools, equipment, services and incidentals for the construction of the Work indicated in the contract documents including lump sum items and unit price items.

B. The Work also includes the following:

1. Work under separate contracts.
    a. Mile-High Vista Site Development
    b. Adjacent vertical construction
    c. West Denver Branch Library Furniture
2. Owner-furnished, Contractor- Installed products
    a. As indicated in documents
3. Owner-furnished, Owner-Installed products
    a. as indicated in documents

C. Reference Contract General Conditions, GC 301, GC 306, GC 804, GC Title 8

1.02 SITE CONDITIONS

A. The Contractor acknowledges satisfaction as to the nature and location of the Work, all of the general and local conditions, particularly those bearing upon availability of transportation, access to the site, disposal, handling and storage of materials, availability of labor, water, power, roads, and uncertainties of weather, or similar physical conditions at the site, the conformation and conditions of the ground, the character of equipment and facilities needed preliminary to and during work, and all other matters that can in any way affect the work or the cost thereof under this contract.

B. The Contractor further acknowledges, by submission of a bid and on each change in work proposal, satisfaction as to the character, quality and quantity of all surface and subsurface materials and all features on top of the surface or at worksites that would be encountered from his inspection of the site and from reviewing available records of exploratory work furnished by the City. Failure by the Contractor to become acquainted with the physical conditions of the sites and all the available information will not relieve the Contractor from responsibility for properly estimating the difficulty or cost of performing the Work.

C. The Contractor warrants that as a result of examination and investigation of all the aforesaid data and the site, that the Contractor can perform the Work in a good and workmanlike manner and to the satisfaction of the City. The City assumes no responsibility for any representations made by any of its officers or agents during or prior to the execution of this contract unless such representation is expressly stated in the contract.

1.03 WORK UNDER SEPARATE CONTRACTS

A. Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

B. Contracts may be Proceeding, Concurrent or Future or Unknown.

C. Mile-High Vista Site Development: the West DenverBranch Library is part of the Mile High Vista development. A two acre parcel of land, formerly part of the Festival Plaza at Avondale, located on the southeast corner of W. Colfax Avenue and Irving Street.

1. Urban Land Conservancy will be the master developer of the site that will include the West Denver Branch Library, a mixed-use work housing development and commercial building.
2. Site improvements under this contract including, but not limited to; earthwork, wet and dry utilities, concrete and asphalt.
3. Construction documents and schedule associated to this work can be provided to the successful bidder to coordinate.
4. The City and County of Denver is purchasing the West Denver Branch Library site, a parcel on the southeast corner of W. Colfax Avenue and Irving Street.
5. Work Associated with the Mile High Vista development has been submitted under a separate log in: 2010D00136 to the City and County of Denver for review and approval.
6. A site remediation contract for removal of hazardous materials in the soils has been completed as part of the site development.
7. Work under separate contracts will likely occur concurrently with the scope of work under the West Denver Branch Library.

D. Adjacent Vertical Construction:

1. Construction documents and schedule associated to this work are unknown and unavailable.

E. West Denver Branch Library Furniture

1. Studiotrope Design Collective is providing design services for Interior Furniture. Scope of Work includes but is not limited to free standing furniture, systems furniture and book shelves.
2. A separate contract will be awarded via public bid for procurement and installation of furnishings.
3. Construction documents and schedule associated to this work will be provided, upon completion, to the successful bidder to coordinate.

1.04 OWNER-FURNISHED, CONTRACTOR INSTALLED PRODUCTS

A. Owner will furnish products indicated. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule

B. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Project Manager noting discrepancies or anticipated problems in use of product, coordination of support systems and connections to building services.

C. The Work includes:

1. Items indicated in documents.

2. Providing support systems, including but not limited to blocking, at all locations to receive Owner's equipment.

3. Providing material and labor for and making building services connections.

D. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.

E. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.

F. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.

G. Contractor shall install and otherwise incorporate Owner-furnished items into the Work.

1.05 OWNER FURNISHED, OWNER INSTALLED PRODUCTS.

A. Owner will furnish products indicated. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.

B. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Project Manager noting discrepancies or anticipated problems in use of product, coordination of support systems and connections to building services.

C. The Owner will furnish and install products indicated in documents

D. The Work includes:

1. Providing support systems, including but not limited to blocking, at all locations to receive Owner furnished and owner installed products.

2. Providing material and labor for and making building services connections.

PART 2 - EXECUTION

2.01 CONTRACTOR'S DUTIES

A. Except as otherwise specified, furnish the following to the full extent required by the contract:

1. Labor, superintendence, supervision and products.
2. Construction equipment, tools, machinery and materials.
3. Utilities required for construction and related activities.
4. Other facilities and services necessary to properly execute and complete the Work, including security for worksite, testing and storage and protection of all materials awaiting incorporation into the Work, providing a safe working environment for workers, City and County of Denver representatives, and the public in accordance with all local, state and federal requirements.

B. Prosecute the Work as specified and in a timely manner. Submit a schedule of Work that will be performed at times other than during the eight-hour working day of Monday through Friday, daylight hours. Submit this schedule five working days prior to the beginning of Work to the Project Manager for review and acceptance. Approval to work at night may be obtained after Contractor presents a written program outlining special precautions to be taken to control the extraordinary hazards presented by night work. That program shall include, but not limited to, supplementary lighting of work areas, availability of medical facilities, security precautions and noise limitations.

2.02 COORDINATION

A. Coordinate prosecution of the Work with those public utilities, governmental bodies, private utilities and other contractors performing work on and adjacent to the worksites. Eliminate or minimize delays in the Work and conflicts with those utilities, bodies and contractors. Schedule governmental, private utility and public utility work that relies upon survey points, lines and grades established by the Contractor to occur immediately after those points, lines and grades have been established. Confirm coordination measures for each individual case with the City in writing.

B. In the coordination effort of work by others, the Contractor shall obtain and refer to equipment locations and other layouts, as available, to avoid interface problems.

C. The City reserves the right to permit access to the site of the Work for the performance of work by other contractors and persons at such times that the City deems proper. The exercise of such reserved right shall in no way or to any extent relieve the Contractor from liability for loss and damage to the work due to or resulting from its operations or from responsibility for complete execution of the Contract. The Contractor shall cooperate with other contractors and persons in all matters requiring common effort.

2.03 CONTRACTOR USE OF WORKSITE

A. Contractors shall have limited use of premises for construction operations as indicated on Drawings by the Limits of Construction. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Areas outside the Limits of Staging may become available for use for staging by the General Contractor during construction, to be determined.

B. Confine worksite operations to areas permitted by law, ordinances, permits and the contract.

C. Consider the safety of the Work and that of the people and property on and adjacent to the worksite when determining amount, location, movement and use of materials and equip-

ment on worksite.

D. Coordinate Use of the Work site with contractors performing work on adjacent site and property owners of adjacent site.

E. Coordinate Use of site with all: preceding Work, concurrent Work and future Work under general contract and under separate contracts.

F. Storage on Worksite relate to Use:

1. Do not load worksite with equipment and products that would interfere with the Work. Only equipment, tools or materials required for this Work may be stored at the worksite.
2. Protect products, equipment and materials stored on worksite.
3. Relocate stored products, equipment and materials which interfere with operations of City, government bodies, public and private utilities, and other contractors.
4. Confine constructions staging operations to areas within the Limits of Staging indicated.

PART 3 - MEASUREMENT

3.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

PART 4 - PAYMENT

4.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this section including any and all necessary relocations requested by the City. The cost of the work described in this section shall be included in the Contract price.

END OF SECTION 01010

SECTION 01050

LAYOUT OF WORK AND SURVEYS

PART 1 - GENERAL

1.01 SCOPE

A. This Section covers the procedures and accuracy requirements for survey services for layout of work and field measurement of work quantities to be determined by surveys.

B. Reference Contract General Conditions, GC 317 and GC 318.

1.02 SUBMITTAL

A. Refer to Technical Specifications Sections 01300 and 01340 for the submittal process.

1. Copies of original pages of field notes.
2. Original field notebooks when filled and at end of contract.
3. As-built measurements.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CONSTRUCTION LINES AND GRADES

A. The Contractor shall make surveys and layouts as necessary to delineate the work. The Contractor shall make the surveys for the proper performance of the Work. As a part of such surveys, the Contractor shall furnish, establish and maintain in good order survey control points that may be required for the completion of the Work subject to the approval of the Project Manager as to their location, sufficiency and adequacy. However, such approval by the Project Manager shall not relieve the Contractor of his responsibility for the accuracy of his survey work.

B. The Contractor shall furnish skilled labor, instrument platforms, ladders and such other temporary structures as may be necessary for making and maintaining points and lines in connection with the surveys required.

C. The City may draw the Contractor's attention to errors or omissions in lines or grades, but the failure to point out such errors or omissions shall not give the Contractor any right or claim nor shall in any way relieve the Contractor of his obligations according to the terms of this contract.

D. The Contractor's instruments and other survey equipment shall be accurate, suitable for the surveys required in accordance with recognized professional standards and in proper condition and adjustment at all times. Surveys shall be performed under the direct supervision of a Colorado licensed surveyor.

3.02 SURVEYING ACCURACY AND TOLERANCES IN SETTING SURVEY, LAYOUT AND QUANTITY CALCULATION STAKES

A. The tolerances generally applicable in setting survey stakes shall be as set forth in the CDOT Survey Manual, latest edition. Such tolerances shall not supersede stricter tolerances required by the drawings or specifications, and shall not otherwise relieve the Contractor of responsibility for measurements in compliance therewith.

3.03 AS-BUILT MEASUREMENTS

A. As-built measurement for items that will be hidden or visible including all civil, mechanical, electrical, control work and all utilities that are placed in concrete, earth or behind walls shall be made Items located within or five feet beyond a building shall be referenced to building column lines and finish floor elevations. Special attention shall be paid to items requiring service, sensors, items with moving parts, access points and locations of junctions, elevation changes and directional changes.

PART 4 - MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

PART 5 - PAYMENT

5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

END OF SECTION 01050

SECTION 01060

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section identifies primary compliance with the State, City and County of Denver's regulatory requirements including:

1. Colorado Department of Transportation
2. Department of Public Works (including The Division of Wastewater Management)

B. Construction shall be based on the latest edition of the referenced codes including additions and revisions thereto that are in effect at the time of project bidding.

1.02 BUILDING CODE

A. All design and construction work shall be governed by the Building Code for the City and County of Denver, latest edition. This is based upon the International Building Code of the International Code Council with Denver Amendments to this code.

1.03 DENVER BUILDING DEPARTMENT

A. For review and approval of all construction documents for compliance to the Denver building code:
City and County of Denver
Community Planning and Development
Building Inspection Division
201 West Colfax Avenue, Dept 205
Denver, Colorado 80202
Telephone 720-865-2720
Fax 720-865-2880

1.04 DENVER FIRE DEPARTMENT

A. For review and approval of plans for compliance with the Denver Fire Department's requirements as they apply to projects for the Department of Public Works:
Denver Fire Department
745 W. Colfax Ave.
Denver, Colorado 80204
Telephone 720-865-2833

B. The Contractor is advised that the Denver Fire Department – Fire Prevention Bureau requires permitting for the following activities as they apply to the scope of work. The Contractor is responsible for obtaining the appropriate permits necessary to complete the work. All costs associated with this permitting and policy compliance shall be the responsibility of the Contractor. The policies all reference the International Fire Code (IFC).

1. "Hot work", which is defined as the operation of any equipment or tool that creates sparks, hot slag, or radiant or convective heat as a result of the work. This includes, but is not limited to, welding, cutting, brazing, or soldering.

2. Use and storage of compressed gas for both temporary storage and permanent facility installation. This includes, but is not limited to, flammable gas (excluding propane-LPG), oxidizer (including oxygen), and inert and/or simple asphyxiates.

3. Tank installation, which includes above-ground storage tanks (AST) and underground storage tanks (UST) for both temporary tanks and permanent facility installations.

C. In addition to the above permits, the Denver Fire Department may require other permits that are associated with the specific work in the Contract Documents. Policies provided by the Denver Fire Department are meant to provide basic information for the most common conditions and situations. In any given occupancy, many other International Fire Code (IFC) requirements may be enforced. These should be addressed with the Denver Fire Department before construction begins and during construction with premise inspection(s). Any questions can be addressed to the Fire Prevention Bureau between 6:30 AM and 9:00 AM Monday-Friday at 720-913-8242 or -8237.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PERMITS AND CERTIFICATIONS

A. The Contractor shall maintain records on site of all permits acquired by federal, state, and local agencies. Posting of permits shall conform to requirements of the respective agencies.

B. At the completion of any inspection by other agencies, the Contractor shall forward copies of the status of the inspection and copies of any approved or "signed-off" inspections by the respective agencies to the Project Manager.

C. At the time of request for Substantial Completion, the Contractor shall forward to the Project Manager all permits approved by the respective agencies.

PART 4 - MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

PART 5 - PAYMENT

5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

END OF SECTION 01060

SECTION 01110

CONSTRUCTION SAFETY

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Work specified in this Section includes construction safety precautions and programs by the Contractor and the basis for reviews by the Project Manager.

B. Reference Contract General Conditions, GC 801 GC 802, GC 803.

1.02 RESPONSIBILITY

A. The General Conditions make it clear that all safety precautions during the construction process are the responsibility of the Contractor. The Contractor is responsible for the health and safety of his employees, agents, subcontractors and their employees, and other persons on the worksite; for the protection and preservation of the work and all materials and equipment to be incorporated therein; and for the worksite and the area surrounding the worksite. The Contractor shall take all necessary and reasonable precautions and actions to protect all such persons and property.

B. This Section shall be interpreted in its broadest sense for the protection of persons and property by the Contractor and no action or omission by the Project Manager or his authorized representatives shall relieve the Contractor of any of its obligations and duties hereunder.

1.03 SUBMITTAL

A. Refer to Technical Specifications Section 01300 and 01340 for the process. A safety plan shall be submitted by the General Contract prior to commencing any work.

1.04 PROJECT MANAGER'S REVIEW

A. The Contractor shall provide two (2) copies of its safety program to the Project Manager for review at least ten days before on-site construction begins. The Contractor's program must meet as a minimum all applicable federal, state and local government requirements.

1. The Contractor must, as part of the Contractor‘s safety program, submit one electronic file in the form of a security-free, fully bookmarked PDF file compatible with Adobe Acrobat 6.0 or newer and one body hard copy of the following information for acceptance by the Project Manager prior to construction:
    a. Name of the Contractor's site safety representative.
    b. If the Contractor is running multiple shifts or working more than 40 hours per week, the name of an assistant Contractor's safety representative who can act in the absence of the site safety representative.
    c. Twenty-four hours per day emergency phone numbers of Contractor site management to be used in case of injury or accident. Provide at least four contacts.
    d. The Contractor's method of ditching and trenching excavation to be used including how slopes will be stabilized with calculations showing the slope stability. The Contractor shall also show how material will be stored beside the excavation. Stored material will include the excavated and backfilled material.
    e. How injuries or accidents will be handled including samples of the forms used to

report injuries or accidents.

f. How employees will be handled who are unable to safely perform their duties, including how the Contractor will determine whether an employee is unable to safely perform his duties.

g. How and when equipment will be checked to see that it is safe, that all safety guards are in place and that the equipment is being used for its designed purpose and within its rated capacity.

h. How and when all electric devices will be checked for proper grounding and insulation. What system will be used to lock out electric systems that should not be energized.

i. How trash and human organic waste will be disposed.

j. How snow and ice will be removed by the Contractor within the project area.

k. How concrete forms will be anchored to ensure their stability, including calculations showing that the forms will safely hold the maximum construction loads.

l. How flammable materials will be stored and handled, and how any spills will be cleaned up and removed for disposal.

m. What system will be used to prevent fires, and if fires do occur who will be trained to fight them. Also what fire fighting equipment will the Contractor have available and how will this equipment’s condition be monitored.

n. How materials will be received, unloaded, stored, moved and disposed of.

o. How personnel working above ground level will be protected from falling.

p. How people working underneath work will be protected.

q. What will be done to protect personnel in case of severe weather.

r. How adequate lighting will be provided and monitored.

s. How the safety of work platforms, man lifts, material lifts, ladders, shoring, scaffolding, etc. will be ensured relating to load capacity and the protection of personnel using or working around them.

B. Prior to the start of any work by a contractor or subcontractor employee, the Contractor shall provide the Project Manager with a list of its employees, subcontractor's employees and other personnel the Contractor has requested to work on site, who have signified in writing that they have been briefed on, or have read and understand, the Contractor's Safety Plan.

PART 2 - PRODUCTS

2.01 CONTRACTOR'S SAFETY PLAN

A. Provide a Contractor's Safety Program as described in Part 1 of Technical Specifications Section 01110.

PART 3 - EXECUTION

3.01 IMPLEMENT CONTRACTOR'S SAFETY PLAN

A. Implement the approved Contractor's Operational Safety Plan as described in Part 1 of this Technical Specifications Section 01110. Technical Specifications Section 01110.

PART 4 - MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

PART 5 - PAYMENT

5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

END OF SECTION 01110

SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work specified in this Section requires the Contractor's Project Manager, Superintendent and Quality Control representative to attend meetings scheduled by the City for the collection and dissemination of information related to the subject contract.

B. The Project Manager will prepare the minutes of each meeting and distribute them to each of the participants.

1.02 OTHER MEETINGS

A. The Contractor will be advised of times, dates and places of contract meetings.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PRECONSTRUCTION MEETING

A. A Preconstruction Meeting will be scheduled by the City after the Contract has been signed by all parties. The purpose of this meeting is to introduce the City's Representatives to their counterparts in the Contractor's organization and to establish lines of communication between these representatives and outline some contract requirements. The Contractor's Superintendent, Contractors Project Manager, Contractors LEED manager and Quality Control Representative(s) shall attend this meeting.

B. The Project Manager will distribute a notice of this meeting, along with an agenda of the subjects to be addressed.

C. The Project Manager will explain and discuss the responsibilities and authorities of the City, the Designer, and the Project Manager's organization.

D. The Project Manager will provide highlights of the following information at this meeting:

1. Minority Business Enterprise (MBE) and Women Business Enterprise (WBE) requirements.
2. Insurance, laws, codes, traffic regulations and permit requirements of public agencies and their regulations.
3. Procedures for processing change orders.
4. Procedures for submitting shop and working drawings, product data and samples.
5. Monthly pay estimate cutoff dates.
6. Payment procedures.
7. Request for information procedures.
8. Communication procedures.
9. Contractor-required Daily Report showing the quantitative progress of work, the use of men, material and equipment, problems, potential delays, weather, shift, down equip-

ment, material and equipment received and information received from the City. Daily reports will be submitted to the Project Manager within 48 hours of start of work. Daily Reports are required every day, including weekends and holidays.

10. Scheduling and coordination requirements.
11. Quality control/assurance procedures.
12. Environmental requirements and permits.
13. As-built documents.
14. Project closeout requirements.

E. The Contractor will introduce the Contractor's representatives and briefly describe each person's responsibilities. The Contractor will provide the following:

1. A list of all subcontractors.
2. Office, storage areas and construction area layouts, along with temporary easements.
3. Safety, first aid, emergency actions and security procedures including the name of the Contractor's insurance company.
4. 60 day preliminary schedule.
5. Sequence of Work.
6. Construction methods and general worksite layout and haul plan.
7. Housekeeping procedures.
8. The Contractor‘s general erosion and sedimentation control plans, noise, hazardous material, air and water pollution control plans and Quality Control Plan.
9. Coordination and notification for utility work.
10. Deliveries and priorities of major equipment.
11. Submittal Schedule

F. Explanations provided by the City will not amend, supersede or alter the terms or meaning of any contract document, and the Contractor shall not claim reliance on such explanations as a defense to any breach or failure by the Contractor to perform as specified in the contract.

3.02 CONSTRUCTION PROGRESS MEETINGS

A. Progress meetings will be scheduled weekly and more often as necessary by the Project Manager to promote the competent and timely execution of the contract.

B. The meetings will be held at the worksite or at a location selected by the Project Manager. Meetings will be chaired by the Contractors Project Manager.

C. The Contractor's personnel, as listed in Technical Specification Section 01200, 3.01.A, shall attend unless otherwise agreed by the Project Manager.

D. The Project Manager will be responsible for publishing minutes of the meetings.

E. At a minimum, the following items will be addressed at each meeting. The items addressed in the meeting do not waive notification or submittal requirements as required elsewhere in the contract.

1. Safety: Contractor shall report any safety issues

2. Quality Control
   a. The Contractor's Quality Control Representative shall present and discuss the Independent Testing Agency weekly test report and/or testing schedule.
   b. The Contractor's Quality Control representative shall report on inspections by other agencies and any follow-up activity required.
   c. The Project Manager will present and discuss issues regarding quality control.
3. Quality Assurance
   a. The Project Manager will present and discuss issues regarding quality assurance
4. Pre-installation Meeting(s):
   a. as listed in individual specification sections and as follows:
   b. Access Floor
   c. Tile
   d. Drywall: to confirm blocking, electrical and data box locations. For owner provided and installed equipment and specialties and general confirmation.
   e. Water Proofing: on exterior concrete. Chalk layout on site to confirm water proofing will be below grade.
   f. Metal Fabrication: North and east screen walls.
5. Design activities: open discussion
6. Shop drawings/submittals/material procurement
   a. The Contractor shall provide and review the Contractor's submittal schedule and provide any updated information and/or changes to the schedule.
   b. The Contractor shall provide information on the status of submittals requiring resubmittal.
   c. The Contractor shall review any accepted submittals that the Contractor plans to re-submit with changes.
   d. Contract shall provide the status of material procurement for long-lead items (long-lead items are materials and equipment that have a fabrication and/or delivery duration that exceeds 15 working days). This information shall be provided by the Contractor in a format satisfactory to the City Project Manager and shall include, at a minimum: submittal/shop drawing preparation duration, review duration, fabrication duration and a delivery duration. All long-lead items shall be identified with a separate activity on the approved CPM project schedule.
7. Construction activities: Open discussion to include coordination items with other Contractors and or agencies.
8. Schedule
   a. The Contractor shall provide to the Project Manager the Contractor's three week look-ahead schedule and review at the meeting the items on the schedule. The schedule shall be in bar chart format based on the approved CPM, and shall include dates of testing activities, items in progress, percentage of completion of items, responsible subcontractor for the items.

PART 4 - MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

PART 5 - PAYMENT

5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

END OF SECTION 01200

SECTION 012200

UNIT PRICES

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work specified in this Section summarizes the administrative and procedural requirements for the unit prices requested by the City.

B. Reference Contract General Conditions, GC 902, 904, 1104.

1.02 DEFINITIONS

C. Unit price is a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.03 PROCEDURES

D. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

E. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

PART 4 - SCHEDULE OF UNIT PRICES

A. Unit Price 1a & 1b: Optic Windows and Roller Shades on South and West walls of Story Time Tower.

1. Description: Provide Optic Window Assembly and Roller Shades as indicated in contract documents. Unit pricing requested is for the City and Public Art contract negotiations.

   Unit of Measurement: Provide pricing:
   a. Per (1) Optic Window assembly.
   b. Per (1) Electrically Powered, Blackout Roller shade individually controlled.

END OF SECTION 012200

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Additive Alternate No 1: Full Dimming with lighting control panels

1. Base bid: As indicated in Documents provide standard ballast with (1) bi-level dimming option.
2. Alternate: Provide 10%-100%, 0-10V Dimming Ballasts for all luminaires shown to have only bi-level switching. Include Wattstopper #LMRC-210 series digital on/off/0-10 volt dimming room controllers for each lighting control zone currently shown on the floor plans. Provide LMLS-500 series photosensor and LDMX-100 series occupancy sensor in lieu of photosensor and occupancy sensor currently specified on the floor plans. Provide LMDM-101 series digital dimming wall switch for each zone in lieu of switches shown on plans.

B. Additive Alternate No. 2: Higher quality glazing

1. Base Bid: As indicated in Documents.
2. Alternate: As indicated in Documents provide pricing for changing Glazing Types on the north and partial west elevations indicated in the Window Schedule information on A-600 and A-601 as follows:
   a) From type C to E
   b. type B remains as type B
   c. type D remains as type D

C. Additive Alternate No. 3: Snowmelt system.

1. Base bid: No snowmelt. As indicated on drawings.
2. Alternate 3a: Provide pricing for circulated hot water snowmelt as indicated on M-100
3. Alternate 3b: Provide pricing for circulated hot water snowmelt as indicated on M-100

D. Additive Alternate No. 4 Add twelve (12) more Solatubes

1. Base Bid: As indicated on Drawings.
2. Alternate: Provide pricing for 12 additional solatubes in locations indicated in Documents.

E. Additive Alternate No 5: Hold Area Lighting

1. Base bid: Nothing as indicated on drawings.
2. Alternate: Provide pricing for added luminaires and associated branch circuiting in this area as indicated in documents.

F. Additive Alternate No. 6: Windows in Children's area

1. Base bid: As indicated in Documents, on south elevation, in lieu of windows shown, provide Wall Type WA-1 with Stucco Type SC-2, and on west elevation, in lieu of window shown, provide WA-3 with S.02S finish on the concrete face exposed to view.
2. Alternate: As indicated in Documents, in lieu of construction indicated in base bid provide pricing for glazing along the south and west elevations. Glazing types: as indicated in documents. Note, interior daylight shelf associated with west facing window is to be part of this alternate, not part of base bid.

G. Additive Alternate No. 7: Acoustical treatments in the "Studio"

1. Base Bid: Provide partition assemblies, ceiling assembly, floor assembly and finishes as indicated on drawings.
2. Alternate: Provide (8) Acoustical Panels (AP2), 4’-0” wide by 6’-0” tall.
   a. Install panels as follows:
      1) Bottom of panel 4’ above finish floor.
      2) Centered panels horizontally on the wall.
      3) North Wall: 1 panel
      4) East Wall: 3 panels
      5) South Wall: 3 panels
      6) West Wall: 1 panel

END OF SECTION 012300

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work specified in this Section summarizes the requirements for the submittal of documents to the City that are defined in these Specifications. It also describes the procedures for "supplemental" submittals.

B. Reference Contract General Conditions, GC 309 and GC 405.

PART 2 - PRODUCTS

2.01 SUBMITTAL SCHEDULE

A. The Contractor shall provide a submittal schedule within 14 days after Notice to Proceed. The Submittal Schedule shall be directly related to the CPM schedule, shall identify all the submittals, and shall include the following information for each submittal item:

1. Specification section, contract article, or special condition
2. Specification Subparagraph
3. Item description
4. Date the submittal shall be submitted
5. Name of subcontractor or supplier

B. The submittal schedule shall be updated every week by the Contractor and submitted with the progress payment request.

C. One electronic submittal submitted on a single CD-ROM or DVD-ROM.

2.02 ELECTRONIC SUBMITTALS

A. All submittals shall be delivered to the Project Manger and Designer in electronic format.

1. Acceptable electronic formats
   a. Adobe Acrobat 8.0 or newer. All files shall be fully compatible with Adobe Acrobat 8.0. File shall have no security and bookmark every applicable submittal.
2. Formats are acceptable only with written permission of the project manager or required by individual spec sections:
   a. Microsoft Office 2003 (2007 preferred) or newer. All files shall be fully compatible with Microsoft Office 2003.
   b. AutoDesk AutoCAD 2007 or newer. All files shall be fully compatible with AutoDesk AutoCAD 2007.
      1) AutoCAD files shall be self contained with no external x-references.
   c. Other files pre-approved by the Project Manager.
3. Electronic file names: Each electronic document shall have a unique file name. File name convention shall be as follows unless otherwise agreed to by Project Manager: -AAA-BBBBB-CCC-RZ
   a. AAA = sequential submittal number starting at 001.

b. BBBBB = specification section containing submittal requirements
c. CCC = sequential specification submittal number starting at 001.
d. RZ = sequential revision number. RZ not required on initial submittals.
e. Example A:005-01370-002", five submittals have been logged overall with two submittals made to specification section 01370.
f. Example B: 009-01370-002-R3, nine submittals made overall and three revisions to submittal 01370-002.

2.03 INITIAL SUBMITTAL

A. Each submittal document shall include a title block showing the following information:

1. Date of submittal and revision dates.
2. Contract title and number.
3. The names of Contractor, subcontractor, supplier, manufacturer and when applicable, the seal and signature of an engineer registered in the State of Colorado, for the involved discipline.
4. Identification of product by either description, model number, style number or lot number.
5. Subject identification by contract drawing or specification reference.

B. On each submitted drawing, include a blank space on each sheet, three inches by four inches, in the lower right corner, just above the title block, in which the City or the Designer of Record may indicate the action taken.

C. Make submissions sufficiently in advance so that the Designer and City review may be completed before any material procurement or Work represented by those submittals is scheduled to be performed.

D. Allow a minimum cycle of 10 working days for review of each submittal to be reviewed by the City.

E. Allow a minimum cycle of 10 working days for review of each submittal to be reviewed by the Designer.

F. Allow a minimum cycle of 15 working days for review of submittals that require multiple parties to review and coordinate, such as structural steel.The Contractor shall at the time of submission describe variations from the contract documents in writing, separate from the submittal document. If the Designer and the Project Manager approves any such variations, an appropriate contract change order shall be issued except that, if the variation is minor and does not involve a change in price or in time of performance, a modification need not be issued. If a submission contains variations and the variation column is not marked on the transmittal form, it will not be considered for review and acceptance. Along with marking the transmittal as a variation, a description must be included which outlines all the differences including maintenance and utility services along with any cost savings from an item not containing the variation.

G. Changes in accepted submittal documents will not be permitted unless those changes have been accepted, in writing, by the City.

H. The form and quality of submittal documents shall comply with Technical Specifications Section 01340.

2.04 SUPPLEMENTAL SUBMITTALS

A. Supplemental submittal documents initiated by the Contractor for consideration of corrective procedures shall contain sufficient data for review. Make supplemental submittals in the same manner as initial submittals with the appropriate primary transmittal referenced.

PART 3 - EXECUTION

3.01 CONTRACTOR'S REVIEW

A. The Contractor shall review submittal documents, stamp and sign as reviewed and approved as complying with contract documents prior to submission to the City.

3.02 CITY REVIEW

A. Submittal documents will be reviewed by the Designer and the Project Manager for conformance to requirements of the contract drawings and specifications. Review of a separate item will not constitute review of an assembly in which the item functions. The Designer or the Project Manager will withhold approval of submittals that depend on other submittals not yet submitted. Review and acceptance will not relieve the Contractor from his responsibility for accuracy of submittals, for conformity of submittal document to requirements of contract drawings and specifications, for compatibility of described product with contiguous products and the rest of the system, or for protection and completion of the contract in accordance with the contract drawings and specifications.

B. The Designer, and/or the Project Manager will review the submittal documents for general conformance with the contract documents and mark the Action Code, sign and date the transmittal.

C. The Action Codes have the following meanings:

1. **A - ACCEPTED** is an approval, and means that the illustration and description appears to conform to the respective requirements of the contract documents.
2. **B - ACCEPTED AS NOTED** is an approval, and means that the illustration and description will conform to the respective requirements of the contract documents after changes in recognition of the reviewer's comments. Submittals so marked need not be resubmitted.
3. **C - REVISE AND RESUBMIT** means that the submittal is unacceptable and must be revised and resubmitted.
4. **E - NOT ACCEPTED** means that the submittal is not approved and that a new submittal in accordance with the contract documents shall be made.
5. **F - RECEIPT ACKNOWLEDGED**, means an item is received by the Designer and Project Manager but no review was made. This mark is for use in resubmitting items that were previously Accepted as Noted and the Contractor has incorporated the notes and wants the Project Managers' staff to have the same material that the Contractor's field staff is using.

3.03 CONTRACTOR'S RESPONSIBILITIES

A. Coordinate each submittal document with the requirements of the Work; place particular emphasis upon ensuring that each submittal of one trade is compatible with other submittals of that trade and submittals of other trades including producing as needed drawings showing the relationship of the work of different trades.

B. Contractor's responsibility for errors and omissions in submittal documents and associated calculations is not relieved by the City's review, correction and acceptance of submittals.

C. Contractor's liability to the City, in case of variations in the submittal document from the requirements of the contract documents, is not relieved by the City's review and acceptance of submittals containing variations unless the City expressly approves the deviation in writing, in which the City describes the variation.

D. The Contractor shall maintain a file of all approved submittal documents at the worksite. The complete file of approved submittal documents shall be turned over to the City with the as-built documents at the end of the job.

E. Schedule impact due to resubmittal requirements is the responsibility of the Contractor.

PART 4 - MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

PART 5 - PAYMENT

5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

END OF SECTION 01300

SECTION 01310

SCHEDULE

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section specifies the preparation of a preliminary schedule, construction schedule, related narratives and monthly progress reports, all encompassing complete performance of contract requirements.

B. The Contractor shall schedule and coordinate the work of all of its subcontractors and suppliers including their use of the worksite. The Contractor shall keep the subcontractors and suppliers informed of the project construction schedule to enable the subcontractors and suppliers to plan and perform their work properly.

C. The Contractor shall, in accordance with the requirements of the technical specifications, submit a construction schedule that shall provide for the expeditious and practicable execution of the Work.

D. The construction schedule for the performance of the Work shall be a Critical Path Method (CPM) system in bar chart format, unless an alternate system is specifically identified in the technical specifications, with reasonable detail including a time scaled network and computer printout as more fully detailed in the technical specifications.

E. Float or slack is defined as the amount of time between the early start date and the late start date or the early finish date and the late finish date of any activities in the schedule. Float or slack is not time for the exclusive use or benefit of either the Contractor or the City.

F. The Contractor shall submit a monthly progress report and schedule update in accordance with the scheduling provisions of the technical specifications.

G. The Contractor shall complete the Work within the contract time and in accordance with the most recent schedule submittal that has been approved in writing by the Project Manager.

H. Reference Contract General Conditions, GC 306, GC 603, GC 909, GC1103, GC 1202

1.02 PLANNING

A. The schedule shall show total contract time, including project milestones, as indicated in the Special Conditions or elsewhere in the contract documents.

B. The Contractor shall prepare a work plan to complete the work within the contract time and complete those portions of work relating to each milestone date and other contract requirements. The Contractor shall generate a computerized Critical Path Method (CPM) schedule in the Precedence Diagram Method (PDM) format for the Work. The computerized format shall be compatible with the City's Primavera system, version 3.1 or Microsoft Office Project Professional 2003 or later. The Schedule shall be submitted electronically to the Project Manager in a dynamic format which will allow review and manipulation of any part of the schedule, and in reproducible hard copy. The schedule activities shall be resource loaded showing labor man hours by crafts, major construction equipment by type and value of the work. The value of the work shall summarize each pay item shown in the Schedule of Val-

ues and balance to their amount.

C. In addition to the construction activities the schedule shall include activities for furnishing materials and equipment and vendor shop drawing preparation. The construction schedule, a supporting narrative, and the overall progress curve shall be submitted for approval within 30 days after Notice to Proceed. Within 30 days the City will respond with approval or direction to revise and resubmit within ten days. Failure of the Contractor to have a construction schedule approved by the City will be considered cause for withholding progress payment(s).

D. To the extent that the construction schedule or any revisions thereof contains anything not jointly agreed upon in writing, or fails to show anything jointly agreed upon in writing, it shall not be considered to have the approval of the City. Failure to include any work item required for performance of this contract shall not excuse the Contractor from completing all work within applicable completion dates, regardless of the City's approval of the schedule.

E. Failure of the Contractor to comply with this Section will be considered cause for withholding progress payment(s) or termination for default.

1.03 SUBMITTALS

A. Refer to Technical Specifications Section 01300 for submittal procedures. Submit the following as indicated:

1. Preliminary schedule (with narrative)
2. Construction schedule data and work plan (with narrative)
3. Monthly progress report
4. Construction schedule change request (as needed)
5. As built construction schedule.
6. Full size schedule (original approved) and latest approved schedule for posting in the onsite office.

PART 2 - PRODUCT

2.01 PLOT AND REPORT FORMAT

A. All plots shall be either 24 x 36 inches or 36 x 44 inches. They shall contain a title block with a minimum 18-point font showing:

1. Contractor's name
2. Contract number and title
3. Plot date
4. Data date
5. Symbol definitions
6. List of all approved changes to the original approved schedule.

B. Plots shall contain a time line at the top.

C. Reports shall be submitted on 8 ½ x 11-inch paper with a one-inch margin in a 3-ring binder, or as directed by the Project Manager.

PART 3 - EXECUTION

3.01 PRELIMINARY SCHEDULE

A. The Contractor shall prepare a preliminary schedule covering the first 90 calendar days of the contract. All reports shall be on 8 ½ x 11-inch paper. This preliminary schedule shall be submitted at the Preconstruction Meeting and shall be accompanied by a narrative description of the work plan. Within 14 days, the City will respond with acceptance or direction to revise and resubmit within ten days.

B. The preliminary schedule shall show all significant work tasks that occur in the first 90 days, including planning, mobilization, shop submittals and approvals, procurement, fabrication and construction. It shall identify work items or milestones that affect or are affected by the City, other Contractor's work, utilities and other third parties, and it shall list major data submittals required by the contract.

C. The preliminary schedule shall be accompanied by a narrative describing the Contractor's approach to mobilization, procurement and construction during the first 90 days. The narrative shall elaborate on the basis of duration, production rates, major equipment to be used, and shall identify all major assumptions used to develop the schedule.

3.02 CONSTRUCTION SCHEDULE

A. The construction schedule shall be a computerized CPM schedule that includes:

1. Work items identified in a Work Breakdown Structure (WBS) format that corresponds with the technical specifications.
2. The order, sequence and interdependence of all significant work items including construction, procurement, fabrication, testing, startup and inspection and delivery of critical or special materials and equipment, submittals and approvals of critical samples, shop drawings, procedures, or other documents that could have a schedule impact.
3. Work items by the City, other Contractors, utilities and other third parties that may affect or be affected by Contractor's activities.
4. Proper referencing of all work items to identify applicable subcontractors or other performing parties.
5. Work item duration not to exceed 20 working days. No more than 25 percent of the work item may be on the critical path.
6. Work items shall be resource loaded to show the direct craft man-hours estimated to perform the work including work by subcontractors.
7. A narrative that explains the basis for the Contractor's determination of construction logic. It shall include estimated quantities and production rates, hours per shift, work days per week, and types, number and capacities of major construction equipment to be used and whether the Contractor plans to work weekends or holidays.

B. The construction schedule shall be prepared to include the data for the total contract duration, and the critical path shall be identified, including critical paths for interim completion dates. Scheduled start or completion dates imposed on the schedule by the Contractor shall be consistent with contract milestone dates. Milestone events shall be the schedule dates specified in the Special Conditions and shall be prominently identified and connected to the appropriate work item, denoting its start or completion. Work items related to any interim milestones shall be coded for that milestone.

C. The Contractor shall submit the following documents to the City upon completion of preparation of the construction schedule:

1. A time phased plot of the CPM schedule in PDM format showing all logic ties and an electronic copy in dynamic format.
2. Various computer generated construction schedule reports that contain the following data for each work item: Identification, description, responsibility, duration, early start and early finish, late start and late finish, total float, and resources. The work items shall be sorted by float, early start, subcontractor or other sorts mutually agreed to. The reports shall also show the logic ties of successor and predecessor work items.
3. A physical progress curve showing either manpower or other appropriate key contract items derived from the construction schedule and against which physical progress performance will be measured for schedule and payment purposes.
4. The narrative described in Technical Specifications Section 01310-3.02.A.7.

3.03 PROGRESS REPORTING

A. The Contractor shall submit a monthly progress report at the end of each month following the Notice to Proceed. At the end of each month, the Contractor and Project Manager shall agree on the progress of the work and the Contractor shall update the construction schedule accordingly. The updated construction schedule is a prerequisite to the submittal of the Contractor's application for progress payment. The schedule shall be made in accordance with Technical Specifications Section 01310-3.02. This review does not constitute an approval of the construction schedule and shall not be used for the purposes of modifying the initially approved construction schedule.

B. The Contractor shall submit the monthly progress report consisting of a written narrative and various construction schedule reports. This report will be reviewed in a meeting between the Contractor and Project Manager.

1. The narrative report shall describe overall progress of the work, provide a critical path analysis, discuss significant problems with proposed corrective action, and show the status of major changes and any other changes in sequence of the Work.
2. The construction schedule reports shall include tabular reports showing the status of resources for completed and in progress work items and for work items scheduled to start in the next 30 days. The report shall include all the information outlined in Technical Specifications Section 01310-3.02.C.2.
3. A bar chart format schedule shall be provided showing the Contractor’s completion status (progress) on each work item along with plots described in Technical Specifications Section 01310-3.02.C.1.
4. The physical progress curve shall be updated to show actual progress.

C. The latest completion time for any work item does not fall within the time allowed by the construction schedule, the sequence of work and/or duration shall be revised by the Contractor through concurrent operations, additional manpower, additional shifts or overtime, additional equipment or alternative construction methods until the schedule produced indicates that all significant contract completion dates, occupancy dates and milestones will be met. No additional costs will be allowed if such expediting measures are necessary to meet the agreed completion date or dates except as provided elsewhere in the contract documents.

3.04 SCHEDULE CHANGES

A. The Contractor's request for construction schedule changes shall be made on the latest approved construction schedule and shall be accompanied by a narrative description and justification for the change, and shall be submitted in accordance with the General Conditions

Title 1105 on changes in time. Minor revisions submitted at monthly progress review meetings are not considered as changes in this context.

B. The construction schedule may be changed when one or more of the following occur:

1. When a change order significantly affects the contract completion date or sequence of work items.

2. When the Contractor elects to change the sequence or duration of work items affecting the critical path.

3. When the City directs a change that affects a milestone date(s) specified in the Special Conditions or alters the length of a critical path.

C. If, after submitting a request for change to the construction schedule, the Project Manager does not agree with the request, the Project Manager will schedule a meeting with the Contractor to discuss the differences. If a settlement cannot be reached on the change in the construction schedule or if the Contractor has failed to submit revisions to the network, the Project Manager has the option of providing suggested logic and/or duration times in all subsequent updating reports. The suggested logic and/or duration times will remain in effect until the change in the construction schedule is settled or until the logic and duration are superseded.

1. If the Contractor has any objections to the data furnished by the Project Manager, he shall advise the Project Manager within ten days in writing, fully supporting the objections with a counter plan. The revisions suggested by the Project Manager shall be used for updating reports until the Project Manager approves the counter plan.

2. If the Contractor does not submit a counter plan and data within ten days after the date of the Project Manager's suggested logic, the Contractor is deemed to concur with the Project Manager's suggested logic/duration time changes. The Project Manager's plan will be the basis of negotiations for any adjustment of the time and cost for performance of the Work.

3.05 CONTRACT EXTENSIONS

A. If the Contractor is granted an extension of time for completion of any milestone or contract completion date under the provisions of the contract, the determination of the total number of extended days will be based upon the current analysis of the schedule and upon all data relevant to the extension. Such data shall be incorporated in the next monthly update of the schedule.

B. The Contractor acknowledges and agrees that delays in work items which, according to schedule analysis do not affect any milestone dates or contract completion date shown on the CPM network at the time of the delay will not be the basis for a contract extension.

3.06 AS-BUILT CONSTRUCTION SCHEDULE

A. After all contract work items are complete, the Contractor shall submit an as built construction schedule showing actual start and finish dates for all work items and milestones.

PART 4 - MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

PART 5 - PAYMENT

5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

END OF SECTION 01310

SECTION 01340

SHOP AND WORKING DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work specified in this Section consists of preparing and submitting shop and working drawings, product data, samples and record documents required by other technical specifications sections.

1. The Contractor shall submit all shop drawings, working drawings, product data and samples, as defined in Title 1 of the City and County of Denver, Department of Public Works, Standard Specifications for Construction and the Contract Documents, 1999 Edition General Conditions, to the Designer in accordance with the requirements in the technical specifications. The Designer will return one copy of the shop drawings, working drawings and product data to the Contractor with a written transmittal within the time periods noted in the technical specifications.

B. Reference Contract General Conditions, GC 110, GC 117, GC 405.

1.02 SUBMITTALS

A. Refer to Technical Specifications Section 01300 for submittal procedures.

B. All submittals shall be delivered to the Designer and Project Manager in electronic format. All submittals must be of a consistent format (all Acrobat or all Word, etc). No combination of electronic file types will be allowed unless required by a specific specification section..

1. Acceptable electronic formats
   a. Adobe Acrobat 8.0 or newer. All files shall be fully compatible with Adobe Acrobat 8.0
   b. Formats are acceptable only with written permission of the Project Manager or required by individual spec sections:
      1) Microsoft Office 2003 (2007 preferred) or newer. All files shall be fully compatible with Microsoft Office 2003.
      2) AutoDesk AutoCAD 2007 or newer. All files shall be fully compatible with AutoDesk AutoCAD 2007.
         a) AutoCAD files shall be self contained with no external x-references.
      3) Other files pre-approved by the Project Manager
2. Adobe Acrobat Requirements:
   a. Drawings shall have security set to “No Security”. Commenting, printing, adding photos, form fields and document signing must be allowed.
   b. PDF submittals shall be one continuous file. No external links are allowed.
   c. All individual components of submittals shall be bookmarked inside the PDF file.
   d. All original documents shall be directly converted from the original electronic format to PDF. Scanning of files shall only be allowed by the Project Manager when the original electronic information is not obtainable.
   e. Failure to comply with these requirements will result in a return of file to the Contractor for immediate revision.

1. Electronic file names: Each electronic document shall have a unique file name. File

name convention shall be as follows unless otherwise agreed to by Project Manager: -AAA-BBBBB-CCC-RZ

a. AAA = sequential submittal number starting at 001.
b. BBBBB = specification section containing submittal requirements
c. CCC = sequential specification submittal number starting at 001.
d. RZ = sequential revision number. RZ not required on initial submittals.
e. Example A:005-01370-002", five submittals have been logged overall with two submittals made to specification section 01370.
f. Example B: 009-01370-002-R3, nine submittals made overall and three revisions to submittal 01370-002.

C. Quantities

1. Post electronic submittals as PDF electronic files directly to Designer's FTP, Contractors FTP site or a site specifically established for the Project.
   a. The Contractor should send an email for each submittal posted to all parties notifying them the submittal is available for review.
   b. The Project Manager or Designer will send an email to the Contractor when the submittal review is complete.
2. Contractor can submit electronic submittals via email as PDF electronic files if approved by the Project Manager.
3. Four samples of each item specified in the various specification sections, unless otherwise specified.
4. Note: If manufacturer's printed information is in color, all copies of submittals must be in color.
   a. Printed information is only allowed when electronic copies are not possible.

D. Review

1. Submittal review comments by the City and the Designer will be in electronic form and incorporated into the electronic submittal file.
2. Resubmittals of electronic documents shall modify the original electronic file with new information and include the City and the Designer's comments with appropriate responses and additional information.

1.03 CHANGES

A. Changes in products for which shop or working drawings, product data or samples have been submitted will not be permitted unless those changes have been accepted and approved in writing by the City and County of Denver.

PART 2 - PRODUCTS

2.01 SHOP AND WORKING DRAWINGS

A. Include the following as they apply to the subject:

1. Contract title, work order and number.
2. Respective contract drawing numbers.
3. Applicable specification section numbers.
4. Relation to adjacent structure or materials.

5. Field dimensions clearly identified as such.
6. Applicable standards such as ASTM or Federal Specification number, and pertinent authority specifications or standards.
7. Identification of deviations from the contract drawings and specifications.
8. Drawing name, number and revision.
9. Contractor's stamp, initialed or signed, certifying:
   a. Verification of field measurements.
   b. Review of submittals for compliance with contract requirements.
   c. Compatibility of the Work shown thereon with that of affected trades.
10. Blank space on each sheet per Technical Specifications Section 01300, paragraph 2.02.B.

B. Drawings of equipment and other items that contain multiple parts shall include exploded views showing the relationship of parts and the description of the parts into the smallest units that may be purchased or serviced.

2.02 PRODUCT DATA

A. Modify manufacturer's standard and/or schematic drawings to delete information which is not applicable to the contract. Supplement standard information with additional information applicable to this contract.

B. Modify manufacturer's standard(s), diagrams, schedules, performance charts, illustrations, calculations and other descriptive data to delete information which is not applicable to the contract. Indicate dimensions, clearances, performance characteristics and capacities. Include with the submittal electrical, plumbing, HVAC and any other diagrams, as applicable.

C. Modify erection, application and placing instructions to delete information that is not applicable to the contract or work order.

D. Include the following:

1. Contract title, work order and number
2. Respective contract drawing numbers
3. Applicable contract technical specification section numbers
4. Applicable standards such as ASTM or Federal Specification number, and pertinent authority specification or standards
5. Identification of deviations from the contract drawings and specifications
6. Contractor's stamp, initialed or signed, certifying:
   a. Dimensional compatibility of the product with the space in which it is intended to be used
   b. Review of submittals for compliance with contract requirements
   c. Compatibility of the product with other products with which it is to perform or which will be next to it.
   d. The products electrical, plumbing, control and HVAC requirements conform to contract documents and the necessary utilities are provided for in the contract documents.

E. Certificates of compliance shall be submitted for all products. The certificates shall:

1. State that the product complies with the respective specification and contract drawing requirements
2. Be accompanied by a certified copy of test results pertaining to the product
3. Show the submittals date, Contractor's name and address, contract title and number, product represented and its location in the contract, producer's name, product trade name and catalog number, place of product origin, test date, testing organization's name and address, quantity of the product to be furnished and related contract drawing and specification section numbers
4. Be signed by an officer or another authorized representative of the producer and notarized

2.03 SAMPLES

A. Submit samples of sizes and quantities to clearly illustrate full color range and functional characteristics of products and materials including attachment devices.

B. Erect field samples and mock ups at the worksite as specified in the several technical specifications sections and at locations acceptable to the Project Manager. All field samples shall be erected in a location that will be readily visible throughout the life of the contract to allow comparison of the work as it progresses to the field sample.

C. The Contractor shall verify, through appropriate inspections and tests, that the samples submitted meet the specifications and shall provide inspection and test data with the samples. The review and comments on the sample shall not relieve the Contractor of his responsibility for completion of the contract.

D. Show the following information:

1. Contract title and number
2. Respective contract drawing numbers
3. Applicable technical specification section numbers
4. Applicable standards such as ASTM or Federal Specification number
5. Identification of deviations from the contract drawings and specifications
6. Contractor's stamp, initialed or signed, certifying:
   a. Dimensional compatibility of the product with the space in which it is intended to be used
   b. Review of submittals for compliance with contract requirements
   c. Compatibility of the product with other products with which it is to perform or which will be next to it
7. If multiple samples are submitted and the Project Manager is requested to make a choice, each sample shall have a unique identification number attached to it so the returned transmittal can state the identification number of the accepted sample and the Contractor will know which one it is.

PART 3 - EXECUTION

3.01 CONTRACTOR RESPONSIBILITIES

A. Verify field measurements, catalog numbers and similar data.

B. The Contractor shall not start work for which submittals are required until a transmittal has

been received by the Contractor showing acceptance or acceptance as noted by the Project Manager.

C. Before making submittals ensure that products will be available in the quantities and at the times required by the contract.

D. Submit final, corrected, electronic drawings of contract and shop and working drawings showing the Work as actually installed, placed, erected and applied. Refer to Technical Specification Section 01700, Contract Closeout.

PART 4 - MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

PART 5 - PAYMENT

5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract Price.

END OF SECTION 01340

SECTION 01370

SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work specified in this Section consists of preparing and submitting the Schedule of Values ("Schedule") as referenced in the General Conditions. The Schedule will be built upon a breakdown of the Work using specification sections and milestones. The Work also includes the preparing and submitting of updated copies of the Schedule if the Schedule is affected by change orders.

B. A Schedule of Stored Material is a detailed cost breakdown for permanent materials that will be temporarily stored prior to their being installed and for which the Contractor seeks partial payments. The Schedule of Stored Material will be incorporated as a part of the Schedule of Values.

C. Within 14 calendar days of issuance of the Notice to Proceed, the Contractor shall submit the Schedule of Values including the Schedule of Stored Material if applicable. The Schedule of Values and Schedule of Stored Material used to prepare the work/cost breakdown for the Schedule will be used for the Contractor's billings.

D. Any contract allowances shall be included in the Schedule. Expenditure of allowances shall be done through the use of the Allowance Authorization form. Use of this form does not increase or decrease the contract value.

E. Reference Contract General Conditions, GC 902, GC 903 and GC 906.

1.02 RELATED DOCUMENTS

A. Technical Specifications Section 01300 Submittals

B. Technical Specifications Section 01340 Shop and Working Drawings, Product Data and Samples

C. Technical Specifications Section 01999 Standard Forms

1.03 SUBMITTAL

A. The Schedule shall be submitted in a format approved by the Project Manager.

B. The Schedule shall identify each item of work. Work items in the Schedule shall represent all work and shall be referenced with the Technical Specifications section numbers, specification subparagraph, specification section title and the bid item number used for the Schedule of Prices and Quantities when applicable. The Schedule shall address the subcontractor, fabricator or supplier furnishing the materials and or labor for each work item.

C. Upon request by the City, the Contractor shall support values given with the data which will substantiate the correctness of the values.

D. The Schedule will be utilized only as a basis for review of the Contractor's application for progress payment.

1.04 REVIEW AND RESUBMITTAL

A. If review by the City indicates that changes to the Schedule are required, the Contractor shall revise and resubmit the Schedule.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PREPARING SCHEDULE OF VALUES

A. Breakdown of the items used in the Schedule shall include costs as follows:

1. Delivered cost of product with applicable taxes paid
2. Total installation cost with overhead and profit
3. Breakdown costs of each lump sum item with a list of products and major operations for which the Contractor seeks to receive progress payments to recover his costs for that bid Item
4. Each unit price item as listed in the bid Schedule of Prices and Quantities shall list products and major operations for which the Contractor seeks to receive progress payments for that bid item.

3.02 PREPARING SCHEDULE OF STORED MATERIAL

A. The Contractor shall submit with the Schedule an indication of whether products will be stored on or off the worksite. The Schedule of Stored Material shall show quantities and types of products that will be stored.

B. Material allowances consist of only the net cost of the product, the cost of delivery and unloading at the storage site, the cost of applicable sales taxes and all discounts.

C. In no case will the cost paid for a permanent material be greater than 90 percent of the contract price for the work in which they are included.

3.03 PAYMENT FOR STORED MATERIALS

A. Only materials that are described in the specifications and on the drawings will be considered permanent materials. Permanent materials are materials that will be left in the work after the contract is completed.

B. Nothing in these specifications shall be interpreted as requiring the City to pay for stored materials. The Project Manager shall decide on a case-by-case basis whether stored materials shall be paid for. No payment will be made for stored materials which have not been submitted and accepted.

C. The Contractor must, at all times, store permanent materials in accordance with manufacturer's recommendations. Any material not properly stored will not be paid for. Amounts will be deducted from payments for any stored permanent material previously paid for and subsequently found to be improperly stored or not present, based upon a physical inventory of stored permanent material.

D. Only the neat line quantity of material needed for the finished product may be paid for.

E. All requests for stored permanent material payment must be accompanied by paid invoices clearly showing the quantity of permanent material, the type of permanent material and dis-

counts or rebates and the net amount paid to the supplier along with a certificate stating that the permanent material is free of any liens or judgments preventing its use by the City.

F. All permanent material stored off site, for which payment is being requested must be insured and stored in bonded, insured warehouses.

G. Any permanent material on which payment is requested must be in such a form that it cannot be used on work other than this contract, or stored in a manner acceptable to the Project Manager to ensure that the permanent material cannot be used on work other than this contract.

3.04 ALLOWANCE AUTHORIZATION AND PAYMENT

A. Contractor shall request written approval for expenditure of any contract allowances PRIOR TO performing the Work involved. List work to be performed and estimated cost in the requesting correspondence.

B. Original copies of all invoices and receipts must be submitted with the Allowance Authorization as part of the request for payment.

C. Using the format provided by the City, the Contractor's request for payment of all contract allowances shall be included in the Schedule of Values.

PART 4 - MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

PART 5 - PAYMENT

5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract Price.

END OF SECTION 01370

SECTION 01400

CONTRACTOR QUALITY CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section identifies the Quality Control activities to be performed during all phases of the contract by the Contractor.

B. The Contractor shall have in place his Quality Control Program as necessary to ensure that all materials and work are completed in compliance with contract documents. The Contractor is solely responsible for Quality Control with the exception of those tests and/or audits that will be conducted by the City as defined in the contract documents.

C. Test schedules and/or testing requirements for materials used on this project are included in the technical specifications. Laboratory and field testing identified in the technical specifications shall be conducted by an Independent Testing Agency (ITA) retained by the City.

1.02 LEVEL OF CONTROL

A. The intent of this section is to enable the Contractor to establish a necessary level of control that will:

1. Adequately provide for the production of acceptable quality materials
2. Provide sufficient information to ensure both the Contractor and the Project Manager that the specification requirements are being met
3. Allow the Contractor as much latitude as possible to develop his or her own standards of control.

1.03 SUBMITTALS

A. Refer to Technical Specification Section 01300 Submittals and Technical Specifications Section 01340, and Technical Specification 014002 Quality Assurancefor submittal requirements.

B. Quality Control Plan: Within 20 working days after Notice to Proceed, the Contractor shall submit a Quality Control Plan for review and acceptance. Acceptance by the Project Manager does not relieve the Contractor of compliance with the contract requirements. The Contractor Quality Control Plan shall address the following as a minimum:

1. Provide a general description of Quality Control monitoring to be performed until final acceptance by the City. Include monitoring activities of Work and the worksite during times no construction activity is scheduled to take place.
2. The Contractor shall designate an employee as the Quality Control Manager qualified to perform quality control monitoring of the Work. The designated individual shall have the authority to direct work changes required to bring the Work into conformance with contract requirements including stopping non-conforming work in progress.
3. The Quality Control Plan shall address each technical specification division’s requirements for quality control. The Contractor shall identify each item requiring submittal and approval/acceptance prior to installation of work. Also, the Contractor shall identify each item of work requiring testing by the independent testing agency.

4. The Quality Control Plan shall address and establish controls and documentation format to ensure that items or materials that have been accepted through receiving inspection are used or installed. Identification and traceability shall be provided throughout all inspections, test activities and records. For stored items, provisions shall be made for the control of item/material identification, consistent with the expected duration and type of storage.

5. Provide methodology of monitoring, testing and exercising of all equipment, valves and/or assemblies to ensure the Work installed is in proper working order.

6. The Contractor shall submit a list of suppliers and subcontractors. This list shall include items to be supplied by each supplier and/or subcontractor and shall identify work to be performed by each subcontractor. The list shall be updated and resubmitted as required.

7. Provide emergency contact information including name, company, title, work phone number, home phone number and other means of contact. The Emergency Contact list shall include at least four individuals. The Emergency Contact list shall be maintained on a daily basis. In the event there is any change in any of the information, the Contractor shall forward the updated list to the Project Manager. The Emergency Contact list shall include the project number, project title and date of issue.

C. Daily Quality Control Report:

1. The Daily Quality Control Report shall be submitted daily. The report shall address as a minimum the following: identify number of workers on site each day by trade, identify notifications and discussions with/by DIA Quality Assurance Inspectors and other agency inspectors, identify quality of work placed that day and any deviations and/or corrections required to bring the Work into conformance with the contract. Daily reporting may be computerized or typed, but must contain an electronic signature. Legible, hand written reports on the approved form shall be accepted. Scanned copies of daily reports are acceptable.

2. Submit one electronic copy of the Daily Quality Control Report to the Project Manager the day following the work. The report shall be signed by the Contractor's Quality Control Representative and the Contractor's Superintendent.

D. Corrective Action Report (CAR)

1. Conditions adverse to quality will be reviewed by the Contractor to determine the cause and to recommend a corrective action that will preclude recurrence. The condition, its cause and the corrective action planned shall be reported to the Project Manager prior to implementation. Follow-up action shall be taken to verify implementation of the corrective action. The Contractor will document the corrective action and a copy of the Corrective Action Report (CAR) will be transmitted to the Project Manager.

1.04 DOCUMENTATION

A. The Contractor shall not change or alter approved submittals, procedures, specifications, drawings or other pertinent documentation without the Project Manager's written authorization.

B. All records and documents that are quality related shall be prepared, identified and maintained by the Contractor and shall be made available to the City upon request. Records shall be protected from damage, deterioration or loss. A copy of the records and documents shall be maintained at the Work site at all times unless the Project Manager has approved other locations in writing. Retention time for all quality records shall be not less than three years from date of Final Acceptance of the contract.

C. The Contractor shall maintain records at the actual worksite and at Contractor's office to show the inspection status of materials and items installed in order to ensure that the required inspections and tests have been performed in a timely and correct manner.

1.05 INSPECTIONS AND TESTS

A. Inspections, tests and system shut down requests, conducted by persons or agencies other than the Contractor, shall not in any way relieve the Contractor of his responsibility and obligation to meet all specifications and the referenced standards. The Contractor's designated Quality Control Representative shall inspect the work and shall ensure the work complies with the contract requirements prior to any requests for inspection or testing.

B. When the specifications, laws, ordinances, rules, regulations or orders of any public agency having jurisdiction require the Project Manager's surveillance of inspections or tests, the Contractor shall notify the Project Manager of the place, date and time a minimum of 48 hours prior to the inspection and/or test. The Contractor shall be responsible for notifying and requesting inspection by other agencies including but not limited to the Denver Building Inspection Division, Denver Fire Department and Denver Water Department. Prior to request for other agency inspections, the Contractor shall meet and plan inspection times with the Project Manager and or the Project Manager’s designated representative.

C. Special inspections or tests may be required by the technical specifications, City, State and/or Federal Agencies in addition to those tests already performed. The Contractor shall notify the Project Manager at least 48 hours in advance of the additional inspections or tests.

1.06 INSPECTION PLAN

A. The Contractor shall utilize the following six-point inspection plan to ensure the conformance of the Work performed by the Contractor meets the requirements of the contract drawings and specifications, the referenced codes and standards and the approved submittals:

1. Prework Coordination: Prior to the start of construction work on the contract and prior to the start of work under each separate specification section and prior to the start of work where a change in a construction operation is contemplated by the Contractor and prior to a new subcontractor starting work, a coordination meeting will be held with the Contractor's superintendent, Quality Control and Safety representative(s), and the ITA representative,. Supervisory, Safety and Quality Control, representatives of all applicable subcontractors will also attend. The Contractor's Quality Control Representative shall chair, prepare and distribute minutes of Quality Control meetings. Meeting minutes shall be electronically distributed within 24 hours of the meeting.
2. The purpose of the meeting is to ensure that the Contractor’s personnel have no misunderstandings regarding their safety and quality procedures as well as the technical requirements of the contract. The following items shall be presented and reviewed by the Contractor:
    a. Contract requirements and specifications
    b. Shop drawings, certifications, submittals and as-built drawings
    c. Testing and inspection program and procedures
    d. Contractor's Quality Control program
    e. Familiarity and proficiency of the Contractor's and subcontractor's workforce to perform the operation to required workmanship standards including certifications of installers

f. Safety, security and environmental precautions to be observed
g. Any other preparatory steps dependent upon the particular operation
h. The Contractor's means and methods for performing the Work.

3. Initial Inspection: Upon completion of a representative sample of a given feature of the Work and no later than two weeks after the start of a new or changed operation, the Project Manager and/or the Project Manager's designated representatives will meet with the Contractor's Quality Control representative and applicable subcontractor's supervisor and their Quality Control representatives to check the following items, as a minimum:
   a. Workmanship to established quality standards
   b. Conformance to contract drawings, specifications and the accepted shop drawings
   c. Adequacy of materials and articles utilized
   d. Results of inspection and testing methods
   e. Adequacy of as-built drawings maintained daily.
4. Once accepted, the representative sample will become the physical baseline by which ongoing work is compared for quality and acceptability. To the maximum practical extent, approved representative samples of work elements shall remain visible until all work in the appropriate category is complete. Acceptance of a sample does not waive or alter any contract requirements or show acceptance of any deviation from the contract not approved in writing by the Project Manager.
5. Follow-up Inspection: The Contractor's Quality Control representative will monitor the work to review the continuing conformance of the work to the workmanship standards established during the preparatory and initial inspections.
6. Completion Inspection: Forty-eight hours prior to the completion of an item or segment of work and prior to covering up any work, the Contractor will notify the Project Manager who will verify that the segment of work is substantially complete, all inspections and tests have been completed and the results are acceptable. The purpose of this inspection is to allow further corrective work upon, or integral to, the completed segment of work. THIS IS NOT AN ACCEPTANCE INSPECTION. If any items are determined to be deficient, need correction or are non-conforming, a Deficiency List will be prepared and issued to the respective Contractor for correction, repair or replacement of any deficient or non-conforming items. The Project Manager and Contractor's Quality Control representative will verify the correction of the deficient and/or non-conforming items prior to the start of the next operation.
7. Pre-Final Acceptance Inspection: Prior to requesting a Pre-Final Acceptance Inspection by the City, all work and operational systems to be inspected shall be satisfactorily completed and tested by the Contractor. The Contractor's written request for this inspection shall be made 72 hours in advance. With the request shall come a list of any known deficiencies and when they will be corrected. If the list is too large or contains too many significant items, in the opinion of the Project Manager, no inspection will be held because of the incompleteness of the work.
8. The Project Manager will schedule the Pre-Final Acceptance Inspection and with the assistance of the Designers will prepare a list of deficient items (punch list) discovered during the inspection. If during the inspection the list becomes too large or too many significant items are on the list, the inspection will be canceled. After the inspection is completed, the Deficiency List will be transmitted to the Contractor for correction of the deficient items.
9. Final Acceptance Inspection: After the Contractor has completed all items on the Deficiency List (generated from the Pre-Final Acceptance Inspection) he shall request a Final Acceptance Inspection. The request shall be made in writing at least 72 hours in

advance of the inspection. All areas must be cleaned and ready for turnover prior to this inspection. The Project Manager, the design consultant, a representative of the funding agency (if applicable) and other interested parties will inspect the subject Work to ensure that all deficiencies have been satisfactorily attended to and that no new deficiencies have appeared and that all systems are completely functional. Any outstanding or additional deficient items will be noted and handled per the requirements of the Pre-Final Acceptance Inspection noted above until the Work is acceptable to the Project Manager.

1.07 SAMPLES

A. The Contractor shall maintain at the worksite a copy of all samples submitted and accepted by the City. Samples shall be made available to the designer or the Project Manager's designated representatives for review and comparison in the field. The Project Manager prior to use on the project must accept all items and materials.

B. The installed work will be compared to the samples and if any of the work is not of the same quality, material, finish, color, texture or appearance as the sample, that portion that is not the same will be considered defective and in nonconformance.

C. Contractor selection of samples will only be considered if taken at random. The Contractor shall permit representatives of the City to witness the selection of samples. Inspection or tests of items or materials that fail shall be sufficient cause to terminate further inspections/tests of the same brand, make or source of that product.

D. The Contractor is obligated to correct any item deemed deficient.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 REQUIREMENTS

A. All materials required for the contract shall be new except where specified otherwise. The Project Manager may elect to perform additional inspections and/or tests at the place of the manufacture, the shipping point or at the destination to verify conformance to applicable specifications. Inspections and tests performed by the City shall not relieve the Contractor from the responsibility to meet the specifications, nor shall such inspections/tests be considered a guarantee for acceptance of materials that will be delivered at a later time.

B. The Contractor is obligated to correct or remove non-conforming materials, whether in place or not. If necessary, the Project Manager will send written notification to the Contractor to correct or remove the defective materials from the project. If the Contractor fails to respond, the Project Manager may order correction, removal and/or replacement of defective materials by others, in which case the Contractor shall bear all costs incurred by such actions.

C. Materials accepted on the basis of a Certificate of Compliance may be sampled and inspected/tested by the City Project Manager or its Designer at any time. The fact that the materials were accepted on the basis of such certification shall not relieve the Contractor of his responsibility to use materials that conform to the specifications.

D. The Contractor shall impose upon his suppliers the same quality control requirements, including inspection and test procedures, as imposed upon him by the specifications and referenced standards. The Contractor shall apply appropriate controls, designed to ensure that all materials supplied meet the requirements and specifications.

PART 4 - MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

PART 5 - PAYMENT

5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract Price. If the City is required to re-inspect work or conduct a special test because a previous inspection, requested by the Contractor, showed that the work was defective or not in conformance, the Manager or authorized representative may deduct from the contract value the cost of re-inspection at the rate of $75.00 per man-hour.

END OF SECTION 01400

SECTION 01402

QUALITY ASSURANCE

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section identifies inspection activities to be performed by inspectors employed by the City and working under the direction of the City Project Manager.

B. Inspection and tests, conducted by persons or agencies other than the Contractor, shall not in any way relieve the Contractor of his responsibility and obligation to meet all specifications and the referenced standards.

C. The inspection and approval of work by other agencies above does not constitute inspection or acceptance of work required by the City. Technical specifications may contain requirements more stringent than Building Inspection Division or other code agency requirements.

D. Reference Contract General Conditions, GC 1701, GC 1702, GC 1703, GC 1704, GC 1705, GC 1706

1.02 RELATED DOCUMENTS

A. Technical Specifications Section 01400 – “Contractor Quality Control”

B. Technical Specifications Section 01300 – “Submittals”

C. Technical Specifications Section 01340 – “Shop and Working Drawings, Product Data and Samples”

D.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CONTRACTOR'S QUALITY CONTROL SYSTEM

A. The Contractor is responsible for quality control of the Construction. All acquisition of materials, sequence of construction (except as otherwise indicated), and means and methods of construction shall be the responsibility of the Contractor. Establish system to perform sufficient inspection and tests of all items of work, including that of subcontractors, to ensure conformance to Contract Documents for materials, workmanship, construction, finish, functional performance and identification.

1. Control System: Establish for all construction except where Contract Documents provide for specific compliance tests by testing laboratories and engineers employed by the City.

2. Control System: Specifically include all testing required by various sections of Specifications.

3. Quality Control System: Means by which Contractor assures himself that construction

complies with requirements of Contract Documents.

a. Controls: Adequate to cover all construction operations and keyed to proposed construction schedule.

B. The Contractor shall be responsible for assuring compliance with the quality standards as indicated in the Contract Documents. In addition, the Contractor shall be responsible for:

1. Review of submittals prior to their being forwarded to the Designer and the City Project Manager for review. The Contractor shall mark submittals with comments and shall indicate the date and party conducting the Contractor's review of each submittal.

2. Final inspection of the project prior to calling for the Designer and City to conduct a final inspection. The Contractor shall provide his inspection comments to the Designer and City prior to the scheduled final inspection.

3. Verification of completion of punch-list items prior to calling for verification inspection by the Designer and the City.

C. Records: Maintain correct records on appropriate form for all inspections and tests performed, instructions received from the Designer and actions taken as result of those instructions.

1. Records: Include evidence that required inspections or tests have been performed (including type and number of inspections or tests, nature of defects, causes for rejection, etc.) proposed or directed remedial action, and corrective action taken.

2. Document inspections and tests as required by each section of Specifications.

D. The Contractor is responsible for complying with the requirements of the Contract Documents. Testing performed by the City's Agents shall not be relied upon by the Contractor as sufficient to assure compliance with the Contract Documents. The Contractor shall procure and pay for testing necessary to assure that the construction is in compliance with the Contract Documents.

E. Quality Control Plan: Submit with proposed Schedule of Values and Construction Progress Schedule. Plan shall include:

1. Personnel, procedures, instructions, and records to be used.

2. List of control tests which Contractor understands he and his subcontractors are to perform.

3. Procedures for reviewing and approving shop drawings, product data, samples and other submittals before submission to the Designer and City Project Manager. Include procedures for obtaining field measurements.

4. Method of documenting quality control operation, inspection and testing including samples of proposed forms.

3.02 STANDARDS

A. Generally accepted Construction Industry standards for materials, products, quality, and workmanship shall supplement the Specifications.

1. Where industry standards are less than the Specifications and Drawings require, the Contract Documents shall govern.

2. The Contractor shall provide materials and products which conform to industry standards of quality.

B. Construction tasks shall be performed by craftsmen skilled and experienced in the trades

required. Work shall be subject to review by the City and the Designer.

C. Work and/or materials which fail to meet accepted industry standards of performance, quality, and/or appearance will be rejected and shall be brought into compliance or replaced by the Contractor at no additional cost to the City.

3.03 MATERIAL AND WORKMANSHIP

A. Unless otherwise specified, or indicated on the Drawings, material shall be new, of best quality, and without flaws, and delivered upon completion in an undamaged condition.

B. Workmanship shall be the best of its respective kind. Labor shall be performed in a thorough workmanlike manner by qualified, efficient, and skilled mechanics, acceptable to the City, Designer and other trades involved on the job requiring acceptable substrate for the performance of their work.

3.04 TESTING – GENERAL

A. Testing Laboratory and/or Engineering services are required for quality control in portions of the work identified in other sections of these specifications.

B. Tests required by these Specifications shall be performed in strict accordance with referenced testing methods, procedures, and conditions. Pertinent data shall be included in clear, comprehensive written forms according to the Designer's or Engineer's requirements.

C. Contractor: Provide equipment and facilities as required for testing at no additional cost, subject to City’s review, for conducting field tests and for collecting and forwarding samples.

1. Do not use materials or equipment represented by samples until tests, if required, have been made and materials or equipment found to be acceptable.

2. Do not incorporate any product into work which becomes unfit for use after acceptance thereof.

D. Testing: Materials or equipment proposed to be used may be tested at any time during their preparation or use. Furnish required samples without charge and give sufficient notice of placing of orders to permit testing. Products may be sampled either prior to shipment or after being received at site of work.

E. Tests: Made by accredited testing laboratory selected by City. Except as otherwise provided, sampling and testing of materials and laboratory methods and testing equipment shall be in accordance with latest standards and tentative methods of ASTM.

1. Specific information concerning testing methods, sample sizes, etc., is included under applicable sections of Specifications.

2. Any modification of, or elaboration on, these test procedures included for specific materials under their respective sections in Specifications shall take precedence over these procedures.

3.05 COST OF TESTING

A. Unless indicated otherwise, City's testing shall be performed by the City's authorized agents, at the City's expense.

B. Costs for re-testing of non-complying work shall be borne by the Contractor.

C. According to the judgment of the City and/or Designer, ANY portion of the work in this contract may be tested at any time for any reason. Costs for such testing shall be borne by the Contractor only if such tests indicate that work does not meet Contract Document requirements.

3.06 OTHER TESTING

A. Following Testing: Performed at expense of Contractor:

1. Any additional tests required because of any tests that fail subject to following conditions:
   a. Quantity and Nature of Tests: Determined by the Designer.
   b. Tests: Taken in presence of the City and/or the Designer.
   c. Proof of Noncompliance: Contractor liable for corrective action which the City and/or the Designer feels is required including complete removal and replacement of defective material.
2. Material Substitution: Any tests of material or equipment offered as substitute for specified item on which test may be required in order to prove its compliance with Specifications.

B. Contractor: May have tests performed on material and equipment for his own information and job control so long as the City does not assume responsibility for costs or for giving them consideration when appraising quality of materials.

3.07 EQUIPMENT TESTING

A. Equipment testing shall be as determined appropriate by the City to assure proper performance according to the manufacturer's specifications for each equipment item.

B. After all utility connections to equipment are completed, the Contractor shall conduct final tests of equipment in presence of the City and the Designer.

C. Unless waived in writing by the City, the requirements of this section shall apply to all installed equipment items having utility connections.

3.08 NOTIFICATION

A. The Contractor shall be responsible for notifying the City and Designer at least three (3) working days prior to commencing work which is identified as requiring testing.

B. The Contractor shall be responsible for scheduling and coordinating all required testing with the City and the City’s Independent Testing Agency.

3.09 TEST REPORTS

A. Test reports, whether performed for the City or the Contractor, shall be submitted to the City and Contractor as soon as results are available. Reports shall be clear, concise, comprehensive written forms containing required test results.

B. Reports of tests made by testing laboratories shall be distributed by testing laboratory as follows: 1 Copy – City Project Manager, 1 Copy – Contractor, 1 Copy - Applicable Supplier or Subcontractor; 1 Copy – Designer and Applicable Engineer;

3.10 MANUFACTURING AND FABRICATION INSPECTIONS

A. The Project Manager may elect to perform additional inspections and/or tests at the place of the manufacture, the shipping point or at the destination to verify conformance to applicable specifications. Inspections and tests performed by the City shall not relieve the Contractor from the responsibility to meet the specifications, nor shall such inspections/tests be considered to be a guarantee for acceptance of materials that will be delivered at a later time.

B. The Project Manager or his authorized representative may inspect at its source any material or assembly to be used in the Work. Manufacturing plants may be inspected from time to time for the purpose of determining compliance with specified manufacturing methods or materials to be used in the Work and to obtain samples for testing and further inspection.

C. Should the Project Manager conduct plant inspections the following conditions shall exist:

1. The Project Manager shall have the cooperation and assistance of the Contractor and the producer with whom the Contractor has contracted for materials.

2. The Project Manager shall have full access during scheduled production or warehousing working hours to parts of the plant that are concerned with the manufacture, production, storage or shipping of materials being furnished.

3. The Contractor shall arrange for adequate office or working space that can reasonably be needed for conducting a plant inspection. Office or working space shall be conveniently located with respect to the plant and/or warehouse as required by the Project Manager.

D. It is understood and agreed that the City shall have the right to re-test at the City's expense any materials that have been tested and accepted at the source of supply after it has been delivered to the site.

PART 4 - MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

PART 5 - PAYMENT

5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

END OF SECTION 01402

SECTION 01500

TEMPORARY FACILITIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work specified in this Section consists of furnishing, installing, operating, maintaining and removing temporary construction barriers, enclosures and field facilities including the Contractor's construction offices, staging areas, yards, storage areas, electrical power, telephone, water, fire protection and sanitary service.

B. Reference Contract General Conditions, GC 326 Power, Lighting, Heating Ventilation, Air Conditioning and Water Services.

C. Construction Office, Yards and Storage Areas

1. Temporary facilities which the Contractor desires to locate in staging areas adjacent to the Work or within the project limits are subject to approval by the Project Manager.
2. Temporary Roads and paved areas are to be proposed in
3. Contractor Field Office
   a. The Contractor shall provide a field office for this Project.
   b. The Contractor shall acquire all necessary permits for installation and construction work related to the Contractor’s field office and fencing.
   c. The Contractor shall provide, as part of his on-site field office, a conference room for weekly meetings. The conference room shall have one available telephone internet access and power.
   d. Jack the mobile office unit off its wheels and provide support.
   e. Install tie downs in compliance with code.
   f. Provide access to the field office and easily accessible space for parking six full size passenger automobiles at a minimum. Grade the field office site, access roadway and parking area for drainage, and surface with gravel paving or crushed stone.
   g. Water and sewer lines to the field office, if installed, shall be installed so they will not freeze.

D. Electrical Service

1. Provide lighting and power for field offices, storage facilities and other construction facilities and areas.
2. Provide power centers for electrically operated and controlled construction facilities including tools, equipment, testing equipment, interior construction lighting, heating, cooling and ventilation equipment.
3. Provide night security lighting at secured areas within construction limits at offices, storage facilities, temporary facilities and excavated areas.
4. Provide battery operated or equivalent emergency lighting facilities at construction areas where normal light failures would cause employees to be subjected to hazardous conditions. Test such facilities monthly and maintain a record of these tests for the Project Manager's review.
5. Bear all costs of temporary electric and water service permits, fees and deposits re-

quired by the governing authorities, and connection charges and temporary easements including installation, maintenance and removal of equipment.

E. Telephone Service

1. The Contractor shall furnish, install and maintain at least two telephones in his main field office.

F. Internet Service

1. The Contractor shall furnish, install and maintain at least one computer with email in his main field office. This computer should be able to access all email and FTP as part of project submittal process. Provide WIFI with access to project manager and design team.

G. Water Service

1. The Contractor shall make all connections and extensions required and shall make use of water in direct support of the Work. The Contractor shall install an approved Water Department tap at the City's water source prior to obtaining any water. The Contractor shall arrange and pay for its supply/distribution system from the City's point of connection. The location and alignment of the Contractor's temporary supply/distribution system must be approved by the Project Manager prior to its installation. The Contractor shall leave in place all above ground and underground water distribution facilities unless otherwise directed by the Project Manager.
2. The Contractor shall not use in place fire hydrants or standpipes as sources for construction water or potable water.

H. Fire Protection

1. Furnish, install and maintain temporary portable fire protection equipment throughout the construction period at all buildings (including the project site), maintenance shops, and fuel storage on all large construction equipment and at the location of any flammable materials or construction materials.

I. Sanitary Service

1. Furnish, install and maintain temporary sanitary facilities and services throughout the construction period.
2. Ensure that separate or single user toilets shall be provided to ensure privacy between the sexes.
3. Provide general washing facilities adequate for the number of employees.
4. Provide special washing facilities adequate for the number of employees engaged in the application of paints, coating and other volatile or hazardous materials.

1.02 QUALITY CONTROL

A. Provide products for, and the execution of, the Work of this Section that will satisfy the requirements of the NEC, OSHA and local codes. Provide products that satisfy requirements of NEMA and are UL listed.

1.03 SUBMITTALS

A. Refer to Technical Specifications Sections 01300 and 01340 for submittal procedures.

B. Submit a shop drawing within five days of the Notice to Proceed that shows the following:

1. Site Plan: Show temporary facilities, utility hookups, staging areas, temporary roads/paved areas, temporary sidewalks, temporary signage and parking areas for construction personnel.
2. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
3. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage, including delivery, handling, and storage provisions for materials subject to water absorption or water damage, discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water damaged Work.
    1) Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
4. Dust-Control and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust-control and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
    1) Locations of dust-control partitions at each phase of the work.
    2) HVAC system isolation schematic drawing.
    3) Location of proposed air filtration system discharge.
    4) Other dust-control measures.
    5) Waste management plan.
5. Temporary facilities equipment and materials (include manufacturer's literature)
6. Details and layout of temporary installations including fences, roads, parking, buildings, storage areas and drainage plans.
7. Lighting plan showing temporary lighting facilities, electrical service panel location, electrical circuit diagram and anticipated light level on the working roadway, pathway or construction surface.

PART 2 - PRODUCTS

2.01 ELECTRICAL SERVICE

A. Provide temporary power and lighting equipment consisting of fixtures, transformers, panel boards, groundings, lamps, switches, poles, conduits and wiring sized and capable of continuous service and having adequate capacity to ensure a complete operating system. Comply with NEMA.

B. Provide temporary extension cords to supply tools not longer than 200 feet, except that additional length may be used if equipment will be grounded within 200 feet of tool or power.

C. Portable power generators shall be grounded.

2.02 DRINKING WATER SERVICE

A. Provide sanitary materials and equipment that satisfies the requirements of codes and regulations pertaining to temporary water systems. Bottled products may be used if those products comply with codes. Clearly label portable containers having a dispensing tap and used

only for drinking water. Provide single service disposable cups and a sanitary container for dispensing cups. A trash receptacle shall be provided and maintained beside each portable water supply.

2.03 FIRE PROTECTION

A. Fire extinguishers shall be UL rated and shall comply with the current City fire code.

2.04 DUST CONTROL

A. Provide Adhesive-Surface Walk-off Matts: Provide mats minimum 36 x 60 inches.

2.05 SANITARY SERVICE

A. Provide materials and equipment adequate for the intended purposes, which will neither create unsanitary conditions nor violate the codes applicable to temporary sanitary facilities. Enclosures for toilet and washing facilities shall be weatherproof, sight proof, ventilated and sturdy.

B. Provide portable type toilet facilities that satisfy the requirements of OSHA.

C. Provide washing facilities as needed. Furnish soap, single-service paper towels, towel dispenser and towel receptacle. If paints, coatings and other volatile or hazardous materials injurious to humans will be applied as part of the contract, provide washing facilities with warm water of approximately 120 degrees F.

PART 3 - EXECUTION

3.01 ELECTRICAL SERVICE

A. The approximate location of primary power lines is shown on the Construction Drawings. The Contractor shall locate electrical service where it will not interfere with equipment, storage spaces, traffic, and prosecution of the Work or the work of others. Installation shall present a neat and orderly appearance and shall be structurally sound. Maintain service in a manner that will ensure continuous electrical service and safe working conditions.

3.02 TELEPHONE SERVICE

A. Install temporary telephone service in a neat and orderly manner and make structurally and electrically sound to ensure continuous service. Modify, relocate and extend as work progress requires. Place conduit and cable where those products will not interfere with traffic, work areas, materials, handling equipment, storage areas and the work of other contractors. Service lines may be aerial.

3.03 WATER SERVICE

A. Install the systems in a neat and orderly manner. Make them structurally and mechanically sound. Provide continuous service. Modify, relocate and extend the systems as the work progresses.

B. Locate systems where they will be convenient to work stations, sanitary facilities and first aid station but will not interfere with traffic, work areas, materials handling equipment, sto-

rage areas or the work of other contractors.

C. Install vacuum breakers, backflow preventers and similar devices in a manner and location which will prevent temporary water from returning to the water mains.

D. Do not incorporate any part of temporary water distribution system into the permanent water distribution system.

3.04 FIRE PROTECTION

A. Install products in conformance with the requirements of the applicable Denver Fire Department and OSHA regulations.

1. Provide functional fire extinguishers that are clearly identified for fire and an accessible supply of water during the period of construction. These fire extinguishers shall remain in place until permanent fire protection systems are functional.

2. Furnish not less than one 20-pound fire extinguisher, type 2A-20ABC within ten feet of cutting and welding operations.

3. Provide 20-pound fire extinguishers, type 2A-20ABC no further then 100 feet apart in buildings.

4. Provide not less than one 20-pound fire extinguisher, type 2A-20ABC on any equipment of 75 horsepower or more.

B. Instruct construction personnel as to location and use of temporary fire protection equipment.

C. Fire extinguishers shall be located for easy access. Their location shall be clearly marked so that they can be seen at least 75 feet away.

3.05 SANITARY SERVICE

A. Place temporary sanitary (and washing) facilities in a neat and orderly manner within the limits of the work and convenient to the work stations. Make these facilities structurally and mechanically sound. Modify, relocate and extend the facilities as required by progress of the work.

B. Service toilets at those time intervals which will minimize the accumulation of wastes and prevent creation of unsanitary conditions, but not less than once a week.

C. The waste from the sanitary and wash facilities shall be disposed of in accordance with all applicable rules, regulations and laws and with the least environmental impact.

3.06 HVAC EQUIPMENT

A. Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

3.07 FENCING

A. Contact all utility service companies prior to planning fence location and post locations for certification of current utilities. Locate pothole posts planned within 5 feet of known utilities. Submit fencing plan and typical details to Project Manager at least seven days before planned execution for review and acceptance.

3.08 REMOVAL

A. The Contractor shall locate all temporary facilities including the underground utilities so they can be completely removed without damaging permanent work or the worksite of other contractors.

B. The Contractor shall remove all temporary facilities, including all underground utilities, and restore the site to the condition in which the City initially provided it to the Contractor.

PART 4 - MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

PART 5 - PAYMENT

5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract Price.

END OF SECTION 01500

SECTION 01620

STORAGE AND PROTECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work specified in this Section consists of providing storage and protection of the materials, products and supplies which are to be incorporated into the construction and indicating such storage areas on the working drawings with the location and dates when such areas will be available for each purpose.

B. Reference Contract General Conditions, GC 803

1.02 SUBMITTALS

A. Refer to Technical Specifications Sections 01300 Submittals. Submit concurrently with submittals required in Section 01050.

B. Submit working drawings showing locations of storage areas not indicated on the Contract Drawings.

C. Submit descriptions of proposed methods and locations for storing and protecting products.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials required for the storage and protection of the items specified shall be durable, weatherproof and either factory finished or painted to present an appearance acceptable to the City. Storage facilities shall be uniform in appearance with similar materials used to the maximum extent possible.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS OF EXECUTION

A. Palletize materials, products and supplies which are to be incorporated into the construction and stored off the ground. Store these items in a manner which will prevent damage and which will facilitate inspection. Leave seals, tags and labels intact and legible. Maintain access to products to allow inspection. Protect products that would be affected by adverse environmental conditions.

B. Periodically inspect stored products to ensure that products are being stored as stipulated and that they are free from damage and deterioration.

C. Do not remove items from storage until they are to be incorporated into the Work.

D. The Contractor shall ensure that all protective wrappings and coverings are secure and ballasted to prevent any items from deterioration and/or subsequent dislodgment. All items on the worksite that are subject to becoming windborne shall be ballasted or anchored.

3.02 HANDLING AND TRANSPORTATION

A. Handling

1. Avoid bending, scraping or overstressing products. Protect projecting parts by blocking with wood, by providing bracing or by other approved methods.
2. Protect products from soiling and moisture by wrapping or by other approved means.
3. Package small parts in containers such as boxes, crates or barrels to avoid dispersal and loss. Firmly secure an itemized list and description of contents to each container

B. Transportation

1. Conduct the loading, transporting, unloading and storage of products so that they are kept clean and free from damage.

3.03 STORAGE

A. Store items in a manner that shall prevent damage to the owner's property. Do not store hydraulic fluids, gasoline, liquid petroleum, gases, explosives, diesel fuel and other flammables in excavations, except one day's supply of diesel fuel may be stored in open excavations.

B. Provide sheltered weather-tight or heated weather-tight storage as required for products subject to weather damage.

C. Provide blocking, platforms or skids for products subject to damage by contact with the ground.

D. All material shall be stored according to the manufacturer’s recommendations. Any material that has to be stored within specified temperature or humidity ranges shall have a 24-hour continuously written recording made of the applicable condition. Should the recording show that the material was not stored within the recommended ranges the material shall be considered defective and in nonconformance. If a certification from the manufacturer's engineering design representative is provided stating that the actual variations are acceptable and will in no way harm the material or affect warranties, then the deficiency will be considered corrected.

E. Store hazardous material separately, with all material marked with a label showing the hazard and how to treat exposure to the material.

3.04 LABELS

A. Storage cabinets and sheds that will contain flammable substances and explosive substances shall be labeled FLAMMABLE--KEEP FIRE AWAY and NO SMOKING with conspicuous lettering and conforming to OSHA requirements.

PART 4 - MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

PART 5 - PAYMENT

5.01 METHOD OF PAYMENT

A. The cost of the Work described in this Section shall be included in the Contract price. See Technical Specifications Section 01370 for additional requirements for the possible payment of stored material.

END OF SECTION 01620

SECTION 01630

SUBSTITUTIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work specified in this Section consists of submitting for the approval of a different material, equipment or process then is described in the Contract Documents.

B. If the substitution changes the scope of work, contract cost or contract time, a change order is required. As-built drawings and specifications must include all substitutions even if a change order is not issued.

C. Reference Contract General Conditions, GC 406.

1.02 QUALITY CONTROL

A. The substitution must provide the same quality as what it is replacing. The level of quality is defined by:

1. Maintenance and operating cost
2. Reliability
3. Durability
4. Life expectancy
5. Ease of cleaning
6. Ability to be upgraded as needed
7. Ease of interacting with other systems or components
8. Ability to be repaired
9. Availability of replacement parts
10. Established history of use in similar environments
11. Performance equal or superior to that which it is replacing.

1.03 SUBMITTAL

A. Refer to Technical Specifications Sections 01300 and 01340 for submittal procedures.

B. A complete Request for Substitution using the form in Section 01999 must be made at least 60 days prior to when an order needs to be placed or a method needs to be changed.

C. The submittal shall contain, as appropriate, detailed product data sheets for the specified items and the substitution. Samples and shop drawings shall also be submitted of the substitution as applicable. The submittal shall contain all the data required to be submitted for acceptance of the originally specified item or process.

D. The submittal shall contain all the applicable information required in Technical Specifications Section 01630, paragraph 2.01 below.

E. A signed statement as outlined in Technical Specifications Section 01630, paragraph

2.03.B below must accompany the Request for Substitution.

PART 2 - EXECUTION

2.01 INFORMATION

A. Provide the following information as applicable with the Request for Substitution on the item or process that is being requested to be substituted:

1. A complete description of the item or process
2. Utility connections including electrical, plumbing, HVAC, fire protection and controls
3. The physical dimensions and clearances
4. A parts list with prices
5. Samples of color and texture
6. Detailed cost comparisons of the substitution and the contract specified item or process
7. Manufacturer warranties
8. Energy consumption over a one-year period
9. What local organization is certified to maintain the item
10. Performance characteristics and production rates
11. A list of any license fees or royalties that must be paid
12. A list of all variations for the item or method specified
13. A list of at least three other projects of similar nature to this contract where the products or methods have been in use for at least one year including telephone number and name of the person to contact at these other projects
14. An analysis of the effect of the substitution on the schedule and contract cost and on the overall project as it relates to adjoining work.

2.02 SUBSTITUTION REQUEST

A. The formal Request for Substitution will be evaluated by the Project Manager and the Designer of Record based on the following criteria:

1. Compatibility with the rest of the project
2. Reliability, ease of use and maintenance
3. Both initial and long term cost
4. Schedule impact
5. The willingness of the Contractor to share equally in any cost savings
6. The ability of the item or process to meet all applicable governing regulations, rules and laws along with funding agency requirements
7. The cost of evaluating the substitution.

B. Based upon the above evaluation the Project Manager will make a final determination of what is in the best interest of the City and either approve, disapprove or approve as noted the requested substitution.

2.03 CONDITIONS

A. As a condition for submitting a Request for Substitution the Contractor waives all rights to claim for extra cost or change in contract time other than those outlined in the request and approved by the Project Manager. The Contractor, by submitting a Request for Substitution, also accepts all liability for cost and scheduling impact on other contractors or the City due to the substitution.

B. Included with the Request for Substitution shall be the following statement:

1. "The substitution being submitted is equal to or superior in all respects to the contract-required item or process. All differences between the substitution and the contract-required item or process are described in this request along with all cost and scheduling data."

C. The statement shall be signed and dated by the Contractor's Superintendent.

PART 3 - EXECUTION (NOT USED)

PART 4 - MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

PART 5 - PAYMENT

5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract Price.

END OF SECTION 01630

SECTION 01650

SYSTEM STARTUP, TESTING AND TRAINING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Provide complete startup, testing and operator training services to ensure operability of all electrical and electronic equipment supplied.

1.02 SUBMITTAL

A. Refer to Technical Specifications Sections 01300 and 01340 for submittal procedures.

1. Test procedures
2. Test report
3. Training outline.

B. Refer to Technical Specifications on LEED for: Sustainability, Planning and Closeout Forms, Construction Waste Management and Disposal, Sustainable Design Requirements, and LEED Commissioning Requirements.

1.03 FIELD TESTS AND ADJUSTMENTS

A. All electrical and mechanical equipment including the interfaces with control systems and the communication system, and all alarm and operating modes for each piece of equipment shall be tested by the Contractor to the satisfaction of the Project Manager before any facility is put into operation. Tests shall be as specified herein and shall be made to determine whether the equipment has been properly assembled, aligned and connected. Any changes, adjustments or replacements required to make the equipment operate as specified shall be carried out by the Contractor as part of the work.

1. At least 30 days before the time allowed in the construction schedule for commencing startup and testing procedures, the Contractor shall submit to the Project Manager six copies of the detailed procedures he proposes for testing and startup of all electrical and mechanical equipment. These procedures are submitted for review and acceptance.
2. The Contractor's startup and testing procedures shall include detailed descriptions of all pre-operational hardware, electrical, mechanical and instrumentation used for testing work. Each control device, item of electrical, mechanical and instrumentation equipment, and all control circuits shall be considered in the testing procedures which shall be designed in a logical sequence to ensure that all equipment has been properly serviced, aligned, connected, wired, calibrated and adjusted prior to operation. Motors shall be tested in accordance with ANSI/IEEE Publication 112. The Contractor is advised that failure to observe these precautions may place the acceptability of the subject equipment in question, and he may either be required to demonstrate that the equipment has not been damaged, or replace it as determined by the Project Manager.
3. Testing procedures shall be designed to duplicate as nearly as possible all conditions of operations and shall be carefully selected to ensure that the equipment is not damaged. All filters shall be in place during startup and testing. Once the Project Manager has accepted the testing procedures, the Contractor shall provide checkout, alignment, adjustment and calibration signoff forms for each item of equipment and each system that will be used. The Contractor and the Project Manager shall use the sig-

noff forms in the field jointly to ensure that each item of electrical, mechanical and instrumentation equipment and each system has been properly installed and tested. The Contractor shall cooperate with project wide systems contractors where startup and testing is to be conducted concurrently.

4. Any special equipment needed to test equipment shall be provided to the City at no cost for a period of 30 days during startup.

B. Before starting up the equipment, the Contractor shall properly service it and other items, which normally require service in accordance with the maintenance instructions. The Contractor shall be responsible for lubrication and maintenance of equipment and filters throughout the entire equipment “break-in” period described by the manufacturer.

1. The Contractor shall be responsible for the startup, adjustment, preliminary maintenance and checkout of all equipment and instrumentation. All systems shall be carefully checked for conformance with the design criteria.

2. If any equipment or system does not operate as specified in the contract, the Contractor shall immediately replace or repair components until it operates properly.

3. The Contractor shall submit a test report to the Project Manager within 30 days after completion of the system startup period.

1.04 SYSTEMS STARTUP AND TESTING

A. The Contractor shall be responsible for a 30-day startup period during which time all hardware, electrical and mechanical equipment, communications, alarm systems and associated devices shall be energized and operated under local and automatic controls. The Contractor shall be present during the startup period with adequate labor and support personnel to adjust equipment and troubleshoot system failures that might arise.

B. When a piece of electrical or mechanical equipment is found to be in conflict with specific criteria, an experienced representative of the manufacturer shall make an adjustment to the item.

C. If adjustments fail to correct the operation of a piece of equipment or fixture, the Contractor shall remove the equipment or fixture from the project site and replace it with a workable replacement that meets the specification requirements.

D. The 30-day startup period shall commence 30 days prior to the contract completion date and shall be completed prior to final payment. If, during the startup, any system fails to operate in accordance with contract requirements, the failure shall be corrected and the startup period shall begin again. At the end of the startup period, all filters shall be replaced with new ones. The City may, at its option, provide a Commissioning Representative to observe or participate in the startup and testing of any system. The Contractor shall coordinate with the Commissioning Representative relating to scheduling, reporting, forms, methods and procedures of the startup and testing.

1.05 FINAL INSTRUCTIONS AND OPERATION TRAINING

A. After startup and testing is completed, the Contractor shall demonstrate to the City's personnel the proper manner of operating the equipment, programming messages, making adjustments, responding to alarms and emergency signals, and maintaining the system.

B. The Contractor shall provide on-the-job training by a suitably qualified instructor to designated personnel and shall instruct them in the operation and maintenance of the systems. In the event qualified instructors on the Contractor’s staff are not available, the Contractor shall arrange with the equipment manufacturer for such instruction at no additional cost to the City.

C. The Contractor shall provide a syllabus to the Project Manager at least seven calendar days prior to the start of each course that outlines topics to be covered, the proposed time allotted to each topic, and the target audience of the training session (technical, casual operator, overview, etc.). The Contractor shall not commence any training courses until the syllabus has been reviewed and approved by the Project Manager.

D. The Contractor shall videotape all training sessions and provide labeled digital video disks (DVD) to the Project Manager. The Contractor shall provide three copies of the DVD to the Project Manager in DVD+R format.

E. The Contractor shall provide an annotated syllabus to the Project Manager that indicates topics contained on each tape.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

PART 4 - MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

PART 5 - PAYMENT

5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price. No contractual item requiring startup or testing will be paid until the conditions of this Section are completely satisfied.

END OF SECTION 01650

SECTION 01700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work specified in this Section includes procedures required prior to Final Acceptance of the Work in addition to those specified in General Conditions Title 20 and Technical Specifications Section 01720.

1.02 PREPARATION FOR FINAL INSPECTION

A. Before requesting inspection for Final Acceptance of the Work by the City, inspect, clean and repair the Work as required.

1.03 FINAL INSPECTION

A. When the Contractor considers that the Work is complete, he shall submit written certification that:

1. All punch list items have been completed.
2. All clean up at the project site has been accomplished.
3. Work has been inspected by the Contractor for compliance with contract documents.
4. Work has been completed in accordance with contract documents.
5. Work is ready for final inspection by the City.
6. All as-built required documents have been submitted and accepted.
7. All damaged or destroyed real, personnel, public or private property has been repaired or replaced.
8. All operation and maintenance manuals have been submitted and accepted and all training has been completed.

B. The Project Manager will inspect to verify the status of completion with reasonable promptness after receipt of such certifications. The inspection of the work will be done in accordance with the General Conditions.

C. If the Project Manager finds incomplete or defective work:

1. The Project Manager may, at the Project Manager's sole discretion, either terminate the inspection or prepare a punch list and notify the Contractor in writing, listing incomplete or defective work.
2. The Contractor shall take immediate steps to remedy stated deficiencies and send a second written certification to the Project Manager that Work is complete.
3. The Project Manager will then reinspect the Work.

1.04 REINSPECTION FEES

A. Should the Project Manager perform reinspection due to failure of the Work to comply with the claims of status of completion made by the Contractor:

1. The Contractor shall compensate the City for such additional services at the rate of

$110.00 per man-hour.

2. The City shall deduct the amount of such compensation from the final payment to the Contractor.

1.05 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a Final Statement of Accounting to the Project Manager.

B. The Final Statement of Accounting shall reflect all adjustments to the contract amount and shall include the following:

1. The original contract amount.
2. Additions and deductions resulting from:
   a. Previous change orders.
   b. Allowances.
   c. Final quantities for unit price items. Along with this statement shall be detailed backup for the quantities.
   d. Deductions or corrected work.
   e. Penalties.
   f. Deductions for liquidated damages.
   g. Deductions for reinspection payments.
   h. City resurveys required due to the Contractor.
   i. Other adjustments.
3. Total contract amount, as adjusted.
4. Previous payments.
5. Sum remaining due.

C. If required, the Project Manager will prepare a final change order, reflecting approved adjustments to the Contract sum which were not previously made by change orders.

1.06 FINAL APPLICATION FOR PAYMENT

A. The Contractor shall submit the final application for payment in accordance with the procedures and requirements stated in the General Conditions Title 20.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

PART 4 - MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

PART 5 - PAYMENT

5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract Price.

END OF SECTION 01700

SECTION 01710

CLEANING

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work specified in this section consists of maintaining a clean, orderly, hazard free worksite during construction, and final cleaning for the City's Final Acceptance. Failure to maintain the worksite will be grounds for withholding monthly payments until corrected to the satisfaction of the Project Manager.

B. Reference Contract General Conditions, GC 324, GC 803, GC 2001

1.02 JOB CONDITIONS

A. Safety Requirements

1. Maintain the worksite in a neat, orderly and hazard-free manner in conformance with all federal, state and local rules, codes, regulations and orders, including all OSHA requirements, until Final Acceptance of the Work. Keep catwalks, underground structures, worksite walks, sidewalks, roadways and streets, along with public and private walkways adjacent to the worksite, free from hazards caused by construction activities. Inspect those facilities regularly for hazardous conditions caused by construction activities.

B. Hazards Control

1. Store volatile wastes in covered metal containers and remove those wastes from worksite daily.
2. Do not accumulate wastes which create hazardous conditions.
3. If volatile and noxious substances are being used in spaces that are not naturally ventilated, provide artificial ventilation.
4. Hazard controls shall conform to the applicable federal, state and local rules and regulations.
5. Provide appropriate waste receptacles in all areas in which employees are working. Waste receptacles shall be kept covered at all times. All materials on site shall be anchored and covered to prevent any objects from becoming wind-borne.

C. Access

1. Maintain the worksite to permit access by other City contractors as required and to allow access by emergency personnel.

1.03 SUBMITTALS

PART 2 - PRODUCTS

2.01 CLEANING MATERIALS

A. Utilize the type of cleaning materials recommended by the manufacturer for the surfaces to

be cleaned.

B. Maintain current Material Safety Data Sheets (MSDS) on site for all chemicals.

C. Ensure proper disposal of all wastes generated from the use of these materials. Must ensure compliance with all environmental regulations.

D. Cleaning Agents: Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that meet Green Seal GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.01 INTERIM CLEANING

A. Clean the worksite every shift/workday for the duration of the construction contract. Maintain structures, grounds, storage areas and other areas of worksite, including public and private properties immediately adjacent to worksite, free from accumulations of waste materials caused by construction operations. Place waste materials in covered metal containers. All hard concrete, steel, wood and finished walking surfaces shall be swept clean daily.

B. Remove or secure loose material on open decks and on other exposed surfaces at the end of each workday or more often in a manner that will maintain the worksite hazard free. Secure material in a manner that will prevent dislodgment by wind and other forces.

C. Sprinkle waste materials with water or acceptable chemical palliative to prevent blowing of dust.

D. Promptly empty waste containers when they become full and legally dispose of the contents at dumping areas off the City's property.

E. Control the handling of waste materials. Do not permit materials to be dropped or thrown from structures.

F. Immediately remove spillage of construction related materials from haul routes, work site, private property or public rights of way.

G. Clean only when dust and other contaminants will not precipitate upon newly painted surfaces.

H. Cleaning shall be done in accordance with manufacturer's recommendation.

I. Cleaning shall be done in a manner and using such materials as to not damage the Work.

J. Clean areas prior to painting or applying adhesive.

K. Clean all heating and cooling systems prior to operations. If the contractor is allowed to use the heating and cooling system it shall be cleaned prior to testing.

L. Clean all areas that will be concealed prior to concealment.

3.02 FINAL CLEANING

A. Inspect interior and exterior surfaces, including concealed spaces, in preparation for completion and acceptance.

B. Remove dirt, dust, litter, corrosion, solvents, discursive paint, stains and extraneous markings.

C. Remove surplus materials, except those materials intended for maintenance.

D. Remove all tools, appliances, equipment and temporary facilities used in the construction.

E. Remove detachable labels and tags. File them with the manufacturer's specifications for that specific material for the City's records.

F. Repair damaged materials to the specified finish or remove and replace.

G. After all trades have completed their work and just before Final Acceptance, all catch basins, manholes, drains, strainers and filters shall be cleaned; roadway, driveways, floors, steps and walks shall be swept. Interior building areas shall be vacuum cleaned and mopped.

H. Final cleanup applies to all areas within and adjacent to the site.

I. General: Perform waste disposal and final cleaning as applicable with Contractor’s portion of Project and the terms of their Contract as indicated below.

J. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

K. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. As applicable with Contractor’s portion of Project and the terms of the Contract, complete the following cleaning operations before requesting inspection for certification of Substantial Completion:
    a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    e. Remove snow and ice to provide safe access to building.
    f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
   1) Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates.
m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
q. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter upon inspection.
   1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report upon completion of cleaning.
r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
s. Leave Project clean and ready for occupancy.

L. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Construction Waste Management and Disposal."

PART 4 - MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

PART 5 - PAYMENT

5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract Price.

END OF SECTION 01710

SECTION 01720

CONTRACT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work specified in this Section consists of maintaining, marking, recording and submitting contract record documents which include shop drawings, warranties, contract documents and contractor records.

B. Reference Contract General Conditions, GC 323

1.02 SUBMITTALS

A. Each submittal of record documents shall contain the following information:

1. Date
2. Project title and numbers
3. Contractor's name and address
4. Title and number of each record document
5. Certification that each document as submitted is complete and accurate
6. Signature of the Contractor or his authorized representative.

B. At the completion of this contract, deliver all record documents including the following:

1. As-built shop drawings, diagrams, illustrations, schedules, charts, brochures and other similar data
2. Warranties, guarantees and bonds
3. Contract documents
4. Contractor records.

1.03 QUALITY CONTROL

A. Record documents shall be prepared to a high standard of quality, such as that set forth in MIL STD 100, ANSI Standard Drafting Manual Y14 or other relevant lower tier specification defining equal drafting quality for microfilming, except for daily reports.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 MAINTENANCE OF DOCUMENTS

A. The Contractor shall maintain at the worksite on a current basis one record copy of all drawings, specifications, addenda, change orders, approved shop drawings, working drawings, product data and samples in good order and marked currently to record all changes made during construction.

B. Maintain at the field office one copy of the following record documents:

1. Contract Documents
    a. Contract drawings with all clarifications, requests for information, directives,

changes and as-built conditions clearly posted.

b. Contract specifications with all clarifications, requests for information, changes, directives and record of manufacturer actually used along with product trade name.

c. Reference Standards in accordance with Technical Specifications Section 01091.

d. One set of drawings to record the following:
   1) Horizontal and vertical location of underground utilities affected by the Work.
   2) Location of internal utilities; include valves, controls, conduit, duct work, switches, pressure reducers, size reducers, transitions, crosses, tees, filters, motors, heaters, dampers, regulators, safety devices, sensors, access doors and appurtenances that are concealed in the construction shall be shown with dimensions given from a visible and recognizable reference to the item being located in all three dimensions. The drawing shall also reference the applicable submittal for the item being located.
   3) Field changes of dimensions and details including as-built elevations and location (station and offset).
   4) Details not on original contract drawings but obtained through requests for information or by other communications with the City.

2. Contractor Records
   a. Daily QC Reports
   b. Certificates of compliance for materials used in construction
   c. Nonconformance Reports (NCRs)
   d. Remedial Action Requests (RARs)
   e. Completed inspection list
   f. Inspection and test reports
   g. Test procedures
   h. Qualification of personnel
   i. Approved submittals
   j. Material and equipment storage records
   k. Safety Plan
   l. Erosion, sediment, hazardous and quality plans
   m. Hazardous material records
   n. First report of injuries

3.02 RECORDING

A. Keep record documents current daily.

B. Legibly mark copies of the contract drawings to record actual construction.

C. Legibly mark up each Section of the technical specifications and contract drawings to record:

   1. Changes made by change orders, requests for information, substitutions and variations approved by submittals.

3.03 DOCUMENT MAINTENANCE

A. Maintain Documents in a clean, dry and legible condition, which shall be turned over to the City prior to final acceptance.

B. Do not use record documents for construction purposes.

C. Make documents available for inspection by the Project Manager and any others having jurisdiction.

3.04 MONTHLY REVIEW

A. Prior to any application for payment, the Project Manager or his designated representative will inspect the record documents to ensure that they are being maintained and contain the most current correct data with particular attention to as-built drawings.

B. If, during the inspection, the Project Manager determines that the documents are not being maintained and kept current as to as-built conditions, an amount may be withheld from the payment request and deducted from the contract value to cover the City's cost of collecting and recording the as-built contract data. This cost will be determined on the basis of $110.00 per man-hour of effort.

PART 4 - MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

PART 5 - PAYMENT

5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

END OF SECTION 01720

SECTION 01730

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work specified in this Section consists of preparing and submitting operation and maintenance data for mechanical, electrical and other specified equipment.

1.02 SUBMITTALS

A. Refer to Technical Specifications Section 01300 and 01340 for submittal procedures.

B. Submit one (1) electronic copy and two (2) bound hard copy of the proposed Operation and Maintenance Data Manual format including a table of contents not less than 90 days prior to acceptance tests and final inspection.

C. Submit one (1) electronic copy and two (2) bound hard copy of Operation and Maintenance Data Manual within ten days after system startup is complete. These copies shall incorporate any comments made on the previous submittals, along with final readings on all settings and gauges taken while the system is in fully satisfactory operation.

1.03 CONTINUOUS UPDATING PROGRAM

A. Furnish one electronic copy of the Contractor’s letter indicating that suppliers have been notified to provide updated operation and maintenance data, service bulletins and other information pertinent to the equipment, as it becomes available.

PART 2 - PRODUCTS

A. The following products are the requirements of hard copies:

B. PAPER SIZE 8-½ inches x 11 inches.

C. PAPER White bond, at least 20 pound weight.

D. TEXT typewritten.

E. PRINTED DATA Manufacturer's catalog cuts, brochures, operation and maintenance data. Clear reproductions thereof will be acceptable. If this data is in color, all final manuals must contain color data.

F. DRAWINGS 8-½ inches x 11inches, bound with the text. Larger drawings are acceptable provided they are folded to fit into a pocket inside the rear cover of the manual. Reinforce edges of large drawings.

G. PRINTS OF DRAWINGS black ink on white paper, sharp in detail and suitable for making reproductions.

H. FLYSHEETS Separate each portion of the manual with colored, neatly prepared flysheets briefly describing the contents of the ensuing portion.

I. COVERS Provide 40 to 50 mil, clear plastic, front and plain back covers for each manual.

The front covers shall contain the information required in paragraph 3.02 below.

J. BINDINGS Conceal the binding mechanism inside the manual; lockable 3 ring binders shall be provided.

PART 3 - EXECUTION

3.01 GENERAL

A. Assemble each operation and maintenance manual using the manufacturer's latest standard commercial data.

3.02 COVER

A. Include the following information on the front cover and on the inside cover sheet:

1. OPERATION AND MAINTENANCE INSTRUCTIONS
2. (TITLE OF STRUCTURE OR FACILITY)
3. (TITLE AND NUMBER OF CONTRACT)
4. (CONTRACTOR'S NAME AND ADDRESS)
5. (GENERAL SUBJECT OF THE MANUAL)
6. (Leave spaces for signatures of the City representatives and acceptance date)

3.03 CONTENTS OF THE MANUAL

A. An index of all volumes in each volume of multiple volume systems.

B. An index in front of each volume. List and combine the literature for each system in the sequence of operation.

C. Name, address and telephone numbers of Contractor, suppliers and installers along with the manufacturer's order number and description of the order.

D. Name, address and telephone numbers of manufacturer's nearest service representatives.

E. Name, address and telephone number of nearest parts vendor and service agency.

F. Copy of guaranties and warranties issued to, and executed in the name of, the City.

G. Anticipated date City assumes responsibility for maintenance.

H. Description of system and component parts including theory of operation.

I. Pre operation check or inspection list.

J. Procedures for starting, operating and stopping equipment.

K. Post operation check or shutdown list.

L. Inspection and adjustment procedures.

M. Troubleshooting and fault isolation procedures for on-site level of repair.

N. Emergency operating instructions.

O. Accepted test data.

P. Maintenance schedules and procedures.

Q. Test procedures to verify the adequacy of repairs.

R. One copy of each wiring diagram.

S. One copy of each piping diagram.

T. Location where all measurements are to be made.

U. One copy of each duct diagram.

V. One copy of control diagram.

W. One copy of each accepted shop drawing.

X. One copy of software programs imputable or changeable on site.

Y. Manufacturer's parts list with catalog names, numbers and illustrations.

Z. A list of components which are replaceable by the City.

AA. An exploded view of each piece of the equipment with part designations.

BB. List of manufacturer's recommended spare parts, current prices and recommended quantities for two years of operation.

CC. List of special tools and test equipment required for the operation, maintenance, adjustment, testing and repair of the equipment, instruments and components.

DD. Scale and corrosion control procedures.

EE. Disassembly and re-assembly instructions.

FF. Troubleshooting and repair instructions.

GG. Calibration procedures.

HH. Ordering information.

II. Training course material used to train City staff, including slides and other presentation material.

PART 4 - MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

PART 5 - PAYMENT

5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

END OF SECTION 01730

SECTION 01740

WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work specified in this Section consists of preparing and submitting warranties and bonds required by these specifications.

B. Reference Contract General Conditions: GC 111, GC 1501, GC 1502, GC 1503, GC 1801, GC 1802.

1.02 SUBMITTALS

A. Refer to Technical Specifications Section 01300 for submittal procedures.

B. Submit executed warranties and bonds.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 WARRANTIES AND BONDS

A. Execute the warranties and bonds required by the Contract Documents. Prepare and submit a list of all warranties and bonds on the form provided by the City. Reference Technical Specifications Section 01999.

B. Provide warranties or bonds for the materials, labor and time period set forth in the sections of these specifications requiring such documents. All warranties shall be for a minimum period of one year unless the technical specifications for a specific item require a greater period of time.

C. Provide all warranties and bonds that the manufacturer or supplier furnishes at no additional cost in regular commercial trade. All warranties shall be for a minimum period of one year unless the technical specifications for a specific item require a greater period of time.

PART 4 - MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

PART 5 - PAYMENT

5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

END OF SECTION 01740

SECTION 017419

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL [LEED]

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous construction waste.
2. Recycling nonhazardous construction waste.
3. Disposing of nonhazardous construction waste.

B. Reference Contract General Conditions, GC 323, GC 324

C.

1.2 RELATED DOCUMENTS

A. Drawings, Contract Forms, Contract format (between the City and the General Contractor), General Submittals Section 01300

B. Sustainable Design Requirements Section 018113.

C. Division 2-33 for disposal of products.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

C. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

D. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

E. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of 75 percent by weight of total waste generated by the Work.

B. Salvage/Recycle Requirements: Owner's goal is to salvage and recycle as much nonhazardous construction waste as possible. Owner has established minimum goals for the following materials:

1. Construction Waste:

    a. Site-clearing waste.
    b. Masonry and CMU.
    c. Lumber.
    d. Wood sheet materials.
    e. Wood trim.
    f. Metals.
    g. Roofing.
    h. Insulation.
    i. Plastic.
    j. Glass.
    k. Carpet and pad.
    l. Gypsum board.
    m. Field and office waste.
    n. Brick.
    o. Acoustical tile.
    p. Piping.
    q. Electrical conduit.
    r. Packaging: Regardless of salvage/recycle goal indicated above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

        1) Paper.
        2) Cardboard.
        3) Boxes.
        4) Plastic sheet and film.
        5) Polystyrene packaging.
        6) Wood crates.

7) Plastic pails.

1.5 SUBMITTALS

A. Waste Management Plan: Submit three copies of plan within 30 days of date established for commencement of the Work.

B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit three copies of report. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in weight and volume.
4. Quantity of waste salvaged, both estimated and actual in weight and volume.
5. Quantity of waste recycled, both estimated and actual in weight and volume.
6. Total quantity of waste recovered (salvaged plus recycled) in weight and volume.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

C. Waste Reduction Calculations: Before request for Substantial Completion, submit three copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

F. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

H. LEED Submittal: LEED letter template for Credit MR 2.1 and 2.2, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.

I. Qualification Data: Waste Management Coordinator

J. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.6 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: LEED Accredited Professional by U.S. Green Building Council.

B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Meeting shall include contractors affected by the Waste Management Plan. Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. For each material recycled or sent to a landfill from the project, include type of material and the weight or volume of that material. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:

1. Total quantity of waste.
2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from salvaged materials.
5. Revenue from recycled materials.
6. Savings in hauling and tipping fees by donating materials.
7. Savings in hauling and tipping fees that are avoided.
8. Handling and transportation costs. Include cost of collection containers for each type of waste.
9. Net additional cost or net savings from waste management plan.

E. Forms: Prepare waste management plan on forms included at end of Part 3.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement waste management plan as approved by the City. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with Division 01 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. The Waste Management Coordinator shall be responsible for instructing workers and overseeing and recording results of the Waste Management Plan. The Coordinator will maintain a log of way-bills, invoices and other documentation confirming that all materials have been hauled to the required locations. Coordinator shall be present at Project site full time for duration of Project.

C. Training: Train workers, subcontractors, and suppliers on appropriate separation, handling, and recycling to be used by all parties and proper waste management procedures, as appropriate for the Work occurring at Project site.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials. Waste bins shall be labeled in English and in the language appropriate for those working on site.
2. To prevent contamination of materials to be recycled, materials will be handled consistent with requirements for acceptance by designated waste-disposal facilities. Where

materials must be commingled they must be taken to a processing facility for separation off site.

3. Hazardous wastes: Hazardous wastes shall be separated, stored, and disposed of in accordance with the requirements of the authorities having jurisdiction, including Federal, State, County and City agencies.
4. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Site-Clearing Wastes: Chip brush, branches, and trees on-site.

1. Comply with requirements in Division 32 Section 329300-Plants for use of chipped organic waste as organic mulch.

C. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

    a. Comply with requirements in Division 32 Section 329300-Plants for use of clean sawdust as organic mulch.

D. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

    a. Comply with requirements in Division 32 Section 329300-Plants for use of clean ground gypsum board as inorganic soil amendment.

E. General: Recycle paper and beverage containers used by on-site workers.

F. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

G. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

H. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
   a. Inspect containers and bins for contamination and remove contaminated materials if found.
2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.

5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

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3.3 SAMPLE FORMS FOR RECYCLING AND WASTE

A. General: The following sample forms should be filled out for each item disposed of to a landfill or recycled. Units shall be by weight or volume, as long as they are consistent for both construction waste and materials that are recycling or salvaged.

B. Construction Waste Log

Date	Ticket No.	Waste [units]

Total		

C. Recycle / Salvage Log

Date	Ticket No.	Recycled Material Type	Recycled Material [units]

D. Construction Waste Management Tracking Form

Diverted/Recycled Materials Description	Diversion/Recycling Hauler or Location	Quantity of Diverted /Recycled Waste	Units (tons/cy)
Total Construction Waste Diverted:			
Landfill Materials Description	Landfill Hauler or Location	Quantity of Waste	Units (tons/cy)
Total construction waste sent to Landfill:			
Total of all construction waste:			
Percentage of construction waste diverted from landfill:			

3.4 WASTE DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 017419

SECTION 018113

SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, Contract Forms, Contract format (between the City and the General Contractor), General Conditions and Supplementary General Conditions, and including Exhibits and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes general requirements and procedures for compliance with certain U.S. Green Building Council's (USGBC) LEED prerequisites and credits needed for the Project to obtain LEED certification.

1. Other LEED prerequisites and credits needed to obtain LEED certification are dependent on material selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests.
2. Additional LEED prerequisites and credits needed to obtain the indicated LEED certification are dependent on the Architect's design and other aspects of the Project that are not part of the Work of the Contract.

B. Related Sections include the following:

1. Divisions 01 through 17 Sections for LEED requirements specific to the Work of each of those Sections. These requirements may or may not include reference to LEED.

1.3 SUBMITTALS

A. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

B. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

C. Project Materials Cost Data: Provide statement indicating total cost for building materials used for Project. Include statement indicating total cost of mechanical and electrical components.

D. LEED Action Plans: Provide preliminary submittals within 30 days of date established for the Notice of Award indicating how the following requirements will be met.

E. Project Materials Tracking Worksheets: Provide statement indicating manufacturer, product, cost, and percentage weight for materials in LEED MR Credit 4, MR Credit 5,, and MR Credit 7. See LEED action plan for additional requirements. Reference Material Tracking examples (attached).

F. LEED Log Binder: Maintain a binder with sectional dividers, divided by LEED Category and credit number, for those credits described in this section. The environmental features described below shall be circled. Contractor shall make this LEED Log Binder accessible at all times and update it weekly as new products are ordered and submit a copy of this binder once a month. Submit final LEED Log Binder as part of project close-out requirements. Contractor is only responsible for collecting the required submittal information described in detail below and for putting these submittals into the LEED Log Binder:

1. Credit MR 2.1 and 2.1: Waste management plan complying with Division 01 Section "Construction Waste Management and Disposal."
2. Credit MR 4.1 and 4.2: List of proposed materials with recycled content.
    a. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.
3. Credit MR 5.1 and 5.2: List of proposed regionally manufactured and extracted, harvested, or recovered materials.
    a. Identify each regional material, its location of manufacture and extraction, harvest, or recovery, and cost.
4. Credit MR 7.0: List of proposed Forest Stewardship Council (FSC) certified wood products.
    a. Indicate each product containing FSC certified wood, its source, and cost.
    b. Include statement indicating total cost for wood-based materials used for Project, including non-rented temporary construction.
    c. Include vendor invoices showing all FSC certified wood products used with Chain of Custody numbers, product cost, and verification whether product is “FSC Pure,” FSC Mixed Credit,” or “FSC Mixed XX%.”
5. Credit EQ 3.1: Construction indoor air quality management plan.
    a. Photographs with dates stamped showing SMACNA measures implemented on site
6. Credit EQ 4.1- 4.4: List for adhesives and sealants used on the interior of the building.
    a. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24) of each product
7. Credit EQc4.2: Product Data for paints and coatings used on the interior of the building
    a. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24) of each product
8. Credit EQc4.3: List all carpet, carpet cushion and hard surface flooring.
    a. Indicate for Carpet and Rug Institute’s Green Label Plus Program certificate for carpet products.
    b. Indicate for Carpet and Rug Institute’s Green Label Program certificate for carpet cushion products.
    c. Indicate Data compliance with the FloorScore standard (current as of the date of the rating system, or more stringent version) by an independent third-party for all hard surface flooring.
9. Credit EQc4.4: List all agrifiber and composite wood products.
    a. Indicate statement verifying that these contain no urea-formaldehyde resin.

G. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:

1. Credit MR 2.1 and 2.2: Waste reduction progress reports complying with Division 01 Section "Construction Waste Management and Disposal."
2. Credit MR 4.1 and 4.2: Recycled content.
3. Credit MR 5.1 and 5.2: Regionally manufactured and extracted, harvested, or recovered materials.
4. Credit MR 7.0: Certified wood.

H. LEED Documentation Submittals: Provide submittals within 30 days of receipt for the following items:

1. Credit SS 7.2: Product Data for roofing materials indicating Solar Reflectance Index.
2. Credit SS 8.0: Product Data for interior and exterior lighting fixtures that stop direct-beam illumination from leaving the building site.
3. Credit WE 3.1 and 3.2: Product Data for plumbing fixtures (water closets, faucets, lavatories, and urinals) indicating water consumption in terms of gpf or gpm.
4. Prerequisite EA 3.0: Product Data for new HVAC equipment indicating absence of CFC refrigerants.
5. Credit EA 1.0: Product data for glazing indicating properties of glazing (U-value, solar heat gain coefficient, and visible light transmittance). Product data for all insulation indicating R-Value per inch and thickness (or total R-Value) and location of insulation in building. Product data for efficiency of HVAC equipment for heating, cooling, and domestic hot water.
6. Credit EA 4.0: Product Data for new HVAC equipment indicating the absence of refrigerants or the ozone depletion potential and global warming potential of refrigerants.
7. Credit EA 5.0: Product Data and wiring diagrams for sensors and data collection system used to provide continuous metering of building energy and water consumption performance over time.
8. Credit MR 2.1 and 2.2: Comply with Division 01 Section "Construction Waste Management and Disposal."
9. Credit MR 4.1 and 4.2: Product Data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.

    a. Include Product Material Tracking Worksheets for MR 4.1 and 4.2 indicating costs and weights of each recycled material.

10. Credit MR 5.1 and 5.2: Product Data indicating location of material manufacturer and location of material extraction/harvesting/recovering for regional materials.

    a. Include statement indicating cost and distance from manufacturer to Project for each regionally manufactured material.
    b. Include statement indicating cost and distance from point of extraction, harvest, or recovery to Project for each raw material used in regionally manufactured materials.
    c. Include statement indicating cost and distance from point of extraction, harvest, or recovery to project for each raw material used in regionally manufactured materials.
    d. If only a fraction of the material is extracted/harvested/recovered and manufactured locally, then indicate percentage by weight of material.
    e. Include Product Material Tracking Worksheets for MR 5.1 and 5.2 indicating costs and weights of each regional material.

11. Credit MR 7.0: Product Data and certificates of chain-of-custody for products containing certified wood.

    a. Include statement indicating product type, manufacturer, and costs for each product containing certified wood.
    b. Include statement indicating total cost for all wood-based materials used for Project, including only wood materials that are permanently installed in the project.
    c. Include Forest Steward Ship Council Chain of Custody certification number for all FSC certified projects.
    d. Include Product Material Tracking Worksheets for MR 7.0 indicating cost for each material.

12. Credit EQ 1.0: Product Data and Shop Drawings for carbon dioxide monitoring system and/or outdoor air monitoring station.
13. Credit EQ 3.1:

    a. Construction Indoor Air Quality (IAQ) management plan.
    b. Product Data for temporary MERV 8 filtration media.
    c. Construction Documentation: Six photographs at three different occasions (18 total) during construction of the different SMACNA requirements along with a brief description of the SMACNA approach employed, documenting implementation of the IAQ management measures, such as protection of ducts, cleaning of air handling units, installation of filters, and on-site stored or installed absorptive materials.

14. Credit EQ 3.2:

    a. Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
    b. Product Data for MERV 8 filtration media used during flush-out.
    c. Report from testing and inspecting agency indicating results of IAQ testing and documentation showing conformance with IAQ testing procedures and requirements.

15. Credit EQ 4.1:

    a. Product Data for adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).
    b. Determine product category of each adhesive or sealant based on the following referenced standards:

        1) South Coast Air Quality Management District (SCAQMD) Rule 1168, effective July 1, 2005 and amendment effective January 7, 2005.
        2) Green Seal Standard for Commercial Adhesives GS-36, effective on October 19, 2000.

16. Credit EQ 4.2:

    a. Product Data for paints and coatings used on the interior of the building indicating chemical composition and VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).
    b. Determine product category of each paint or coating based on the following referenced standards:

1) Green Seal Standard GS-11, Paints, First Edition, May 20, 1993.
2) Green Seal Standard GC-03, Anti-Corrosive Paints, Second Edition, January 7, 1997.
3) South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, effective January 1, 2004.

17. Credit EQ 4.3:

a. Product Data for carpet products indicating compliance with the testing and product requirements of the Carpet and Rug Institute's Green Label Plus Program.
b. Product Data for carpet cushion products indicating compliance with the testing and product requirements of the Carpet and Rug Institute's Green Label Program.
c. Product Date for carpet and carpet cushion adhesive indicating compliance with the South Coast Air Quality Management District (SCAQMD) Rule 1168, effective July 1, 2005 and amendment effective January 7, 2005.
d. Product Data for all hard surface flooring indicating compliance with the FloorScore standard (current as of the date of the rating system, or more stringent version) by an independent third-party.
e. Product Data for all concrete, bamboo, wood, and cork floor finishes (sealer, stain, finish etc.) floor finishes such as sealer, stain and finish indicating compliance with the requirements of South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, effective January 1, 2004.
f. Product Data for all tile setting adhesives and grout indicating compliance with South Coast Air Quality Management District (SCAQMD) Rule 1168, effective July 1, 2005 and amendment effective January 7, 2005.

18. Credit EQ 4.4: Product Data for composite wood and agrifiber products indicating that products contain no urea-formaldehyde resin.

a. Include statement indicating adhesives and binders used for each product.

b. Product Data for all laminating adhesives used to fabricate on-site and shop applied composite wood and agrifiber assemblies indicating that they do not contain added urea-formaldehyde resins

19. Credit EQ 5: Product Data for entryway grille. Product Data for MERV 13 filtration media used during occupancy.
20. Credit EQ 7.1 and 7.2: Product Data and Shop Drawings for sensors and control system used to monitor and control room temperature.

PART 2 - PRODUCTS

2.1 RECYCLED CONTENT OF MATERIALS

A. Credit MR 4.1: Provide building materials with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 10 percent of the cost of materials used for the Project.

1. The cost of post-consumer recycled content of an item shall be determined by dividing the weight of post-consumer recycled content in the item by the total weight of the item and multiplying by the cost of the item.
2. The cost of post-consumer recycled content plus one-half of pre-consumer recycled content of an item shall be determined by dividing the weight of post-consumer recycled

content plus one-half of pre-consumer recycled content in the item by the total weight of the item and multiplying by the cost of the item.

3. Do not include mechanical and electrical components in the calculation.
4. Recycled content of materials shall be defined according to the International Organization for Standardization document, *ISO 14021- Environmental labels and declarations- Self-declared environmental claims (Type II environmental labeling)*

B. Credits MR 4.2: Provide building materials with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 20 percent of the cost of materials used for the Project.

2.2 REGIONAL MATERIALS

A. Credit MR 5.1: Provide 10 percent of building materials (by cost) that are regionally manufactured materials and regionally extracted, harvested, or recovered.

B. Credit MR 5.2: Provide 20 percent of building materials (by cost) that are regionally manufactured materials and regionally extracted, harvested, or recovered.

2.3 CERTIFIED WOOD

A. Credit MR 7.0: Provide a minimum of 50 percent (by cost) of wood-based materials that are produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria."

1. Wood-based materials include but are not limited to the following materials when made from made wood, engineered wood products, or wood-based panel products:

    a. Rough carpentry.
    b. Miscellaneous carpentry.
    c. Heavy timber construction.
    d. Wood decking.
    e. Metal-plate-connected wood trusses.
    f. Structural glued-laminated timber.
    g. Finish carpentry.
    h. Architectural woodwork.
    i. Wood paneling.
    j. Wood veneer wall covering.
    k. Wood flooring.
    l. Wood lockers.
    m. Wood cabinets.

2.4 LOW-EMITTING MATERIALS

A. Credit EQ 4.1: For interior applications use adhesives and sealants that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA method 24):

B.

SCAQMD Rule #1168	
Architectural Applications	Specialty Applications
1. Indoor Carpet Adhesives: 50 g/L.	2. PVC Welding: 510 g/L.
3. Carpet Pad Adhesives: 50 g/L.	4. CPVC Welding Compounds: 490 g/L.
5. Wood Flooring Adhesive: 100 g/L.	6. ABS Welding Compounds: 325 g/L.
7. Rubber Floor Adhesives: 60 g/L.	8. Plastic Cement Welding: 250 g/L.
9. Subfloor Adhesives: 50 g/L.	10. Adhesive Primer for Plastic: 550 g/L.
11. Ceramic Tile Adhesives: 65 g/L.	12. Contact Adhesive: 80 g/L.
13. VCT and Asphalt Tile Adhesives: 50 g/L.	Special Purpose Contact Adhesive: 250 g/L.
14. Drywall and Panel Adhesives: 50 g/L.	15. Structural Wood Member Adhesive: 140 g/L.
16. Cove Base Adhesives: 50 g/L.	17. Sheet Applied Rubber Lining Operations: 850 g/L
18. Multipurpose Construction Adhesives: 70 g/L.	19. Top and Trim Adhesive: 250 g/L.
20. Structural Glazing Adhesives: 100 g/L.	21.
Sealants	22. Substrate Specific Applications
23. Architectural: 250 g/L.	24. Metal to Metal: 30 g/L.
25. Nonmembrane Roof: 300 g/L.	26. Plastic Foams: 50 g/L.
27. Roadway: 250 g/L.	28. Porous Materials (Except Wood): 50 g/L.
29. Single-Ply Roof Membrane: 450 g/L.	30. Wood: 30 g/L.
31. Other: 420 g/L.	32. Fiberglass: 80 g/L.
33. Sealant Primers	34.
35. Architectural Non Porous: 250 g/L.	36.
37. Architectural Porous: 775 g/L.	38.
39. Other: 750 g/L	40.

C.

Green Seal GS-36
Aerosol Adhesives
General purpose mist spray: 65% VOCs by weight
1. General purpose web spray: 55% VOCs by weight
2. Special purpose aerosol adhesives (all types): 70% VOCs by weight

D. Credit EQ 4.2: For interior applications use paints and coatings that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA method 24) and the following chemical restrictions:

E.

SCAQMD Rule 1113	Green Seal Standard GS-11
Clear Wood Finishes - Varnish: 350 g/L.	Interior Paints and Coatings
Clear Wood Finishes - Lacquer: 550 g/L.	Flat: 50 g/L.
Sealers - Waterproofing Sealers: 250 g/L.	Non-Flat and Primers: 150 g/L.
Sealers - Sanding Sealers: 275 g/L.	1.
Sealers - All Other Sealers: 200 g/L.	2.
3. Stains: 250 g/L.	4.
5. Shellac – Clear: 730 g/L	
6. Shellac – Pigmented:	7.
8. Green Seal Standard GC-03	9.
10. Anti-Corrosive or Anti-Rust Paints (Applied to Interior Ferrous Substrates): 250g/L.	11.

12. *[not included in LEED; optional to this project. Included in other sustainability guidelines.]* Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
13. [not included in LEED; optional to this project. Included in other sustainability guidelines.] Restricted Components: Paints and coatings shall not contain any of the following:

    a. Acetone.
    b. Acrolein.
    c. Acrylonitrile.
    d. Antimony.
    e. Benzene.
    f. Butyl benzyl phthalate.
    g. Cadmium.
    h. DEHP.
    i. Di (2-ethylhexyl) phthalate.
    j. Di-n-butyl phthalate.
    k. Di-n-octyl phthalate.
    l. 1,2-dichlorobenzene.
    m. Dichloromethane.
    n. Diethyl phthalate.
    o. Dimethyl phthalate.
    p. Dioxin.
    q. Ethylbenzene.
    r. Formaldehyde.
    s. Hexavalent chromium.
    t. Isophorone.
    u. Lead.
    v. Mercury.
    w. Methyl ethyl ketone.
    x. Methyl isobutyl ketone.
    y. Methylene chloride.
    z. Naphthalene.
    aa. Toluene (methylbenzene).
    bb. 1,1,1-trichloroethane.
    cc. Vinyl chloride.
    dd. 4-PC.

F. Credit EQ 4.3: All carpet installed in the building interior shall meet the testing and product requirements of the Carpet and Rug Institute's Green Label Plus program. All carpet cushion

installed in the building interior shall meet the requirements of the Carpet and Rug Institute Green Label program. All carpet adhesive shall meet the requirements of EQ Credit 4.1: VOC limit of 50 g/L.

G. Credit EQ 4.4: Do not use composite wood and agrifiber products that contain urea-formaldehyde resin.

H. All hard surface flooring shall meet the requirements of the FloorScore standard (current as of the date of the rating system, or more stringent version) as shown with testing by an independent third-party.

I. Concrete, wood, bamboo and cork floor finishes such as sealer, stain and finish shall meet the requirements of South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004.

J. Tile setting adhesives and grout shall meet South Coast Air Quality Management District (SCAQMD) Rule 1168. VOC limits correspond to an effective date of July 1, 2005 and rule amendment date of January 7, 2005.

PART 3 - EXECUTION

3.1 SITE DISTURBANCE

A. SS Prerequisite 1: Comply with 2003 EPA Construction General Permit or local erosion and sedimentation control standards and codes, whichever is more stringent.

3.2 CONSTRUCTION WASTE MANAGEMENT

A. Credit MR 2.1 and 2.2: Comply with Division 01 Section "Construction Waste Management and Disposal."

3.3 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

A. Credit EQ 3.1: Comply with SMACNA IAQ Guideline for Occupied Buildings under Construction.

1. During construction meet or exceed the recommended Control Measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd Edition 2007, ANSI / SMACNA 008-2008 (Chapter 3) , as summarized below:

    a. HVAC Protection – Use temporary heaters whenever feasible. Seal all duct and equipment openings with plastic. If permanently installed air handlers are used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8, as determined by ASHRAE 52.2-1999, shall be used over each return air grille. Replace all filtration media immediately prior to occupancy. All leaks in ducts and air handlers should be repaired promptly.
    b. Source Control – For Contractor information, all paints, carpet, caulks, adhesives, sealants are specified as low-VOC and non-toxic. Recover, isolate and ventilate containers housing toxic materials. Avoid exhaust fumes from idling vehicles and gasoline fueled tools.

c. Pathway Interruption – During construction, isolate areas of work to prevent contamination of clean or spaces. Ventilate using 100% outside air to exhaust contaminated air directly to the outside during installation of VOC emitting materials. Use pressure differentials or barriers between work and clean areas to prevent contaminated air from entering clean areas.
d. Housekeeping – Protect building materials from weather and store in a clean area prior to unpacking for installation. Clean all coils, air filters, and fans before performing testing and balancing procedures. Institute cleaning activities designed to control contaminants in building spaces.
e. Scheduling – Complete applications of wet and odorous materials such as VOCs in paints, sealants, and coatings before installing absorbing materials such as ceiling tiles, carpets, insulation, gypsum products, and fabric-covered furnishings. Avoid exposure of all interior materials to moisture.

2. Protect stored on-site or installed absorptive materials from moisture damage.
3. If owner authorizes the use of permanent heating, cooling, and ventilating systems during construction period as specified in Division 01 Section "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2-1999 at each return-air inlet for the air-handling system used during construction. Replace all filtration media with filter media having a MERV 13 according to ASHRAE 52.2-1999 immediately prior to occupancy.

B. Credit EQ 3.2: After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total air volume of 14,000 cu.ft. of outdoor air per sq.ft. of floor area while maintaining an internal temperature of at least 60 degrees F and relative humidity no higher than 60%.

1. Contractors option: Either full continuous flush-out or air contaminant testing is required, not both,
2. For building flushout, perform building flush-out before occupancy and after construction is compete, HVAC systems have been tested, adjusted, and balanced, and new filtration media has been installed. Perform a building flush-out by supplying a total air volume of 14,000 cu.ft. of outdoor air per sq.ft. of floor area while maintaining an internal temperature of at least 60 degrees F and relative humidity no higher than 60%. If interior spaces must be occupied prior to completion of the flush-out, supply a minimum of 25% of the total air volume prior to occupancy and provide minimum outside air volumes of 0.30 cfm per square foot or design minimum outside air rate, whichever is greater. Install new HVAC filtration media after completion of flush-out and before occupancy or further testing. OR
3. For Air Contaminant testing, perform air contaminant testing prior to occupancy, after interior finishes are installed, HVAC system has been tested, adjusted, and balanced, and new HVAC filtration media has been installed. Collect indoor air samples representative of occupied areas. Collect samples at outside air intake of each air handler at the same time as indoor samples are taken. Analyze air samples and submit report. If air samples show concentrations higher than those specified, ventilate with 100% outside air and retest, or conduct full building flushout as specified above.
4. Air Contaminant Concentration Determination and Limits:

5. For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting non-complying building areas, take samples from same locations as in the first test.

Contaminant	Maximum Concentration	EPA Compendium method	ISO method
Formaldehyde	27 parts per billion	IP-6	ISO 16000-3
Particulates (PM10)	50 micrograms per cubic meter	IP-10	ISO 7708
Total volatile organic compounds (TVOCs)	500 micrograms per cubic meter	IP-1	ISO 16000-6
4-Phenylcyclohexene (4-PCH)*	6.5 micrograms per cubic meter	IP-1	ISO 16000-6
Carbon monoxide (CO)	9 part per million and no greater than 2 parts per million above outdoor levels	IP-3	ISO 4224
* This test is only required if carpets and fabrics with styrene butadiene rubber (SBR) latex backing are installed as part of the base building systems.			

6. Air-sample testing shall be conducted as follows:

   a. All measurements shall be conducted prior to occupancy but during normal occupied hours, and with building ventilation system starting at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.
   b. Building shall have all interior finishes installed including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Nonfixed furnishings such as workstations and partitions are encouraged, but not required, to be in place for the testing.
   c. Number of sampling locations varies depending on the size of building and number of ventilation systems. For each portion of building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq. ft. or for each contiguous floor area, whichever is larger, and shall include areas with the least ventilation and greatest presumed source strength.
   d. Air samples shall be collected between 3 and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum four hour period.

END OF SECTION 018113

SECTION 019113

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Commissioning. Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:

1. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
2. Verify and document proper performance of equipment and systems.
3. Verify that O&M documentation left on site is complete.
4. Verify that the Owner's operating personnel are adequately trained.

B. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

1.2 COORDINATION

A. Commissioning Team. The members of the commissioning team consist of the Commissioning Agent (CA), the City's Project Manager (PM), the General Contractor (GC or Contractor), the architect and design engineers (A/E), the Mechanical Contractor (MC), the Electrical Contractor (EC), the Testing, Adjusting, Balancing (TAB) representative, the Controls Contractor (TC), the Denver Public Library maintenance staff, and any other installing subcontractors or suppliers of equipment. All contractors under GC are sometimes referred as 'subs' in this documentation.

B. Management. The CA is hired by the Owner. The CA directs and coordinates the commissioning activities and the reports to the Project Manager.

C. Scheduling. The CA will work with the PM to schedule the commissioning activities. The CA will provide sufficient notice to the PM and GC for scheduling commissioning activities. The GC will integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

D. Seasonal and other modes of Functional Performance Testing. These tests will occur under actual conditions, unless otherwise directed by the PM.

1.3 COMMISSIONING PROCESS

A. Commissioning Process. The following activities describe the commissioning tasks during construction and the general order in which they occur. All activities are coordinated by the commissioning agent.

1. Scoping Meeting. All members of the design and construction team involved in the commissioning process meet and agree on the scope of work, tasks, schedules, deliverables, and responsibilities involved in the implementation of the Commissioning Plan.
2. Commissioning Plan. The commissioning plan provides a guideline for commissioning execution. After the scoping meeting the CA will update the plan. The plan will continue to evolve and expand as the project progresses. The Specifications take precedence over the Commissioning Plan if a dispute over commissioning execution or responsibilities arise.
3. Submittals. The CA receives equipment documentation/submittals from all Subs installing or selecting equipment. If the A/E is responsible for normal submittals in the construction process, the A/E is also responsible to provide the CA the documentation. This documentation is to include detailed start-up procedures.
4. Start-Up/Pre-Functional Checklists. The CA works with the Subs to develop startup plans and documentation formats. This includes providing the Subs with pre-functional checklists to be completed during the startup process.
5. Functional Performance Testing. The CA develops specific equipment and system functional performance test procedures. The Subs review the procedures. The procedures are executed by the either the Subs or the CA (depending upon the task), under the direction of, and documented by the CA.
6. Deficiencies and Resolution. The CA documents issues of non-compliance of the Start-Up/Pre-Functional Tests of the Functional Tests. The items are corrected at the Sub's expense and the equipment or systems are retested.
7. Operations and Maintenance Documentation. The CA reviews the O&M documentation for completeness. The CA reviews and coordinates the training provided by the Subs and verifies that it was completed.
8. Seasonal Testing. Deferred or seasonal testing is conducted, as required.

1.4 RELATED SECTIONS

1. Section 223000 – Plumbing Equipment

2. Section 230501 – Mechanical and Electrical Coordination
3. Section 230502 – Basics Mechanical Requirements
4. Section 230503 – Basics Mechanical Materials and Methods
5. Section 230513 – Motors and Starters
6. Section 230521 – Pipe and Pipe Fittings
7. Section 230522 – Piping Accessories
8. Section 230523 – Valves
9. Section 230529 – Pipe Supports and Anchors
10. Section 230530 - Electronic Speed Controllers
11. Section 230548 – Vibration Control
12. Section 230553 – Mechanical Identification
13. Section 230593 – Test-Adjust-Balance
14. Section 230700 – Mechanical Insulation
15. Section 230900 – Building Automation and Automatic Temperature Control Systems
16. Section 232123 – HVAC Pumps
17. Section 232300 – Refrigerant Piping
18. Section 233113 - Ductwork
19. Section 233300 – Ductwork Accessories
20. Section 233400 – Fans
21. Section 233613 – Underfloor Air Terminal Units
22. Section 233700 – Air Inlets and Outlets
23. Section 234000 – Air Cleaning

24. Section 235100 – Flue Systems
25. Section 236213 – Air-Cooled Condensing Units
26. Section 237400 – Packaged Rooftop Air Conditioning Units
27. Section 238239 – Heating Terminal Units
28. Section 239000 – Project Closeout
29. 260923 – Lighting Control Devices

1.5 RESPONSIBILITIES

A. The responsibilities of the parties in the commissioning process are provided in this section. The responsibilities of the mechanical contractor and controls contractor are in Division 23. It is noted that services of the Project Manager, Design Team, and Commissioning Agent are not provided in this contract. That is, the Contractor is not responsible for providing their services. Their responsibilities are listed here to clarify the commissioning process.

B. All Parties

1. Attend commissioning scoping meeting and additional meetings, as necessary.

C. Architect (A/E)

1. Construction and Acceptance Phase

a. Attend the commissioning scoping meeting and selected commissioning team meetings.
b. Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual preparation, etc., as contracted.
c. Provide design narrative documentation requested by the CA.
d. Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.
e. Prepare and submit final as-built design intent documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.

D. Mechanical and Electrical Designers/Engineers (A/E)

1. Construction and Acceptance Phase

a. Perform normal submittal review, construction observation, as-built drawing preparation, etc., as contracted.
b. Provide design narrative and sequences documentation requested by the CA.
c. Attend commissioning scoping meetings and other selected commissioning team meetings.
d. Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents.
e. Prepare and submit the final as-built design intent and operating parameters documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.
f. Optional: Review the equipment start-up and pre-functional checklists. Review the functional performance test plans. Witness performance testing

E. Commissioning Agent (CA)

1. The CA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CA may assist with problem-solving, non-conformance, or deficiencies, but ultimately that responsibility resides with the general contractor and the A/E team. The primary role of the CA is to develop and coordinate the execution of a testing plan, observe, and document performance. It is the goal to insure that systems are functioning in accordance with the documented design intent and the Contract Documents.

2. Construction and Acceptance Phase

    a. Coordinates and directs all commissioning activities in a logical and efficient manner. Work with the GC and PM to ensure that commissioning activities are being scheduled.
    b. Revise, as necessary, the Commissioning Plan.
    c. Plan and conduct a commissioning scoping meeting.
    d. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures, and sequences of operation.
    e. Review Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.
    f. Develop start-up and checkout plan with Subs. Write and distribute pre-functional checklists.
    g. Perform site visits, as necessary, to observe component and system installations. Attend selected planning and job-site meetings to obtain information on construction progress.
    h. Review completed pre-functional checklist and start-up reports for owner approval.
    i. Coordinate any start-up requirements with TAB contractor.
    j. Write the functional performance test procedures for equipment and systems. Submit to PM and A/E for review.
    k. Coordinate, witness, and document functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved.
    l. Maintain a master deficiency and resolution record. Provide the PM with written progress reports and test results with recommended actions.
    m. Provide a final commissioning report.

F. Owner's Project Manager (PM)

1. Construction and Acceptance Phase

    a. Manage the contract of the A/E, GC, and of the CA.
    b. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions according to the Commissioning Plan.
    c. Provide final approval for the completion of the commissioning work.

G. General Contractor (GC)

1. Construction and Acceptance Phase

    a. Facilitate the coordination of the commissioning work by the CA.
    b. Include the cost of coordinating with the commissioning process in the contract price.
    c. Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the

CA.

d. In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks, and training.
e. Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.
f. A representative shall attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the commissioning process.
g. Coordinate the training of owner personnel.
h. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.
i. Allocation of cost among subs if retesting occurs beyond in accordance to Specification 230800. This includes reimbursing the CA if retesting is required.

H. Mechanical Contractors.

1. Attend initial commissioning coordination meeting.

2. Provide a complete set of all submittals for mechanical equipment to the CxA

3. Provide complete equipment and systems start-up including personnel and tools, as required for safe, proper and complete start-up of all mechanical equipment.

4. Perform installation verification, start-up and TAB and complete required documentation as directed by CxA.

5. Correct all deficiencies found during installation verification, start-up and TAB to ensure that all equipment and systems are fully functional and ready for functional performance testing.

6. Prepare O&M manuals and supplementary information on all equipment as directed by CxA and assemble in binders tabbed and indexed. Supplementary information may include, but is not limited to, such items as power/control field wiring diagrams, equipment maintenance schedule, vendor and maintenance contact lists. Submit to CxA when requested.

7. Prepare preliminary schedule for O&M manuals submission, owner training, pipe and duct system testing, flushing and cleaning, equipment start-up, and TAB for use by the CxA. Update schedule throughout the construction period.

8. Notify CxA a minimum of two weeks in advance of equipment and system start-up and/or installation verification testing.

9. Set-up and schedule vendors and contractors required to participate in the owner training sessions for all equipment and systems.

10. Provide a complete set of as-built record drawings and schematics with a copy to the CxA.

11. Return to site with the GC approximately 10 months after the start of the warrantee period to review system operation and to address operational issues.

I. TAB Contractor(s)

1. Attend initial commissioning coordination meeting.

2. Submit TAB procedures to CxA and Mechanical Consultant for review and acceptance.

3. Provide a preliminary TAB report showing that the system is complete and capable of being balanced. Provide an additional copy of the report labelled “For CA”.

4. Attend TAB review meeting scheduled by the CxA. Be prepared to discuss procedures that shall be followed in TAB and findings of preliminary TAB.

5. Submittal of final TAB report showing all flows, pressures, motor speeds, voltages and amperages etc., as required for a full and complete balancing report on all systems. Provide an additional copy of the TAB final report labelled “For CA”, and include as-built distribution systems schematics.

6. Participate in verification of the TAB report, which will consist of repeating any selected measurement contained in the TAB report where required by the CxA for verification or diagnostic purposes.

J. Building Controls and Automation System Contractor(s)

1. Attend initial commissioning coordination meeting.

2. Attend Sequence of Operation and Graphics review meeting scheduled by the CxA. Be prepared to discuss all sequences including all changes, and provide a schematic for each proposed graphic.

3. Provide the following submittals to the CxA at time of FPT. (Note: The following shall be updated to as-built conditions).

   a. Hardware and software submittals and shop drawings.

   b. Narrative description of each control sequence for each piece of equipment or system controlled.

   c. Point-to-point and sensor calibration verification checklists

   d. As-built diagrams showing all control points, sensor locations, point names, actuators, controllers and, where necessary, points of access, superimposed on diagrams of the physical equipment.

   e. Printout of panel layouts including all analog input, analog output, digital input, and digital output connections. Provide a separate list for each stand alone control unit.

   f. Printout of final control programming algorithms, include current values of all parameters for each system point.

   g. Owners operation and maintenance manuals.

4. Provide thorough training to operating personnel on hardware, operation and programming, and the application program for the system.

5. Demonstrate system performance to CxA. including all modes of system operation. (e.g. normal, abnormal, emergency).

6. Provide control system technician to operate systems as required by and under the direction of the CxA during system verification and functional performance testing.

7. Provide support and coordination with TAB contractor on all interfaces between their scopes of work. Provide all devices, such as portable operators' terminals, for TAB use in completing TAB procedures.

8. Provide any trend logs as may be required by the CxA.

9. Return to site with the GC and CxA approximately 10 months after the start of the warrantee period to review system operation and to address operational issues.

K. Electrical Contractor

1. Attend commissioning meetings scheduled by the CxA.

2. Provide a complete set of all submittals for electrical equipment to the CxA

3. Correct all deficiencies found during Installation Verification Inspection (IVI), start-up, TAB and FPT to ensure all equipment and systems are fully functional and in

4. Prepare O&M manuals and supplementary information on all equipment as directed by CxA and assemble in binders tabbed and indexed. Supplementary information may include, but is not limited to, such items as power/control field wiring diagrams, equipment maintenance schedule, vendor and maintenance contact lists. Submit to CxA when requested.

5. Provide electrical system technicians to assist during system verification and functional performance testing as required by the CxA.

6. Provide a complete set of as-built record drawings and schematics with a copy to the CxA.

7. Return to site with the GC and CxA approximately 10 months after the start of the warrantee period to review system operation and to address operational issues.

L. Equipment Suppliers

1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
2. Assist in equipment testing per agreements with Subs.
3. Provide information requested by CA regarding equipment sequence of operation and testing procedures.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division contractor for the equipment being tested. For example, the mechanical contractor of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and controls system in

Division 23, except for equipment specific to and used by TAB in their commissioning responsibilities.

B. Data logging equipment and software required to test equipment will be provided by the CA, but shall not become the property of the Owner.

C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications.

PART 3 - EXECUTION

3.1 MEETINGS

A. Scoping Meeting. Within 60 to 90 (?working?) days of commencement of construction, the CA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CA. Information gathered from this meeting will allow the CA to revise the Commissioning Plan.

B. Miscellaneous Meetings. Other meetings will be planned and conducted by the CA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Subs. The CA will plan these meetings and will minimize unnecessary time being spent by Subs.

3.2 RETESTING OF DEFICIENCIES

A. The Contractor or Sub is responsible for a deficiency shall carry the cost to rework the deficiency and complete the Functional Performance Test. The CxA will direct the first retesting of the equipment at no charge. If corrections of deficiencies have been reported to be successfully completed but are determined during testing to be faulty or otherwise incomplete, the time for the CxA to direct second or subsequent retests will be billed as an extra to the CA's contract. The GC may choose to recover costs from the party responsible for executing the party at fault.

3.3 REPORTING

A. The CA will provide regular reports to the PM with increasing frequency as construction and commissioning progresses.

B. The CA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.

C. A final Commissioning Report is compiled which summarizes the procedures, findings, conclusions, and recommendations of the commissioning process.

END OF SECTION 019113

SECTION 01999

STANDARD FORMS

PART 1 - GENERAL

1.01 FORMS

A. The forms listed below and appended to this Section will be used for performance of the Work as indicated. This is not a complete listing of all required forms. The Contractor may be permitted to recreate some of the forms so that they are compatible with the Contractors Project Management system. However, Contractor must achieve prior approval from the Project Manager before using modified forms. The Contractor shall properly complete all forms required by the contract or the Project Manager. The Project Manager shall review and approve all submitted forms. If submitted forms are not acceptable the Contractor shall resubmit forms in an acceptable format.

1.02 APPENDICES

A. Attached to this Technical Specifications Section are the following (Sample) forms:

1. Daily Quality Control Report (Sample Attached)
2. Request for Information (Sample Attached)
3. Submittal Transmittal Form (Sample Attached)
4. Submittal Transmittal Form (Sample Attached)
5. Document Transmittal Form (Sample Attached)
6. Contractor Warranty ((Sample Attached))
7. Contractor/Subcontractor Warranty ((Sample Attached))
8. Contractors Certification of Payment (Included within the Bid Documents)
9. Pay Application Form (Reference the Contract General Conditions)
10. Subcontractor Partial Lien Release Form (Included within the Bid Documents)
11. Subcontractor Final Lien Release Form (Included within the Bid Documents)
12. Request for Substitution (Form CM-09) (Sample Attached)
13. Non-Conformance Report (Sample Attached)

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 COMPLETING FORMS

A. All documents are to be filled digitally by the Contractor using the format provided by the Project Manager or using Adobe Acrobat 6 or newer. It is at the discretion of the Project Manager if other forms or formats will be accepted.

3.02 SIGNING FORMS

A. Original hand written signatures are acceptable for all documents. The Contractor is to fill out the document as indicated above prior to signing the hard copy. If the form is to be submitted digitally to the Project Manager the document shall be scanned and saved as an Adobe Acrobat 6 or newer file.

B. Digital signatures are acceptable for all documents. The Contractor is to fill out the document digitally in the format provided by the Project Manager or Adobe Acrobat 6 or newer. The file must be signed using Adobe Acrobat 6 or newer and submitted digitally to the Project Manager.

1. Add digital signatures must contain the name of signer in plain text and the time and date the signature is executed.

PART 4 - MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for work under this Section.

PART 5 - PAYMENT

5.01 METHOD OF PAYMENT

A. No separate payment will be made for work under this Section. The cost of the work described in this Section shall be included in the Contract price.

END OF SECTION 01999

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Agreement and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

B. Screw Piles.
   1. Foundation walls on Pier Caps.
   2. Slabs-on-grade.
   3. Form Liner
   4. Concrete toppings.
   5. Vapor barrier.
   6. Concrete stain
   7. Graffiti resistance coating

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

B. Reveal: Projection or indentations of concrete surface after completion of exposure operations.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

C. Product Data for Credit MRc4: Building materials in this section must have post- and/or pre-consumer recycled content by weight or total product.
   a. Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).
   b. Include information on Material Tracking Worksheets.

D. Design Mixtures for Credit ID 1.1: For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements and for equivalent concrete mixtures that do not contain portland cement replacements.
   1. Product Data for Credit MRc5: Building materials in this section must be extracted, harvested, or recovered, and manufactured and assembled within five hundred (500) miles of the jobsite.
      a. Submit product data or other published information verifying the location of manufacturing facility including name, address, and distance between manufacturing facility and the

project site. Provide manufacturer's documentation indicating location where the base materials were extracted, mined, quarried, harvested, etc. and the distance between this location and the project site. Also include material costs (excluding costs of installation).

b. Include information on Material Tracking Worksheets.

2. Product Data for Credit EQc4.1: Adhesives and Sealants applied on site within the weather proofing exterior in this section must comply with South Coast Air Quality Management District Rule 1168 OR Green Seal Standard GS-36. Refer to LEED Specification 018113 for specific VOC requirements.
   a. Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standard

E. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Indicate amounts of mixing water to be withheld for later addition at Project site.

F. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

G. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
   1. Form shops for all areas indicated to be exposed to view for verification of joint pattern, knock outs, and form liner locations.

H. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
   1. Location of construction joints is subject to approval of the Architect.

I. Qualification Data: ACI certification for on installer, finisher + supervisor.

J. Stain samples : stain on 2 x 2.75 inch concrete chips of up to 6 different colors chosen from manufacturer's full range of options. Provide printed color chart for architect's selection.

K. Welding certificates.

L. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Form materials and form-release agents.
   4. Steel reinforcement and accessories.
   5. Fiber reinforcement.
   6. Curing compounds.
   7. Floor and slab treatments.
   8. Bonding agents.
   9. Adhesives.
   10. Semirigid joint filler.
   11. Joint-filler strips.
   12. Repair materials.

M. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
   1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

N. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

O. Field quality-control reports.

P. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Stain Applicator Qualifications: Experienced applicator as well as successful installation of similar waterborne concrete stains.

F. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

G. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specifications for Structural Concrete"
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

H. Concrete Testing Service: Owner will engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

I. Mockups: Cast concrete formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.
   1. Build panel approximately 100 sq. ft. for formed surface in the location indicated or, if not indicated, as directed by Architect. Mockup to include all types of wall finishes including form liner, slick finish, stained surfaces, grafitti resistance coating, and knock-outs.
      a. 25 sq. ft. mock-up is adequate, but 100 sq. ft. may be necessary to achieve approved mock-up, assumes 4 attempts.
   2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
   3. Mock up to be completed in non-exposed area as directed by Architect and Owner.

J. Preinstallation Conference: Conduct conference at Project site.
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete subcontractor.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement. Store elevated above grade and protected.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows, depending on location:
      a. High-density overlay, Class 1 or better, at all surfaces exposed to view with slick finish.
      b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
      c. Structural 1, B-B or better; mill oiled and edge sealed.

B. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

C. Form Liners: Units of face design, texture, arrangement, and configuration to match design reference sample (see image below). Furnish with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent surface treatments of concrete.
   1. ½” Sine Wave by Spec Formliners, Inc.
   2. approved equal.

D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

E. Chamfer Strips: prohibited in areas exposed to view, care shall be taken to achieve 90 degree corners without chipping.

F. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

G. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces including spray applied concrete stain and will not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

H. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.
4. At location of form liners use ties that will leave no discernable presence once form liner is removed.

2.2 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Regional Material Source (MRc5): Building materials in this section must be extracted, harvested, or recovered, and manufactured and assembled within five hundred (500) miles of the jobsite.

C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

D. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

E. Plain-Steel Wire: ASTM A 82/A 82M, as drawn

F. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
1. Portland Cement: ASTM C 150, Type I/II gray white. Supplement with the following:
a. Fly Ash: ASTM C 618, Class F

B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Lightweight Aggregate: ASTM C 330, 3/4-inch nominal maximum aggregate size.

D. Water: ASTM C 94/C 94M and potable.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.

C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.

2.6 FIBER REINFORCEMENT

A. Synthetic Fiber: fibrillated polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III

B. Products:
   1. Fibrillated Fibers:
      a. Axim Concrete Technologies; Fibrasol F.
      b. Euclid Chemical Company (The); Fiberstrand F.
      c. FORTA Corporation; Forta.
      d. Grace Construction Products, W. R. Grace & Co.; Grace Fibers.
      e. SI Concrete Systems; Fibermesh.
      f. Approved Equal.

2.7 WATERSTOPS

A. Chemically Resistant Flexible Waterstops: Thermoplastic elastomer rubber waterstops, for embedding in concrete to prevent passage of fluids through joints; resistant to oils, solvents, and chemicals. Factory fabricate corners, intersections, and directional changes.
   1. Dimensions: 6 inches by 3/8 inch thick; nontapered.

B. Products:
   1. JP Specialties, Inc.; Earth Shield TPE-Rubber.
   2. Vinylex Corp.; PetroStop.
   3. WESTEC Barrier Technologies, Inc.; 600 Series TPE-R.
   4. Approved Equal.

2.8 VAPOR BARRIER

A. Multi-layer plastic extrusion manufactured with prime, virgin, polyolefin resins. Uses in systems for the control of soil gases.
   1. Basis of Design: Min. thickness 10 mil (0.254 mm) Stego Wrap Class A Vapor Retarder by Stego Industries, LLC
   2. Acceptable alternative : Florprufe® 120 Membrane by Grace Construction Products, nominal thickness 0.5mm
   3. Or equal

B. Physical Properties:
   1. Water Vapor Permeance of less than 0.03 Perms per ASTM F 1249 or ASTM E 96
   2. Class A when tested per ASTM E 1745.

3. Puncture resistance minimum of 2200 grams by ASTM D 1709

C. Accessories: Provide tape, adhesive, fasteners as recommended by manufacturer.

2.9 CONCRETE STAIN

A. Combination of acid solution, wetting agents, and metallic ions. When mixed with water, chemically combines with portland cement to form permanent colors.
1. Basis of design: Color Wall Stains by Smith Paint Products. 2200 Paxton Street, Harrisburg, PA 17111, (717) 233-8781, www.smithpaints.com
2. Color: As selected by Architect
3. Description: Water-based, modified acrylic and pigments

2.10 GRAFITTI RESISTANT COATING
1. One component, non sacrificial anti graffiti coating.
2. Products:
   a. For Exterior application only
      1) Basis of Design : Tamms AG 400 three coat system by The Euclid Chemical Company, 19218 Redwood Rd, Cleveland, OH 44110
      2) Approved equal.
      3) Compatible Clear Sealers: solvent and water based acrylics, 1 and 2 component epoxies, 1 and 2 component poly-urethanes and poly-ureas
      4) Incompatible Clear Systems: penetrating sealers including lithium, potassium and sodium silicates as well as methyl methacrylate sealers (a.k.a. MMA's).
3. Apply to all exterior concrete surfaces exposed to view, including site walls.

2.11 INSTALLING NON-SACRIFICIAL GRAFITTI RESISTANCE COATINGS

A. Exterior Application
1. Perform Rylem Tube test prior to and after mock-up of exterior coatings. More than one coat may be required if test fails

2.12 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
1. Basis of Design: Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
2. Low emitting coatings (EQc4.2) : Paints and coatings applied on site within the weather proofing exterior in this section must comply with Green Seal Standard GS-11, Green Seal Standard GC-03, OR South Coast Air Quality Management District Rule 1113. Refer to LEED Specification 01 81 13 for specific VOC requirements

2.13 CURING MATERIALS

A. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

B. Water: Potable.

2.14 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.15 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1752

2.16 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
   4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

2.17 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Use fly ash, as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 25 percent.
   1. Fly Ash: 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
   4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.18 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Refer to Drawings for additional information on mixes.

B. Foundation Walls and Column Pilasters: Proportion normal-weight concrete mixture as follows:

C. Minimum Compressive Strength: 4000 psi at 28 days.
1. Maximum Water-Cementitious Materials Ratio: As indicated
2. Slump Limit: As indicated, plus or minus 1 inch.
3. Air Content: As indicated percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.

D. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

E. Minimum Compressive Strength: 4000 psi at 28 days.
1. Minimum Cementitious Materials Content: As indicated.
2. Slump Limit: As indicated, plus or minus 1 inch.
3. Air Content: As indicated percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.

F. Suspended Slabs: Proportion structural lightweight concrete mixture as follows:

G. Minimum Compressive Strength: 4000 psi at 28 days.
1. Calculated Equilibrium Unit Weight: 115 lb/cu. ft., plus or minus 3 lb/cu. ft. as determined by ASTM C 567.
2. Slump Limit: As indicated, plus or minus 1 inch.
3. Air Content: As indicated, plus or minus 2 percent at point of delivery for nominal maximum aggregate size greater than 3/8 inch.
4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.

2.19 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.20 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
   1. Class A, 1/8 inch for smooth-formed finished surfaces.
   2. Class B, 1/4 inch rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Do not chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF VAPOR BARRIER

A. Earth and stone substrates shall be well compacted to produce an even, solid substrate. Remove loose aggregate or sharp protrusions. Concrete substrates shall be smooth or broom finished and monolithic. Remove standing water prior to membrane applications.

B. Installation shall be in accordance with manufacturer’s instructions and ASTM E 1643–98, including but not limited to, the following:

1. Apply membrane with the HDPE film facing the prepared substrate. Remove the release liner during application.
2. Apply succeeding sheets by overlapping the previous sheet 50-mm along the marked lap line. End Laps should be staggered to avoid a build up of layers.
   a. Mechanical Fastening Method - To prevent the membrane from moving and gaps opening, the laps should be fastened together at 1.0m maximum centers. Fix through the center of the lap area using 12 mm long washer-head self-tapping galvanized screws or similar allowing the head of the screw to bed into the adhesive compound to self-seal. *Ensure the membrane lays flat and no openings occur*. Additional fastening may be required at corners, details etc.

   OR

   b. Taped Lap Method - For additional security use manufacturer's approved tape to secure and seal the overlaps. Overband the lap with the tape using the lap line for alignment. Remove plastic release liner to ensure bond to concrete.
3. Mix and apply Grace liquid detailing compound to seal around penetrations such as drainage pipes, etc.

3.3 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
   3. Install dovetail anchor slots in concrete structures as indicated.

3.4 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect or Engineer

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

F. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to view to be covered with a coating or covering material applied directly to concrete

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
   1. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
   1. Apply float finish to surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo .

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   1. Apply a trowel finish to surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
   2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
      a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
      b. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
      c. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.
      d. Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.
   3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
   1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
   1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.11 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
      a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
      b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
      c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3.12 WALL STAIN APPLICATION

A. Apply concrete stain in accordance with manufacturer's instructions at locations indicated on the drawings.

B. Dilution: When diluting color concentrate, use only distilled, de-ionized or reverse osmosis water.

C. Color: Apply stain to intended substrate according to manufacturer’s written instructions.
   1. Dilute product concentrate to achieve desired appearance. Recommended dilution ratio is 1 part concentrate to 4 parts distilled, de-ionized or reverse osmosis water.
   2. Decreased dilution ratio (amount of water): increases color intensity and opacity.

3. Increased dilution ratio : decreases color intensity and opacity.
4. Color is best applied to large areas via an airless paint sprayer using 65-70 pounds of pressure and a #13 tip. Use a pump sprayer, sea sponge or paintbrush for touchup or smaller areas.
5. Ensure the surface is clean and dry. Remove loose particles, and efflorescence. Acid washing improves adhesion by providing a clean open surface for water-based materials to penetrate. A clean surface is very important with water-based coatings, as the particle size of molecules is larger than in solvent-based materials. Particle size affects the amount of penetration. The greatest problems arise when dust or dirt prevents good adhesion and penetration of the materials.
6. The ideal temperature for application is 70 degrees, but the range can be as low as 45 and as much as 90 degrees. Humidity slows drying time and its best to not apply paint in direct sunlight if temperatures are extremely high

D. Remove or mask fixtures and areas that are not to be stained.

E. Ensure concrete has cured after removal from mold for a minimum of 48 hours.

F. Prepare surfaces in accordance with manufacturer’s instructions.
1. Remove loose concrete, dust, oil, grease, and other contaminants using 15 degree tip in conjunction with a 12,000 work units pressure washer (work units = gallons per minutes x PSI)

3.13 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than three days' old, comply with manufacturer’s recommendations.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.14 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
   1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. After concrete has cured at least 14 days, correct high areas by grinding.
   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
   4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
   5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
   6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
   7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

B. Inspections:
   1. Steel reinforcement placement.
   2. Steel reinforcement welding.
   3. Headed bolts and studs.
   4. Verification of use of required design mixture.
   5. Concrete placement, including conveying and depositing.
   6. Curing procedures and maintenance of curing temperature.
   7. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
      a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
   3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
   5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   6. Compression Test Specimens: ASTM C 31/C 31M.
      a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
      b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
   7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
      a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
      b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
   8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
   9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
   10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
   11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
   12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine

adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

3.17 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

SECTION 034100 - PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

1.2 SUMMARY

A. Section Includes:
   1. Precast concrete stair treads, bolted to supports on steel stairs.

B. Related Sections:
   1. Division 05 Section "Structural Steel Framing" for furnishing and installing connections attached to structural-steel framing.
   2. Division 05 Section "Metal Stairs:" Stairs and stringers designed, fabricated and installed to meet applicable building codes, including weld plates for field attachment of Steptread welding plates.
   3. Division 05 Section "Metal Fabrications" for kickers and other miscellaneous steel shapes.

1.3 DEFINITION

A. Design Reference Sample: Sample of approved precast structural concrete color, finish, and texture, preapproved by Architect.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Fabricator responsible for engineering precast structural concrete units.
   1. Live Loads: As indicated on Drawings.

1.5 SUBMITTALS

A. Product Data: for each type of product indicated

B. LEED Submittals:
   1. Product Data for Credit MR 4: Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).
   2. Product Data for Credit MR 5 - Regional Materials: For each type of product indicated, product data or other published information verifying the location of manufacturing facility including name, address, and distance between manufacturing facility and the project site. Provide manufacturer’s documentation indicating location where the base materials were extracted, mined, quarried, harvested, etc. and the distance between this location and the project site. Also include material costs (excluding costs of installation).
   3. Design Mixtures for Credit ID 1.1: For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements and for equivalent concrete mixtures that do not contain portland cement replacements.

C. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.

D. Shop Drawings:
1. Provide setting drawings and templates showing recommended installation of anchorage devices
2. Include member locations, plans, elevations, dimensions, shapes and sections, openings, support conditions, and types of reinforcement, including special reinforcement. Detail fabrication and installation of precast structural concrete units.
3. Indicate joints, reveals, and extent and location of each surface finish.
4. Indicate welded connections by AWS standard symbols. Show size, length, and type of each weld.
5. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
6. Indicate shim sizes and grouting sequence.
7. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

E. Samples:
1. Submit two 3” wide by full depth samples of each type of stair tread unit to show the full range of color and texture of treads and integral detectable warning stripes, for selection and approval. If sealer is to be applied to stair tread surfaces, apply sealer on one sample.

F. Manufacturer's Installation Details: Submit complete.

G. Warranty: Provide certified copies of manufacturer's product warranties.

1.6 QUALITY ASSURANCE

A. Compliance with Regulations: Comply with requirements of state and local building codes and with rules and regulations relating to building accessibility.

B. Qualifications of Manufacturer: Company specializing in manufacture of precast concrete stair treads with a minimum of 10 continuous years of documented experience.

C. Treads, landing and connections shall be capable of supporting dead loads plus a uniform live load of 100 pounds per square foot.

D. Pre-installation Conference: As directed by the Architect

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials to the installation site in the manufacturer's original packaging. Packaging shall contain manufacturer's name, customer name, order, identification number, and other related information.

B. Handle and store stair treads and landings in accordance with manufacturer's recommendations.

1.8 WARRANTY

A. Provide warranty covering precast concrete stair treads, risers and landings against defects in material and workmanship for a period of 5 years. Unusual abuse and neglect are accepted.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Wausau Tile, Inc.

B. Product / Profile: C-30 Tread or a comparable product acceptable to Architect.

2.2 MATERIALS:

A. PC-1: Stair treads shall be C-30 "Flat Treads", precast concrete, consisting of Portland cement, aggregate, color admixtures, and reinforcing, factory formed to profiles indicated.

1. Portland Cement: ASTM C 150, Type III, high early strength.
2. Aggregate: ASTM C 33.
3. Color Admixture: By Davis Colors, or equal, as required to achieve color as selected.
4. Aggregate for exposed aggregate surface: As selected.
5. Reinforcement - Standard 2-1/4 inch thick: Galvanized welded wire mesh, No. 7 and No. 10, 2 inch by 6 inch.
6. Reinforcement - Long Span: Galvanized rebar cage.

B. Tread style:
   1. Open Riser - available thickness noted by profile:
      a. Wedge profile with integral detectable aggregate warning stripe.

C. Provide starter tread at top of stair (2nd floor level) with integral detectable warning stripe to match tread style and color.
   1. See Drawings for size of tread, unique to all other treads.

D. Landings: Of size indicated or required, matching treads in color and texture.

2.3 COLORS AND FINISHES:

A. Colors: JC9 - Oatmeal

B. Finishes: Walking surfaces of treads and landings shall have minimum coefficient of friction of 0.60, wet and dry.
   1. Exposed aggregate

C. Factory Application of Sealer: Factory apply one coat of penetrating sealer to all surfaces of treads. Sealer shall be non-staining, penetrating material, suitable for exterior or interior use, type which does not glaze or gloss, discolor or darken the surface.

2.4 PHYSICAL PROPERTIES:

A. Compressive strength: Minimum 5,000 psi.

B. Size: 12” wide x 2-1/2” thick, length as required for width of stair.

C. Weight:
   1. Open Riser: 30 pounds per square foot at 2-1/2 inches thick; 36 pounds per square foot at 3 inches thick.
   2. Closed Riser: 37.2 pounds per lineal foot at 12 inch depth.
   3. Long-Span Closed Riser: 48 pounds per lineal foot at 12 inch depth.
   4. Landing Units: 30 pounds per square foot at 2-1/2 inches thick; 36 pounds per square foot at 3 inches thick.

D. Water absorption: Not more than 5% average, not more than 6% for any individual unit.

E. Unit size: Within 3/16 inch of designated length, width and thickness.

2.5 ATTACHMENT ACCESSORIES:

A. For Welding to Steel stringers:
   1. 11 gauge galvanized weld plate, 4” x 7-1/4” for 2-1/2” thick Treads.
   2. 3/8” galvanized weld plate, 6” x 6” for 3” thick Long-Span Closed and Open Riser Treads.
   3. Starter Nosings have a galvanized weld plate/angle (2-1/2” x 2-1/2” x 3/16”) full length of the tread.

B. For Bolting to Steel stringers:
   1. 11 gauge galvanized steel angles, 1-5/8” x 3” x 7-1/4” long.
   2. 4 gauge galvanized steel starter nosing brackets.
   3. Non-Corrosive threaded inserts with 3/8” bolts, flat washer and lock washer.

4. Bolting not available on Long-Span Closed and Open Riser Treads.

2.6 FABRICATION:

A. Stair treads, risers and landing planks shall be hand-made, wet-cast of cement conforming to ASTM C 150, Type III, and aggregates conforming to ASTM C 33.

B. Reinforcement:
1. Recycled Content of Steel Reinforcement Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 60 percent.
2. Regional Material Source (MRc5): Building materials in this section must be extracted, harvested, or recovered, and manufactured and assembled within five hundred (500) miles of the jobsite.
3. Standard 2-1/2" thick Steptreads: Galvanized welded wire mesh, No. 7 and No. 10, 2 inch by 6 inch.
4. Long Span Steptreads: Galvanized rebar cage.
5. Landing Planks: Galvanized rebar cage.

2.7 SOURCE QUALITY CONTROL

A. Concrete for Steptreads and risers shall be tested frequently to assure that mixes provide units having not less than 5,000 psi compressive strength at 28 days (average test strength not less than 4,500 psi).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that structural components of stairs are in place, aligned and level, within tolerances for proper installation of stair treads and risers, and required structural inspections have been completed.

3.2 INSTALLATION - GENERAL

A. Installation shall comply with requirements of applicable building codes and state and local jurisdictions.

B. Install stair treads aligned, level and with uniform treads and risers throughout the extent of the stair. Where cutting is necessary, use powered masonry saw.

C. Do not install stair treads having excessively stained, defaced, or damaged faces, edges, or corners where to remain exposed. Remove dust and dirt from stair tread units using oil-free compressed air.

3.4 INSTALLATION: WELDED TO STEEL STAIR SUPPORTS

A. Weld plates on Steptreads shall be welded to structural steel stairs as indicated on approved submittals.

B. Welding shall comply with AWS D1.1, Structural Welding Code.

3.5 CLEANING

A. Clean exposed surfaces of stair treads and risers. Use cleaners appropriate for precast concrete finishes and colors. Acid based cleaners may alter finish and color.

3.6 SEALING

A. Field-applied sealer for the prevention of freeze-thaw is optional in mild climates. If precast concrete paving units are factory sealed, test for compatibility before applying additional sealer.

B. In geographic regions exposed to freeze-thaw conditions field-applied sealing the entire paving area, including joints, after installation is mandatory. Follow sealer manufacturer's instructions for application and maintenance of the sealer.

3.7 COMPLETION

A. Protect precast concrete paving units from damage due to subsequent building operations.

B. After installation and before completion, inspect precast concrete paving units for construction damage and obtain new precast concrete paving units if required.

C. Immediately prior to final acceptance of project, clean precast concrete paving units.

END OF SECTION 034819

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Structural steel.
   2. Architecturally exposed structural steel.
   3. Grout.

B. Related Sections include the following:
   1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
   2. Division 05 Section "Steel Decking" for field installation of shear connectors.
   3. Division 05 Section "Metal Fabrications" for steel lintels or shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other metal items not defined as structural steel.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

B. Architecturally Exposed Structural Steel: Structural steel designated as architecturally exposed structural steel in the Contract Documents.

1.4 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand ASD-service loads indicated and comply with other information and restrictions indicated.
   1. Select and complete connections using schematic details indicated and AISC's "Manual of Steel Construction, Allowable Stress Design," Part 4.

B. Construction: Type 2, simple framing.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.
   1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Include embedment drawings.

3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

C. Welding certificates.

D. Qualification Data: For Installer-fabricator.

E. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Direct-tension indicators.
4. Tension-control, high-strength bolt-nut-washer assemblies.
5. Shear stud connectors.
6. Shop primers.
7. Nonshrink grout.

F. Source quality-control test reports.

G. Recycled Content (MRc4):
1. Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).
2. Include information on Material Tracking Worksheets.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category Sbd.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

E. Comply with applicable provisions of the following specifications and documents:
1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
3. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
5. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
6. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

F. Mockups: Build mockups of architecturally exposed structural steel to set quality standards for fabrication and installation.
1. Coordinate finish painting requirements with Division 09 painting Sections.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
   1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
   2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.8 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M.

B. Channels, Angles, M , S-Shapes: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
   1. Weight Class: As indicated.
   2. Finish: Black.

F. Welding Electrodes: Comply with AWS requirements.

G. Recycled Content MRc4:
   1. Building materials in this section must have post- and/or pre-consumer recycled content by weight of total product (W shaped, Channels, Angles, M, S Shapes – 60% , Others 25%).

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
   1. Finish: Plain.
   2. Direct-Tension Indicators: ASTM F 959, Type 325 compressible-washer type.
      a. Finish: Plain.

B. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.
   1. Direct-Tension Indicators: ASTM F 959, Type 490 , compressible-washer type, plain.

C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy hex round head steel structural bolts with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
   1. Finish: Plain.

D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.
   1. Finish: Plain.

E. Headed Anchor Rods: ASTM F 1554, Grade 55, weldable, straight.
   1. Nuts: ASTM A 563 heavy hex carbon steel.
   2. Plate Washers: ASTM A 36/A 36M carbon steel.
   3. Washers: ASTM F 436 hardened carbon steel.
   4. Finish: Plain.

F. Clevises and Turnbuckles: ASTM A 108, Grade 1035, cold-finished carbon steel.

G. Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.

H. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

2.3 PRIMER

A. Primer: As specified in Division 09 painting Sections.

B. Galvanizing Repair Paint: ASTM A 780.

2.4 GROUT

A. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404, Size No. 2. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
   1. Camber structural-steel members where indicated.
   2. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
   3. Mark and match-mark materials for field assembly.

4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Architecturally Exposed Structural Steel: Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel identified as architecturally exposed structural steel, only for the items listed I nthe structural details, not the blanket AESS specification.
1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.
2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

D. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."

G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

H. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.

I. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches o.c., unless otherwise indicated.

J. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
    a. Grind butt welds flush.
    b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:
1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials.
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.
1. Fill vent holes and grind smooth after galvanizing.
2. Galvanize exterior steel, including lintels shelf angles attached to structural-steel frame and located in exterior walls.

2.9 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:
   1. Liquid Penetrant Inspection: ASTM E 165.
   2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
   3. Ultrasonic Inspection: ASTM E 164.
   4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:
   1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
   2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.
   1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."

B. Base and Bearing]Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
   1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of base plate.
   3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.

4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.

H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design "for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
    a. Grind butt welds flush.
    b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
   1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:
      a. Liquid Penetrant Inspection: ASTM E 165.
      b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
      c. Ultrasonic Inspection: ASTM E 164.
      d. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:
   1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
   2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.
   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
   2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION 051200

SECTION 051213 - ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes architecturally exposed structural-steel framing.
   1. Requirements in Division 05 Section "Structural Steel Framing" also apply to AESS framing.

B. Related Sections:
   1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
   2. Division 05 Section "Structural Steel Framing" for additional requirements applicable to AESS.
   3. Division 05 Section "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other metal items not defined as structural steel.
   4. Division 05 Section "Metal Stairs."
   5. Division 09 painting Sections for surface preparation and priming requirements.

1.3 DEFINITIONS

A. Architecturally Exposed Structural Steel: Structural steel designated as "architecturally exposed structural steel" or "AESS" in the Contract Documents.

B. Category 1 AESS: AESS that is within 96 inches vertically and 36 inches horizontally of a walking surface and is visible to a person standing on that walking surface or is designated as "Category 1 architecturally exposed structural steel" or "AESS-1" in the Contract Documents.

C. Category 2 AESS: AESS that is within 20 feet vertically and horizontally of a walking surface and is visible to a person standing on that walking surface or is designated as "Category 2 architecturally exposed structural steel" or "AESS-2" in the Contract Documents.

D. Category 3 AESS: AESS that is not defined as Category 1 or Category 2 or that is designated as "Category 3 architecturally exposed structural steel" or "AESS-3" in the Contract Documents.

1.4 SUBMITTALS

A. Shop Drawings: Show fabrication of AESS components. Shop Drawings for structural steel may be used for AESS provided items of AESS are specifically identified and requirements below are met for AESS.
   1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Include embedment drawings.
   3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Indicate grinding, finish, and profile of welds.

4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections. Indicate orientation of bolt heads.
5. Indicate exposed surfaces and edges and surface preparation being used.
6. Indicate special tolerances and erection requirements.

B. Samples: Submit samples of AESS to set quality standards for exposed welds for Category 1 AESS.
1. Two steel plates, 3/8 by 8 by 4 inches, with long edges joined by a groove weld and with weld ground smooth.
2. Steel plate, 3/8 by 8 by 8 inches, with one end of a short length of rectangular steel tube, 4 by 6 by 3/8 inches, welded to plate with a continuous fillet weld and with weld ground smooth and blended.
3. Round steel tube or pipe, minimum 8 inches in diameter, with end of another round steel tube or pipe, approximately 4 inches in diameter, welded to its side at a 45-degree angle with a continuous fillet weld and with weld ground smooth and blended.

C. Qualification Data: For qualified Installer-fabricator.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

B. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Mockups: Build mockups of AESS to set quality standards for fabrication and installation.
1. Build mockup of typical portion of AESS as shown on Drawings.
2. Coordinate finish painting requirements with Division 09 painting Sections.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Use special care in handling to prevent twisting, warping, nicking, and other damage. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.7 PROJECT CONDITIONS

A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

PART 2 - PRODUCTS

2.1 BOLTS, CONNECTORS, AND ANCHORS

A. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round-head assemblies, consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
   1. Finish: Plain.

2.2 PRIMER

A. Primer: Comply with Division 09 painting Sections.

B. Primer: SSPC-Paint 25 BCS, Type II, zinc oxide, alkyd, linseed oil primer.

2.3 FABRICATION

A. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.

B. In addition to special care used to handle and fabricate AESS, comply with the following:
   1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, and roughness.
   2. Grind sheared, punched, and flame-cut edges of Category 1 AESS to remove burrs and provide smooth surfaces and edges.
   3. Fabricate Category 1 AESS with exposed surfaces free of mill marks, including rolled trade names and stamped or raised identification.
   4. Fabricate Category 1 and Category 2 AESS with exposed surfaces free of seams to maximum extent possible.
   5. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
   6. Fabricate with piece marks fully hidden in the completed structure or made with media that permits full removal after erection.
   7. Fabricate Category 1 AESS to the tolerances specified in AISC 303 for steel that is designated AESS.
   8. Fabricate Category 2 and Category 3 AESS to the tolerances specified in AISC 303 for steel that is not designated AESS.
   9. Seal-weld open ends of hollow structural sections with 3/8-inch closure plates for Category 1 AESS.

C. Coping, Blocking, and Joint Gaps: Maintain uniform gaps of 1/8 inch with a tolerance of 1/32 inch for Category 1 AESS.

D. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

E. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.4 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened.
   2. Grind butt and groove welds flush to adjacent surfaces within tolerance of plus 1/16 inch, minus 0 inch for Category 1 and Category 2 AESS.
   3. Remove backing bars or runoff tabs; back-gouge and grind steel smooth for Category 1 and Category 2 AESS.
   4. At locations where welding on the far side of an exposed connection of Category 1 and Category 2 AESS occurs, grind distortions and marking of the steel to a smooth profile aligned with adjacent material.
   5. Make fillet welds for Category 1 and Category2 AESS oversize and grind to uniform profile with smooth face and transition.

2.5 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
   1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Examine AESS for twists, kinks, warping, gouges, and other imperfections before erecting.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep AESS secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
   1. If possible, locate welded tabs for attaching temporary bracing and safety cabling where they will be concealed from view in the completed Work.

3.3 ERECTION

A. Set AESS accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
   1. Erect Category 1 AESS to the tolerances specified in AISC 303 for steel that is designated AESS.
   2. Erect Category 2 and Category 3 AESS to the tolerances specified in AISC 303 for steel that is not designated AESS.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened.
   2. Orient bolt heads in same direction for each connection and to maximum extent possible in same direction for similar connections.

B. Weld Connections: Comply with requirements in "Weld Connections" Paragraph in "Shop Connections" Article.
   1. Remove backing bars or runoff tabs; back-gouge and grind steel smooth for Category 1 and Category 2 AESS.
   2. Remove erection bolts in Category 1 and Category 2 AESS, fill holes, and grind smooth.
   3. Fill weld access holes in Category 1 and Category 2 AESS and grind smooth.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect AESS as specified in Division 05 Section "Structural Steel Framing." The testing agency will not be responsible for enforcing requirements relating to aesthetic effect.

B. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

3.6 REPAIRS AND PROTECTION

A. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Grind steel smooth.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION 051213

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Roof deck.
   2. Acoustical roof deck.
   3. Cellular roof deck.
   4. Acoustical cellular roof deck.
   5. Composite floor deck.

B. Related Sections include the following:
   1. Division 03 Section "Cast-in-Place Concrete" for concrete fill.
   2. Division 03 Section "Lightweight Insulating Concrete" for lightweight insulating concrete fill.
   3. Division 05 Section "Structural Steel Framing" for shop- and field-welded shear connectors.
   4. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
   5. Division 09 painting Sections for repair and finish painting of primed deck.
   6. Division 26 Section "Underfloor Raceways for Electrical Systems" for preset inserts, activation kits, afterset inserts, service fittings, header ducts, and trench header ducts used with cellular floor-deck systems.

1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

C. Product Certificates: For each type of steel deck, signed by product manufacturer.

D. Welding certificates.

E. Field quality-control test and inspection reports.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
   1. Power-actuated mechanical fasteners.
   2. Acoustical roof deck.

G. Research/Evaluation Reports: For steel deck.

H. Recycled Content (MR-4):

1. Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).
2. Include information on Material Tracking Worksheets.

J. Material Source (MR-5):
1. Submit product data or other published information verifying the location of manufacturing facility including name, address, and distance between manufacturing facility and the project site. Provide manufacturer's documentation indicating location where the base materials were extracted, mined, quarried, harvested, etc. and the distance between this location and the project site. Also include material costs (excluding costs of installation).
2. Include information on Material Tracking Worksheets.

K. Indoor Environmental Quality (IEQc4.2):
1. For paints, including printed statement of VOC content and chemical components.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.

B. Source Limitations for Electrified Cellular Floor Deck: Obtain cellular floor-deck units and compatible electrical components, such as preset inserts, activation kits, afterset inserts, service fittings, header ducts, and trench header ducts, from same manufacturer.

C. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

D. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

E. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

F. Electrical Raceway Units: Provide UL-labeled cellular floor-deck units complying with UL 209 and listed in UL's "Electrical Construction Equipment Directory" for use with standard header ducts and outlets for electrical distribution systems.

G. FMG Listing: Provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

1.6 COORDINATION

A. Coordinate installation of sound-absorbing insulation strips in topside ribs of acoustical deck with roofing installation specified in Division 07 Section "Thermoplastic Membrane Roofing" to ensure protection of insulation strips against damage from effects of weather and other causes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Steel Deck:
      a. ASC Profiles, Inc.
      b. Canam Steel Corp.;The Canam Manac Group.
      c. Consolidated Systems, Inc.
      d. DACS, Inc.
      e. D-Mac Industries Inc.
      f. Epic Metals Corporation.
      g. Marlyn Steel Decks, Inc.
      h. New Millennium Building Systems, LLC.
      i. Nucor Corp.; Vulcraft Division.
      j. Roof Deck, Inc.
      k. United Steel Deck, Inc.
      l. Valley Joist; Division of EBSCO Industries, Inc.
      m. Verco Manufacturing Co.
      n. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Recycled Content (MRc4):
   1. Building materials in this section must have minimum 50% post- and/or pre-consumer recycled content by weight of total product.

D. Regional Material Source (MRc5):
   1. Building materials in this section must be extracted, harvested, or recovered, and manufactured and assembled within 500 miles of the jobsite.

E. Paints & Coatings (EQc4.2):
   1. Paints and coatings applied on site within the weather proofing exterior in this section must comply with Green Seal Standard GS-11, Green Seal Standard GC-03, OR South Coast Air Quality Management District Rule 1113. Refer to LEED Specification 01 81 13 for specific VOC requirements.

2.2 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:
   1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
      a. Color: Manufacturer's standard.

2. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
   a. Color: Manufacturer's standard.
3. Deck Profile: As indicated.
4. Profile Depth: As indicated.
5. Design Uncoated-Steel Thickness: As indicated.
6. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated.
7. Span Condition: As indicated.
8. Side Laps: Overlapped or interlocking seam at Contractor's option.
9. Painting: Factory-paint deck in accordance with Division 09 Section "Interior Painting."

2.3 ACOUSTICAL ROOF DECK

A. Acoustical Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:
   1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
      a. Color: Manufacturer's standard.
   2. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
      a. Color: Manufacturer's standard.
   3. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Structural Steel (SS), Grade 33 minimum, AZ50 aluminum-zinc alloy coating.
   4. Deck Profile: As indicated.
   5. Cellular Deck Profile: As indicated, with bottom plate.
   6. Profile Depth: As indicated.
   7. Design Uncoated-Steel Thickness: As indicated.
   8. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated.
   9. Span Condition: As indicated.
   10. Side Laps: Overlapped or interlocking seam at Contractor's option.
   11. Acoustical Perforations: Cellular deck units with manufacturer's standard perforated flat-bottom plate welded to ribbed deck.
   12. Sound-Absorbing Insulation: Manufacturer's standard premolded roll or strip of glass or mineral fiber.
      a. Factory install sound-absorbing insulation into cells of cellular deck.
   13. Acoustical Performance: NRC 0.90, tested according to ASTM C 423.
   14. Painting: Factory-paint deck in accordance with Division 09 Section "Interior Painting."

2.4 COMPOSITE FLOOR DECK

A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:
   1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade [33] [40] [80] minimum, with top surface phosphatized and unpainted and underside surface shop primed with manufacturers' standard white baked-on, rust-inhibitive primer.
   2. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard white baked-on, rust-inhibitive primer.

3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: As indicated.
6. Painting: Factory-paint deck in accordance with Division 09 Section "Interior Painting."

2.5 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 30 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0747 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and sloped recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

K. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

L. Galvanizing Repair Paint: ASTM A 780.

M. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
   1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
   1. Weld Diameter: As indicated, nominal.
   2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.
   3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 inches, and as follows:
   1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
   2. Mechanically clinch or button punch.
   3. Fasten with a minimum of 1-1/2-inch- long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
   1. End Joints: Lapped 2 inches minimum.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches apart with at least one weld at each corner.
   1. Install reinforcing channels or zees in ribs to span between supports and weld.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
   1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

G. Sound-Absorbing Insulation: Manufacturer's standard, as required to comply with specified noise reduction coefficient.

3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
   1. Weld Diameter: As indicated, nominal.
   2. Weld Spacing: Space and locate welds as indicated.
   3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches, and as follows:
   1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
   2. Mechanically clinch or button punch.
   3. Fasten with a minimum of 1-1/2-inch- long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2 inches, with end joints as follows:
   1. End Joints: Lapped.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

F. Install piercing hanger tabs at 14 inches apart in both directions, within 9 inches of walls at ends, and not more than 12 inches from walls at sides, unless otherwise indicated.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
   1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Exterior non-load-bearing wall framing.
   2. Interior non-load bearing wall framing
   3. Ceiling Joist framing

B. Related Sections include the following:
   1. Division 09 Section "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
   1. Design Loads: As indicated.
      a. Dead Loads: Weights of materials and construction.
      b. Live Loads: As indicated.
      c. Roof Loads: As indicated.
      d. Snow Loads: As indicated.
      e. Wind Loads: As indicated.
      f. Seismic Loads: As indicated.
   2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
      a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height.
   3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
   4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
      a. Upward and downward movement of 1-1/2 inches.

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
   1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
   2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
   3. Roof Trusses: Design according to AISI's "Standard for Cold-Formed Steel Framing - Truss Design."

1.4 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated. Product data for ¼" FRP shims to be placed between roof and floor slab bent plates and cold formed framing slip clips.

B. LEED Submittal:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
      a. Include statement indicating costs for each product having recycled content.
   2. Credit MR 5 - Regional Materials: For each type of product indicated, product data or other published information verifying the location of manufacturing facility including name, address, and distance between manufacturing facility and the project site. Provide manufacturer's documentation indicating location where the base materials were extracted, mined, quarried, harvested, etc. and the distance between this location and the project site. Also include material costs (excluding costs of installation).

C. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
   1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Welding certificates.

E. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
   1. Steel sheet.
   2. Expansion anchors.
   3. Power-actuated anchors.
   4. Mechanical fasteners.
   5. Vertical deflection clips.
   6. FRP shims for thermal conductivity
   7. Horizontal drift deflection clips
   8. Miscellaneous structural clips and accessories.

F. Research/Evaluation Reports: For cold-formed metal framing.

1.5 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.

D. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

E. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

F. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
   1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 GENERAL

A. Building materials in this section must be extracted, harvested, or recovered, and manufactured and assembled within 500 miles of the jobsite.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:
   1. Allied Studco.
   2. AllSteel Products, Inc.
   3. California Expanded Metal Products Company.
   4. Clark Steel Framing.
   5. Consolidated Fabricators Corp.; Building Products Division.
   6. Craco Metals Manufacturing, LLC.
   7. Custom Stud, Inc.
   8. Dale/Incor.
   9. Design Shapes in Steel.
   10. Dietrich Metal Framing; a Worthington Industries Company.
   11. Formetal Co. Inc. (The).
   12. Innovative Steel Systems.
   13. MarinoWare; a division of Ware Industries.
   14. Quail Run Building Materials, Inc.
   15. SCAFCO Corporation.
   16. Southeastern Stud & Components, Inc.
   17. Steel Construction Systems.

18. Steeler, Inc.
19. Super Stud Building Products, Inc.
20. United Metal Products, Inc.

2.3 MATERIALS

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than **25** percent.

B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
1. Grade: As required by structural performance
2. Coating: G60, A60or equivalent.

C. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
1. Grade: As required by structural performance.
2. Coating: G90.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: As required by structural performance
2. Flange Width: As required by structural performance.
3. Section Properties: As required by structural performance.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: As required by structural performance.
2. Flange Width: As required by structural performance.

C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Dietrich Metal Framing; a Worthington Industries Company.
    b. MarinoWare, a division of Ware Industries.
    c. SCAFCO Corporation
    d. The Steel Network, Inc.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Dietrich Metal Framing; a Worthington Industries Company.
    b. MarinoWare, a division of Ware Industries.
    c. SCAFCO Corporation
    d. The Steel Network, Inc.
2. Minimum Base-Metal Thickness: As required by structural performance.

3. Flange Width: 1 inch plus the design gap for 1-story structures and 1 inch plus twice the design gap for other applications.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
   1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
      a. Minimum Base-Metal Thickness: As required by structural performance.
   2. Flange Width: 1 inch plus the design gap for 1-story structures and 1 inch plus twice the design gap for other applications.
   3. Inner Track: Of web depth indicated, and as follows:
      a. Minimum Base-Metal Thickness: As required by structural performance.
      b. Flange Width: Equal to sum of outer deflection track flange width plus 1 inch.

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
   1. Supplementary framing.
   2. Bracing, bridging, and solid blocking.
   3. Web stiffeners.
   4. Anchor clips.
   5. End clips.
   6. Foundation clips.
   7. Gusset plates.
   8. Stud kickers, knee braces, and girts.
   9. Joist hangers and end closures.
   10. Hole reinforcing plates.
   11. Backer plates.
   12. FRP shims.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: As required by structural performance: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts headless bolts, with encased end threaded, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
   1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.8 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
   1. Fabricate framing assemblies using jigs or templates.
   2. Cut framing members by sawing or shearing; do not torch cut.
   3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
   4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
   2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
   1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
   1. Cut framing members by sawing or shearing; do not torch cut.
   2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
      c. Cold formed framing clips shall be isolated from the floor slab edge (and roof deck edge) steel bent plates using ¼” thick FRP shims.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 LOAD-BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
   1. Anchor Spacing: As shown on Shop Drawings.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
   1. Stud Spacing: As indicated.
   2. Stud Spacing: As indicated.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
   1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
   2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
   1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced as indicated on Shop Drawings. Fasten at each stud intersection.
   1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of 2 screws into each flange of the clip angle for framing members up to 6 inches deep.
   2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
   3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
   1. Stud Spacing: As indicated.
   2. Stud Spacing: As indicated.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
   1. Install single-leg deflection tracks and anchor to building structure.
   2. Install double deep-leg deflection tracks and anchor outer track to building structure.
   3. Connect vertical deflection clips to bypassing studs and anchor to building structure.
   4. Connect drift clips to cold formed metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
   1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
      a. Install solid blocking at centers indicated on Shop Drawings.
   2. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.6 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section is general in nature. Fabrications specified may or may not be required for this Project.

B. Section includes :
1. Steel framing and supports for operable partitions.
2. Steel framing and supports for overhead doors.
3. Steel framing and supports for countertops.
4. Steel framing and supports for mechanical and electrical equipment.
5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
6. Aluminum façade screen framing, supports and plates.
7. Elevator hoist beams.
8. Shelf angles.
9. Loose bearing and leveling plates.
10. Steel weld plates and angles for casting into concrete not specified in other Sections.
11. Miscellaneous steel trim including.
12. Metal ladders.
13. Metal bollards.

C. Products furnished, but not installed, under this Section include the following:
1. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

D. Related Sections:
1. Division 01 Section "Sustainable Design Requirements" for additional Leadership in Energy & Environmental Design (LEED) requirements.
2. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
3. Division 05 Section "Structural Steel Framing."
4. Division 05 Section "Metal Stairs."
5. Division 05 Section "Architectural Railings."
6. Division 05 Section "Metal Gratings."
7. Division 06 Section "Miscellaneous Rough Carpentry" for metal framing anchors.
8. Division 14 Section "Hydraulic Elevators" for support angles for elevator door sills.

1.03 PERFORMANCE REQUIREMENTS

A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in American National Standards Institute (ANSI) A14.3 "Standard for Ladders - Fixed - Safety Requirements."

B. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Minimum Requirements:
1. Where thickness of steel members is not indicated on Drawings, provide 1/4 inch minimum thickness.
2. Where welding or other connection requirements are not indicated on Drawings, components are to be welded all around with a 3/16 inch fillet weld on all faying surfaces.
3. Items noted as embedded in concrete and not fully defined shall have 1/2 inch diameter by 4 inch long headed anchor studs at 12 inches on center.

1.04 SUBMITTALS

A. Product Data: For the following:
1. Paint products.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.
1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. LEED Submittals:
1. Credit MR 4 - Recycled Content: For each type of product indicated, submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).

D. Welding certificates.

1.05 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:
1. American Welding Society (AWS) D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions. Account for trimming and fitting at site.

1.07 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 GENERAL

A. Building materials in this section must have post- and/or pre-consumer recycled content by weight of total product.

B. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.02 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM International (ASTM) A 36 "Standard Specification for Carbon Structural Steel."

B. Steel Tubing: ASTM A 500 "Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes," cold-formed steel tubing.

C. Steel Pipe: ASTM A 53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless ," standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

D. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3.
   1. Size of Channels: 1-5/8 by 1-5/8 inches .
   2. Material: Steel complying with ASTM A 1008 "Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable," commercial steel, Type B ; 0.0966-inch minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel .

2.03 NONFERROUS METALS

A. Aluminum Plate and Sheet: ASTM B 209 "Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate," Alloy 6061-T6.

B. Aluminum Extrusions: ASTM B 221 "Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes," Alloy 6063-T6.

2.04 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 "Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel," Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307 "Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength," Grade A; with hex nuts, ASTM A 563 "Standard Specification for Carbons and Alloy Steel Nuts;" and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 "Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs" for bolts and ASTM F 594 "Standard Specification for Stainless Steel Nuts" for nuts, Alloy Group 1 .

D. Anchor Bolts: ASTM F 1554 "Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength," Grade 36.

1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

E. Eyebolts: ASTM A 489 "Standard Specification for Carbon Steel Lifting Eyes."

F. Machine Screws: American Society of Mechanical Engineers (ASME) B18.6.3 "Machine Screws and Machine Screw Nuts."

G. Lag Bolts: ASME B18.2.1 "Large Rivets."

H. Wood Screws: Flat head, ASME B18.6.1 "Wood Screws (Inch Series)."

I. Plain Washers: Round, ASME B18.22.1 "Plain Washers."

J. Lock Washers: Helical, spring type, ASME B18.21.1 "Lock Washers (Inch Series)."

K. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488 "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements," conducted by a qualified independent testing agency.
1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 "Standard Specification for Ferritic Malleable Iron Castings," malleable iron, or ASTM A 27 "Standard Specification for Steel Castings, Carbon, for General Application," cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153 "Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware ."

L. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

2.05 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 09 painting Sections.

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with The Society for Protective Coatings (SSPC)-Paint 20.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187 "Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal."

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107 "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)." Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.06 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide suitable anchorage; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
   1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.07 MISCELLANEOUS STEEL FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
   1. Fabricate units from slotted channel framing where indicated.
   2. Furnish inserts if units are installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Galvanize exterior miscellaneous framing and supports and miscellaneous framing and supports located in exterior walls.

2.08 ALUMINUM FAÇADE SCREEN FRAMING, SUPPORTS AND PLATES

A. General: Provide aluminum framing, and plates needed to complete the Work.

B. Fabricate units from aluminum shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

2.09 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
   1. Provide mitered and welded units at corners.
   2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. Galvanize shelf angles located in exterior walls.

C. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete and fully-grouted concrete unit masonry.

2.10 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication.

2.11 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.12 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim.

2.13 METAL LADDERS

A. General:
   1. Comply with ANSI A14.3 "American National Standard for Ladders - Fixed - Safety Requirements," unless otherwise indicated.
   2. For elevator pit ladders, comply with ANSI/ASME A17.1 "Safety Code for Elevators and Escalators."
   3. Space siderails 18 inches apart, unless otherwise indicated.
   4. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted brackets, made from same metal as ladder.

B. Steel Ladders:
   1. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
   2. Rungs: 3/4-inch- diameter steel bars.
   3. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
   4. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.

2.14 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe.
   1. Cap bollards with 1/4-inch- thick steel plate.
   2. Where bollards are indicated to receive push-button controls for door operators, provide necessary cutouts for push-button controls and hole for wire.

2.15 FINISHES, GENERAL

A. Comply with National Association of Architectural Metal Manufacturers (NAAMM)'s "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.16 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
   1. ASTM A 123 "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products ," for galvanizing steel and iron products.
   2. ASTM A 153 , for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
   1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.17 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

C. Powder-Coated Finish: Subject to compliance with the requirements, provide "Alesta AR500" by Dupont or a comparable product acceptable to Architect.
   1. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.02 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.03 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.04 INSTALLING METAL BOLLARDS

A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

B. Fill bollards solidly with concrete, mounding top surface to shed water.
1. Do not fill removable bollards with concrete.

3.05 INSTALLING PIPE GUARDS

A. Provide pipe guards at exposed vertical pipes in parking garage where not protected by curbs or other barriers. Install by bolting to wall or column with expansion anchors. Provide four 3/4-inch bolts at each pipe guard. Mount pipe guards with top edge 26 inches above driving surface.

3.06 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780 "Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings."

3.07 CONSTRUCTION WASTE MANAGEMENT

A. Manage construction waste in accordance with provisions of Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 055000

SECTION 055100 - METAL STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Preassembled steel stairs with concrete-filled treads.
   2. Ornamental steel-framed stairs. (Feature Stair) with precast concrete landing and treads.

B. Related Sections:
   1. Division 03 Section "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
   2. Division 03 Section “Precast Structural Concrete Stair Treads” for treads associated with feature stair.
   3. Division 05 Section "Architectural Railings" for stair railings and railings not attached to metal stairs.
   4. Division 06 Section Rough Carpentry for wood blocking for anchoring railings.
   5. Division 09 Section "Non-Structural Metal Framing" for metal backing for anchoring railings.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design metal stairs, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
   1. Uniform Load: 100 lbf/sq. ft.
   2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
   3. Uniform and concentrated loads need not be assumed to act concurrently.
   4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
   5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.

C. Seismic Performance: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE 7-05.
   1. Component Importance Factor is 1.5.

1.4 SUBMITTALS

A. Product Data: For metal stairs and the following:
   1. Prefilled metal-pan stair treads.
   2. Precast concrete treads.
   3. Epoxy-resin-filled stair treads.
   4. Nonslip aggregates and nonslip-aggregate finishes.

5. Abrasive nosings.
6. Metal floor plate treads.
7. Paint products.
8. Grout.

B. LEED Submittals:
1. Product Data for Credit MR 4: Indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

D. Samples for Initial Selection: For products involving selection of color, texture, or design.

E. Samples for Verification: For the following products, in manufacturer's standard sizes:
1. Precast concrete treads specified in Division 03 Section "Precast Structural Concrete."
2. Abrasive nosings.

F. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

G. Welding certificates.

H. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
1. Preassembled Stairs: Commercial class.
2. Ornamental Stairs: Architectural class.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.6 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral

anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Tubing: ASTM A 500 (cold formed).

D. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25, unless another grade is required by design loads; exposed.

2.3 ABRASIVE NOSINGS

A. Slip-resistant General Purpose Tread Tape : Service Stair only
   1. Manufacturers: Basis of Design : Tread Safety-Walk 610 by 3M or equal.
      a. Color : Black
      b. Location : every tread and landing nosing, apply between ½” and 2” from nosing.

2.4 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
   1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for [exterior stairs] [stairs indicated to be galvanized] [stairs indicated to be shop primed with zinc-rich primer].

D. Machine Screws: ASME B18.6.3.

E. Lag Screws: ASME B18.2.1.

F. Plain Washers: Round, ASME B18.22.1.

G. Lock Washers: Helical, spring type, ASME B18.21.1.

H. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
   1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 "Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel," Class Fe/Zn 5.
   2. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 "Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs," and nuts complying with ASTM F 594 "Standard Specification for Stainless Steel Nuts" for nuts, Alloy Group 1.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 09 painting Sections.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

E. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

F. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.

G. Welded Wire Fabric: ASTM A 185/A 185M, 6 by 6 inches, W1.4 by W1.4, unless otherwise indicated.

2.6 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
   1. Join components by welding unless otherwise indicated.
   2. Use connections that maintain structural value of joined pieces.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld connections to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 4 welds: good quality, uniform undressed weld with minimal splatter.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.7 STEEL-FRAMED STAIRS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Alfab, Inc.
   2. American Stair, Inc.
   3. Sharon Companies Ltd. (The).

B. Stair Framing:
   1. Fabricate stringers of steel plates or channels.
      a. Provide closures for exposed ends of channel stringers.
   2. Construct platforms of steel \plate or channel headers and miscellaneous framing members as indicated.
   3. Weld stringers to headers; weld framing members to stringers and headers.
   4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

C. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness [needed to comply with performance requirements but not less than 0.067 inch.
   1. Steel Sheet: Uncoated cold rolled steel sheet unless otherwise indicated.
   2. Steel Sheet: Galvanized-steel sheet, where indicated.
   3. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
   4. Shape metal pans to include nosing integral with riser.
   5. At Contractor's option, provide stair assemblies with metal-pan subtreads filled with reinforced concrete during fabrication.
   6. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.
      a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

2.8 STAIR RAILINGS

A. Comply with applicable requirements in Division 05 Section "Pipe and Tube Railings".
   1. Fabricate newels of square steel tubing and provide newel caps , as shown.
   2. Rails may be bent at corners, rail returns, and wall returns, instead of using prefabricated fittings.
   3. Connect posts to stair framing by direct welding unless otherwise indicated.

B. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
   1. Rails and Posts: 1-1/2-inch- square top and bottom rails and 1-1/2-inch- square posts.
   2. Mesh Infill: Woven wire mesh crimped into 1-by-1/2-by-1/8-inch steel channel frames. Orient wire mesh as indicated.

C. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
   1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.

D. Form changes in direction of railings as follows:
   1. As detailed.

E. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

F. Close exposed ends of railing members with prefabricated end fittings.

G. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
   1. Connect posts to stair framing by direct welding unless otherwise indicated.
   2. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.

I. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.9 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal stairs after assembly.

C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

G. Place and finish concrete fill for treads and platforms to comply with Division 03 Section "Cast-in-Place Concrete."
   1. Install abrasive nosings according to manufacturer’s recommendations.

H. Install precast concrete treads as indicated on Drawings.

3.2 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of baseplates.

B. Set steel stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
   1. Use nonmetallic, nonshrink grout unless otherwise indicated.
   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055100

SECTION 055219 - ARCHITECTURAL RAILINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes:
   1. Steel pipe and tube railings.
   2. Post-supported railings with glass infill.

B. Related Sections:
   1. Division 01 Section "Sustainable Design Requirements" for additional Leadership in Energy & Environmental Design (LEED) requirements.
   2. Division 06 Section "Miscellaneous Rough Carpentry" for wood blocking for anchoring railings.
   3. Division 09 Section "Non-Structural Metal Framing " for metal backing for anchoring railings.

1.03 DEFINITIONS

A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas, pedestrian guidance and support, visual separation, or wall protection.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
   1. Steel: 72 percent of minimum yield strength.
   2. Glass: 25 percent of mean modulus of rupture (50 percent probability of breakage), as listed in "Mechanical Properties" in AAMA's Aluminum Curtain Wall Series No. 12, "Structural Properties of Glass."

C. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails and Top Rails of Guards:
      a. Uniform load of 50 lbf/ ft. applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Infill of Guards:
      a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
      b. Uniform load of 25 lbf/sq. ft. applied horizontally.
      c. Infill load and other loads need not be assumed to act concurrently.

D. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.05 SUBMITTALS

A. Product Data: For the following:
   1. Manufacturer's product lines of railings assembled from standard components.
   2. Grout, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.
   1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
   2. Each type of glass required.
   3. Fittings and brackets.
   4. Welded connections.

D. LEED Submittals:
   1. Credit MR 4 - Recycled Content: For each type of product indicated, submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).

   1. Credit IEQ 4.2 - Low Emitting Materials - Paints and Coatings: For each type of product indicated, submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standards.

E. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Welding certificates.

1.06 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.

B. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."
   2. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating railings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions. Account for trimming and fitting at site.

1.08 COORDINATION AND SCHEDULING

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.01 GENERAL

A. Building materials in this section must have post- and/or pre-consumer recycled content by weight of total product.

B. Use interior paints and coatings that comply with Green Seal Standard GS-11 "Paints and Coatings," summarized by the VOC content limits specified in Division 01 Section "Sustainable Design Requirements."

2.02 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails, unless otherwise indicated.

2.03 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed) or ASTM A 513 "Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing," Type 5 (mandrel drawn).

B. Bars: Hot-rolled, carbon steel complying with ASTM A 29 "Standard Specification for Steel Bars, Carbon and Alloy, Hot-Wrought, General Requirements for," Grade 1010.

C. Pipe: ASTM A 53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless," Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
   1. Provide galvanized finish for exterior installations and where indicated.

D. Plates, Shapes, and Bars: ASTM A 36 "Standard Specification for Carbon Structural Steel."

E. Castings: Either gray or malleable iron, unless otherwise indicated.
   1. Gray Iron: ASTM A 48 "Standard Specification for Gray Iron Castings," Class 30, unless another class is indicated or required by structural loads.
   2. Malleable Iron: ASTM A 47 "Standard Specification for Ferritic Malleable Iron."

2.04 GLASS AND GLAZING MATERIALS

A. Subject to compliance with the requirements, provide glass as specified in Division 08 Section "Glazing."

B. Tempered Glass: ASTM C 1048 "Standard Specification for Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass," Kind FT (fully tempered), Condition A (uncoated), Type 1 (transparent flat glass), Quality-Q3. Provide products that have been tested for surface and edge compression according to ASTM C 1048 and for impact strength according to 16 CFR 1201 for Category II materials.
   1. Thickness for Glass Infill Panels: As required by structural loads, but not less than 12.0 mm.
   2. Color: Dark gray.

3. Provide safety glass permanently marked with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

C. Glazing Gaskets for Glass Infill Panels: Provide glazing gaskets and related accessories recommended or supplied by railing manufacturer for installing glass infill panels in post-supported railings.

2.05 FASTENERS

A. General: Provide the following:
1. Uncoated Steel Components: Plated-steel fasteners complying with ASTM B 633 "Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel," Class Fe/Zn 25 for electrodeposited zinc coating where concealed; Type 304 stainless-steel fasteners where exposed.
2. Galvanized Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
3. Dissimilar Metals: Type 304 stainless-steel fasteners.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work, unless exposed fasteners are unavoidable.
1. Provide square or hex socket flat-head machine screws for exposed fasteners, unless otherwise indicated.

D. Anchors: Provide cast-in-place or chemical anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements," conducted by a qualified independent testing agency.

2.06 MISCELLANEOUS MATERIALS

A. Wall Brackets: One-piece castings of round escutcheon with centered bracket-arm and mounting plate.
1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

B. Panel Clips: 2-piece, stainless steel compression-grip assembly, including compressible gasket and support-pin to carry glass.
1. Products: Subject to compliance with the requirements, provide one of the following:
a. "Z-Series Z710BS Large Square Glass Clamps" by C.R. Laurence Company.

C. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

D. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

E. Shop Primers: Provide primers that comply with Division 09 painting Sections.

F. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187 "Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal."

H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107 "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)." Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.07 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove flux immediately.
   4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

H. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
   1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

I. Form changes in direction as follows:
   1. By flush bends.

J. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

K. Close exposed ends of hollow railing members with prefabricated end fittings.

L. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 inch or less.

M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.
   1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

O. For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with steel plate forming bottom closure.

2.08 GLAZING PANEL FABRICATION

A. General: Fabricate to sizes and shapes required; provide for proper edge clearance and bite on glazing panels.

B. Infill Panels: Provide heat-strengthened glass panels.

2.09 FINISHES, GENERAL

A. Comply with National Association of Architectural Metal Manufacturers (NAAMM)'s "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.10 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform finish indicated, free of cross scratches.
   1. Run grain of directionally textured finishes with long dimension of each piece.

C. Directional Satin Finish: No. 4.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.11 STEEL AND IRON FINISHES

A. Galvanized Railings:
   1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
   2. Comply with ASTM A 123 "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products," for hot-dip galvanized railings.
   3. Comply with ASTM A 153 "Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware," for hot-dip galvanized hardware.
   4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
   5. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for Society for Protective Coatings (SSPC) surface preparation specifications and environmental exposure conditions of installed railings:
   1. Exterior Railings (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

2. Interior Railings (SSPC Zone 1A): SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."

E. Apply shop primer to prepared surfaces of railings, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
1. Do not apply primer to galvanized surfaces.
2. Stripe paint corners, crevices, bolts, welds, and sharp edges.

F. Painted Finish: Comply with Division 09 painting Sections.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.02 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.03 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches of post.

3.04 ANCHORING POSTS

A. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout , mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

C. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch buildup, sloped away from post.

D. Anchor steel posts to steel with flanges, angle or floor type as required by conditions, welded to posts and bolted to metal supporting members.

3.05 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to walls with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.
   1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

B. Secure wall brackets to building construction as follows:
   1. For concrete anchorage, use drilled-in expansion shields and hanger or lag bolts.
   2. For steel-framed gypsum board partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs or fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.06 INSTALLING GLASS PANELS

A. Post-Supported Glass Railings: Install assembly to comply with requirements in other Part 3 articles. Erect posts and other metal railing components, then set factory-cut glass panels. Do not cut, drill, or alter glass panels in field. Protect edges from damage.

3.07 CLEANING

A. Clean stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

B. Clean and polish glass.

C. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780 "Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings."

3.08 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units.

3.09 CONSTRUCTION WASTE MANAGEMENT

A. Manage construction waste in accordance with provisions of Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 055219

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
1. Framing with dimension lumber.
2. Rooftop equipment bases and support curbs.
3. Wood blocking and nailers.
4. Wood furring.
5. Plywood backing panels.

B. Related Sections:
1. Division 01 Section "Sustainable Design Requirements" for additional Leadership in Energy & Environmental Design (LEED) requirements.
2. Division 06 Section "Sheathing."

1.03 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NHLA: National Hardwood Lumber Association.
3. NLGA: National Lumber Grades Authority.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.04 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
2. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. LEED Submittals:
1. Credit MR 4 - Recycled Content: For each type of product indicated, submit product data or other published information indicating total weight of product to be provided for the Project, percent of Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled

material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation). post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).

2. Credit MR 5 - Regional Materials: For each type of product indicated, product data or other published information verifying the location of manufacturing facility including name, address, and distance between manufacturing facility and the project site. Provide manufacturer's documentation indicating location where the base materials were extracted, mined, quarried, harvested, etc. and the distance between this location and the project site. Also include material costs (excluding costs of installation).
3. Credit MR 7 - Certified Wood:
    a. Forest Stewardship Council (FSC): Provide letter of certification signed by lumber supplier. Indicate compliance with FSC "Principles for Natural Forest Management" and identify certifying organization.
        1) Submit FSC certification numbers; identify each certified product on a line-item basis.
        2) Submit copies of invoices bearing the FSC certification numbers and verification of if the product is "FSC Pure," "FSC Mixed Sources," or "FSC Mixed XX%."
4. Credit IEQ 4.1 - Low Emitting Materials - Adhesives and Sealants: Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standard.
5. Credit IEQ 4.4 - Low Emitting Materials - Composite Wood and Agrifiber Products: For each type of product indicated, including associated laminating adhesive if applicable, submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standard.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.01 GENERAL

A. Building materials in this section must have post- and/or pre-consumer recycled content by weight of total product.

B. Building materials in this section must be extracted, harvested, or recovered, and manufactured and assembled within five hundred (500) miles of the jobsite.

C. Building materials in this section must be FSC certified.

D. Adhesives and Sealants applied on site within the weather proofing exterior in this section must comply with South Coast Air Quality Management District Rule 1168 OR Green Seal Standard GS-36. Refer to LEED Specification 01 81 13 for specific VOC requirements.

E. Composite wood, agrifiber products, and laminating adhesives must contain no added urea-formaldehyde resins.

F. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
   3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
   4. Provide dressed lumber, S4S, unless otherwise indicated.

G. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

2.02 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   1. Use treatment that does not promote corrosion of metal fasteners.
   2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
   3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
   4. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
   1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece] [or] [omit marking and provide certificates of treatment compliance issued by inspection agency.

E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat all miscellaneous carpentry unless otherwise indicated.

2.03 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade and any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Northern species; NLGA.
7. Eastern softwoods; NeLMA.
8. Western woods; WCLIB or WWPA.

B. Other Framing: No. 2 grade and any of the following species:
1. Hem-fir (north); NLGA.
2. Southern pine; SPIB.
3. Douglas fir-larch; WCLIB or WWPA.
4. Mixed southern pine; SPIB.
5. Spruce-pine-fir; NLGA.
6. Douglas fir-south; WWPA.
7. Hem-fir; WCLIB or WWPA.
8. Douglas fir-larch (north); NLGA.
9. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

2.04 IPE PLANKING

A. Heartwood planks, size as indicated on Drawings.

2.05 COMPOSITE WOOD PLANKING

A. Provide "Earthwood Solid Planks" by TimberTech, color "Tropical Pink."

2.06 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.
7. Utility shelving.

B. For items of dimension lumber size, provide Construction or No. 2 grade and any of the following species:
1. Hem-fir (north); NLGA.
2. Mixed southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Western woods; WCLIB or WWPA.
7. Northern species; NLGA.
8. Eastern softwoods; NeLMA.

C. For utility shelving, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
1. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Premium or No. 2 Common (Sterling) grade; NeLMA, NLGA, WCLIB, or WWPA.
2. Mixed southern pine, No. 1 grade; SPIB.
3. Hem-fir or hem-fir (north), Select Merchantable or No. 1 Common grade; NLGA, WCLIB, or WWPA.

4. Spruce-pine-fir (south) or spruce-pine-fir, Select Merchantable or No. 1 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
   1. Mixed southern pine, No. 2 grade; SPIB.
   2. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
   3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
   4. Eastern softwoods, No. 2 Common grade; NELMA.
   5. Northern species, No. 2 Common grade; NLGA.
   6. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

E. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

F. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

G. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.07 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: DOC PS 1, Exterior, AC, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.
   1. Plywood shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.08 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1.

G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
   1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
   2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.09 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

D. Do not splice structural members between supports unless otherwise indicated.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
   1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

F. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

G. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
   3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

H. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.02 WOOD BLOCKING AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.03 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal-size furring at 24 inches o.c.

C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal-size furring vertically at 16 inches o.c.

3.04 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

3.05 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 061053

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

B. Wall sheathing.
   1. Roof sheathing.
   2. Sheathing joint and penetration treatment.

C. Related Sections:
   1. Division 01 Section "Sustainable Design Requirements" for additional Leadership in Energy & Environmental Design (LEED) requirements.
   2. Division 06 Section "Miscellaneous Rough Carpentry" for plywood backing panels.
   3. Division 07 Section "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.03 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

B. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory." and GA-600, "Fire Resistance Design Manual.".

1.04 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
   2. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
   3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
   4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. LEED Submittals:
   1. Credit MR 4 - Recycled Content: For each type of product indicated, submit product data or other published information indicating total weight of product to be provided for the Project, percent of Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation). post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).

2. Credit MR 5 - Regional Materials: For each type of product indicated, product data or other published information verifying the location of manufacturing facility including name, address, and distance between manufacturing facility and the project site. Provide manufacturer's documentation indicating location where the base materials were extracted, mined, quarried, harvested, etc. and the distance between this location and the project site. Also include material costs (excluding costs of installation).
3. Credit MR 7 - Certified Wood:
   a. Forest Stewardship Council (FSC): Provide letter of certification signed by lumber supplier. Indicate compliance with FSC "Principles for Natural Forest Management" and identify certifying organization.
      1) Submit FSC certification numbers; identify each certified product on a line-item basis.
      2) Submit copies of invoices bearing the FSC certification numbers and verification of if the product is "FSC Pure," "FSC Mixed Sources," or "FSC Mixed XX%."
4. Credit IEQ 4.1 - Low Emitting Materials - Adhesives and Sealants: Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standard.
5. Credit IEQ 4.4 - Low Emitting Materials - Composite Wood and Agrifiber Products: For each type of product indicated, including associated laminating adhesive if applicable, submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standard.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.01 GENERAL

A. Building materials in this section must have post- and/or pre-consumer recycled content by weight of total product.

B. Building materials in this section must be extracted, harvested, or recovered, and manufactured and assembled within five hundred (500) miles of the jobsite.

C. Building materials in this section must be FSC certified.

D. Adhesives and Sealants applied on site within the weather proofing exterior in this section must comply with South Coast Air Quality Management District Rule 1168 OR Green Seal Standard GS-36. Refer to LEED Specification 01 81 13 for specific VOC requirements.

E. Composite wood, agrifiber products, and laminating adhesives must contain no added urea-formaldehyde resins.

2.02 WOOD PANEL PRODUCTS

A. Plywood: Either DOC PS 1 or DOC PS 2 unless otherwise indicated.

B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

C. Factory mark panels to indicate compliance with applicable standard.

2.03 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

C. Use treatment that does not promote corrosion of metal fasteners.
   1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
   2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
   3. Design Value Adjustment Factors: Treated lumber plywood shall be tested according ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F shall be not less than span ratings specified.

D. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

E. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

F. Application: Treat all plywood unless otherwise indicated.

2.04 WALL SHEATHING

A. Plywood Wall Sheathing: Exterior, Structural I sheathing.

B. Span Rating: Not less than 16/0.
   1. Nominal Thickness: Not less than 1/2 inch.

C. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. CertainTeed Corporation; GlasRoc.
      b. G-P Gypsum Corporation; Dens-Glass Gold.
      c. National Gypsum Company; Gold Bond e(2)XP.
      d. Temple-Inland Inc.; GreenGlass
      e. United States Gypsum Co.; Securock.
   2. Type and Thickness: Regular, 1/2 inch thick.

2.05 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

B. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153.

C. Nails, Brads, and Staples: ASTM F 1667.

D. Power-Driven Fasteners: NES NER-272.

E. Wood Screws: ASME B18.6.1.

F. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

G. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

H. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

I. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C 1002.
   1. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.

2.06 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

B. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

2.07 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 and ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

D. NES NER-272 for power-driven fasteners.
   1. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."

E. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

F. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

G. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

H. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.02 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

C. Wall and Roof Sheathing:
1. Screw to cold-formed metal framing.
2. Space panels 1/8 inch apart at edges and ends.

3.03 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

B. Fasten gypsum sheathing to wood framing with nails or screws.
1. Fasten gypsum sheathing to cold-formed metal framing with screws.
2. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
3. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

C. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

D. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.
1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
    a. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

E. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
    a. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

F. Seal sheathing joints according to sheathing manufacturer's written instructions.

G. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.

1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.04 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 061600

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Agreement and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Interior standing and running trim.
   2. Interior frames and jambs.
   3. Plastic-laminate cabinets.
   4. Solid-surfacing-material countertops.
   5. Shop finishing of interior woodwork.
   6. High Density Plywood (WD-#) with linoleum top
   7. Closet and utility shelving

B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
   2. Division 09 Section, "Linoleum Flooring" for sheet linoleum used in woodwork items.

1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, including cabinet hardware and accessories and finishing materials and processes.

B. LEED Submittal:
   1. Recycled Content (MRc4):
      a. Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).
      b. Include information on Material Tracking Worksheets.
   2. Certified Wood (MRc7):
      a. Forest Stewardship Council (FSC): Provide letter of certification signed by lumber supplier. Indicate compliance with FSC "Principles for Natural Forest Management" and identify certifying organization.
         1) Submit FSC certification numbers; identify each certified product on a line-item basis.
         2) Submit copies of invoices bearing the FSC certification numbers and verification of if the product is “FSC Pure,” “FSC Mixed Sources,” or “FSC Mixed XX%”
   3. Adhesives & Sealants (EQc4.1)):

a. Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standard.

4. Low-Emitting Composite Wood & Agrifiber Products (EQc4):
   a. Submit product data or other published information verifying the composite wood, agrifiber products, and laminating adhesives used contain no added urea-formaldehyde resins.

5. Rapidly Renewable (MRc6):
   a. Building materials in this section must be rapidly renewable.

6. Adhesives & Sealants (EQc4.1):
   a. Adhesives and Sealants applied on site within the weather proofing exterior in this section must comply with South Coast Air Quality Management District Rule 1168 OR Green Seal Standard GS-36. Refer to LEED Specification 01 81 13 for specific VOC requirements

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show details full size.
   2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers and other items installed in architectural woodwork.
   4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

D. Samples for Initial Selection:
   1. Shop-applied transparent finishes.
   2. Plastic laminates.
   3. PVC edge material.
   4. Thermoset decorative panels.
   5. High Density Plywood w/ Linoleum laminate topSolid-surfacing materials.

E. Samples for Verification:
   1. Veneer leaves representative of and selected from flitches to be used for transparent-finished woodwork.
   2. Veneer-faced panel products with or for transparent finish, 8 by 10 inches for each species and cut. Include at least one face-veneer seam and finish as specified.
   3. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with 1 sample applied to core material.
   4. Thermoset decorative-panels, 8 by 10 inches, for each type, color, pattern, and surface finish with edge banding on 1 edge.
   5. Solid-surfacing materials, 6 inches square.
   6. Corner pieces as follows:
      a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
      b. Miter joints for standing trim.
   7. Exposed cabinet hardware and accessories, one unit for each type and finish.

F. Sustainability Submittals:
   1. Product Data:
      a. For installation adhesives, including printed statement of VOC content.
      b. For each composite-wood product used, documentation indicating that the bonding agent contains no urea formaldehyde.
      c. For each adhesive used, documentation indicating that the adhesive contains no urea formaldehyde.

d. For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content
   1) Include statement indicating costs for each product having recycled content.

2. Certificates: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body.
   1) Include statement indicating costs for each certified wood product.

G. Product Certificates: For each type of product, signed by product manufacturer.

H. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

I. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Certified participant in AWI's Quality Certification Program.

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers and wood doors with face veneers that are sequence matched with woodwork.

D. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
1. Provide AWI Quality Certification Program labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified.
2. Finishes shall be completed according to “Architectural Woodwork Standards” Section 1.2.13.8 published by AWI

E. Forest Certification: Provide interior architectural woodwork produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
   2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Recycled Content (MRc4):
   1. Building materials in this section must have post- and/or pre-consumer recycled content by weight of total product.
   2. Particleboard: minimum 50% recycled content; Cabinetry MDF: minimum 80% recycled content)

C. Rapidly Renewable Materials:

D. Certified Wood (MRc7):
   1. Building materials in this section must be FSC certified.

E. For material finishes and colors refer to Division 09 Section “Schedule for Finishes”

F. Wood Species and Cut for Transparent Finish:
   1. Species: Birch.
   2. Finish: Stain to match WD1.

G. Wood Products: Comply with the following:
   1. Hardboard: AHA A135.4.
   2. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
   3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

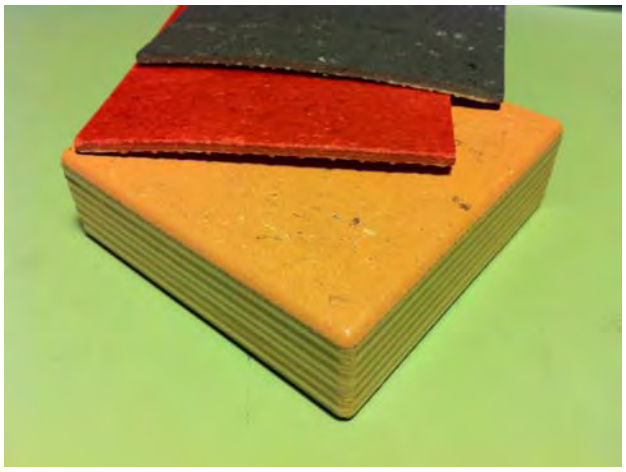
4. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
5. Softwood Plywood: DOC PS 1, Medium Density Overlay.
6. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

H. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges.

I. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

J. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.

K. Linoleum: As specified in Division 09 Section "Linoleum Flooring."



2.2 CABINET HARDWARE

A. General: Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish as selected by Architect from manufacturer's full range.

B. Pulls: Cut outs with edge bands.

C. Hinges: Concealed European-style self-closing hinges, BHMA A156.9, B01602, 170 degrees of opening, self closing.

D. Sliding Door Hardware: European Style.
1. Basis of Design Rockler, Woodworking Hardware, 2 sliding door tracks. 2 Sliding door upper guides and 2 sliding door lower rollers.
2.

E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071, with shelf rest. Heavy Duty type KV or approved other.
1. KV #80 Standards.
2. KV # 180 Brackets.

F. Undercounter Bracket:
   1. KV # 208 L Bracket.

G. Shelf Rest: BHMA A156.9, B04013.

H. Grommets for Cable Passage Through Countertops: 2 inch OD, black molded plastic grommets and matching plastic caps with slot for wire passage.
   1. Product: SG Series by Doug Mockett and Co inc.

I. Exposed hardware Finishes: Comply with Stainless Steel BHMA A156.18 finish number BHMA 630.

J. For Concealed hardware, provide manufacturer's standard finish that complies with product class and requirements in BHMA A156.9.

2.3 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

C. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Wood Glues: 30 g/L.
   2. Contact Adhesive: 250 g/L.

2.4 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
   1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.
   2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch mm).
   3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.

D. Fabrication of paper composite, comply with manufacturers recommendations.

E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
   1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
   2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

F. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
   1. Seal edges of openings in countertops with a coat of varnish.

G. Install glass to comply with applicable requirements in Division 08 Section "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

2.5 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Grade: Custom.

B. Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building, unless otherwise indicated.
   1. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.

C. For trim items wider than available lumber, use veneered construction. Do not glue for width.

D. For rails wider or thicker than available lumber, use veneered construction. Do not glue for width or thickness.

E. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

F. Assemble casings in plant except where limitations of access to place of installation require field assembly.

2.6 HIGH DENSITY PLYWOOD (WD-#) WITH LINOLEUM TOP

A. Refer to Schedule of Finishes 090600 for color selections

B. Basis of Design Product: Forbo Marmoleum Desktop", 2.0 mm gauge over High Density Plywood or approved equal.
   1. Installation required by “Forbo Master Mechanic”

C. Forbo Maroleum Desktop.
   1. Description: Homogeneous sheet linoleum of primarily natural materials consisting of linseed oil, wood flour, and rosin binders, mixed and calendered onto natural jute backing with an applied polyolefin comfort layer. Pattern and color shall extend throughout total thickness of material.
   2. Adhesive:
   3. Heat Welding Rod:

D. High Density Plywood : Subject to compliance with requirements provide:
   1. 15 ply b/bb grade or better
   2. Exposed edges, sanded smooth and sealed.

2.7 PLASTIC-LAMINATE WOODWORK

A. Grade: Custom.

B. AWI Type of Cabinet Construction: Flush overlay.

C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
   1. Colors: Refer to Division 09 Section “Schedule for Finishes”
   2. Horizontal Surfaces Other Than Tops: Grade HGS.
   3. Postformed Surfaces: Grade HGP.
   4. Vertical Surfaces: Grade HGS.
   5. Edges: PVC edge banding,0.12 inch thick, matching laminate in color, pattern, and finish

D. Materials for Semiexposed Surfaces:
   1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
      a. Edges of Plastic-Laminate Shelves: As indicated.
      b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.
   2. Drawer Sides and Backs: Thermoset decorative panels.
   3. Drawer Bottoms: Hardwood plywood.

E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   1. Refer to Division 09 Section “Schedule for Finishes”

2.8 SOLID-SURFACING-MATERIAL COUNTERTOPS

A. Grade: Custom.

B. Manufacturer and product, Refer to Division 09 Section “Schedule for Finishes”

C. Fabricate tops and edge in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
   1. Fabricate tops with shop-applied edges of materials and configuration indicated.

D. Drill holes in countertops for plumbing fittings and soap dispensers in shop, polish edges where they wil be exposed.

E. Adhesive and sealants as recommended by manufacturer.

2.9 SHOP FINISHING

A. Grade: Provide finishes of same grades as items to be finished.

B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
   1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.

C. Transparent Finish:
   1. Grade: Custom.
      a. System 5 – Varnish, Conversion.
   2. Staining: Match approved sample for color.

3. Wash Coat for Stained Finish: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
4. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
5. Sheen: Semigloss, 46-60 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails[or finishing screws] for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than [36 inches] [60 inches] [96 inches] long, except where shorter single-length pieces are necessary.[Scarf running joints and stagger in adjacent and related members.]
1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
2. Install wall railings on indicated metal brackets securely fastened to wall framing.
3. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

G. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening, unless otherwise indicated.
1. Install flush paneling with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.

H. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.

3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

I. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
   1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
   2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
   3. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

J. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064023

SECTION 071113 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes cold-applied, emulsified-asphalt dampproofing for use on:
   a. Foundation walls and grade-beams that do not enclose interior space.
   b. Upstream side of retaining walls.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include recommendations for method of application, primer, number of coats, coverage or thickness, and protection course.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain primary dampproofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.

1.05 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.

B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.01 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. BASF; Sonneborn Brand Products.
   2. ChemMasters Corp.
   3. Gardner Gibson, Inc.
   4. Henry Company.
   5. Karnak Corporation.
   6. Meadows, W. R., Inc.
   7. Tamms Industries, Inc.

B. Trowel Coats: ASTM D 1227 "Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing," Type II, Class 1.

C. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.

D. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

E. VOC Content: 0.25 lb/gal. or less.

2.02 DRAINAGE/PROTECTION COURSE

A. Geotextile-Faced Wall Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578 "Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation," Type VI, 40-psi minimum compressive strength; fabricated with tongue-and-groove edges and with one side having grooved drainage channels faced with nonwoven geotextile filter fabric.
   1. Manufacturers: Subject to compliance with requirements, provide "Insul-Drain Foamular Extruded Polystyrene" by Owens Corning or a comparable product acceptable to Architect.
   2. Thickness: 2 1/4 inches minimum.

2.03 MISCELLANEOUS MATERIALS

A. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended by manufacturer.

B. Asphalt-Coated Glass Fabric: ASTM D 1668 "Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing," Type I.

C. Patching Compound: Manufacturer's fibered mastic of type recommended by dampproofing manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.
   1. Proceed with dampproofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.
   2. Test for surface moisture according to ASTM D 4263 "Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method."

3.02 PREPARATION

A. Protection of Other Work: Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

B. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.

C. Apply patching compound for filling and patching tie holes, honeycombs, reveals, and other imperfections.

3.03 APPLICATION, GENERAL

A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.
   1. Apply additional coats if recommended by manufacturer or if required to achieve coverages indicated.
   2. Allow each coat of dampproofing to cure 24 hours before applying subsequent coats.
   3. Allow 48 hours drying time prior to backfilling.

B. Apply dampproofing to footings and foundation walls that do not enclose occupied space.
   1. Apply from finished-grade line to top of footing, extend over top of footing, and down a minimum of 6 inches over outside face of footing.
   2. Extend 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.

3. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inch- wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.

C. Apply dampproofing to upstream side of retailing walls.
1. Apply from finished-grade line to top of footing, extend over top of footing, and down a minimum of 6 inches over outside face of footing.
2. Extend 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
3. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inch- wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.

D. Apply to below-grade steel columns and base plates to one inch below finished floor line.

3.04 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. On Concrete Foundations: Apply 2 brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat, 1 fibered brush or spray coat at not less than 3 gal./100 sq. ft., or 1 trowel coat at not less than 4 gal./100 sq. ft.

3.05 INSTALLATION OF PROTECTION COURSE

A. Install protection course over completed-and-cured dampproofing used for footings and foundation walls. Comply with dampproofing material manufacturer's written recommendations for attaching protection course.
1. Support protection course with spot application of adhesive of type recommended by protection board manufacturer over cured coating.
2. Install protection course within 24 hours of installation of dampproofing (while coating is tacky) to ensure adhesion.

3.06 CLEANING

A. Remove dampproofing materials from surfaces not intended to receive dampproofing.

3.07 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 071113

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Foam-plastic board insulation.
2. Glass-fiber board insulation.
3. Mineral-wool board insulation.
4. Glass-fiber blanket insulation.
5. Mineral-wool blanket insulation.
6. Loose-fill insulation.
7. Spray-applied cellulosic insulation.
8. Spray polyurethane foam insulation.
9. Radiant barriers.
10. Vapor retarders.

B. Related Sections:
1. Division 07 Section(s) "Thermoplastic Polyolefin (TPO) Roofing" for insulation specified as part of roofing construction.
2. Division 07 Section "Fire-Resistive Joint Systems" for insulation installed as part of a perimeter fire-resistive joint system.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:
1. Recycled Content (MRc4):
a. Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).
b. Include information on Material Tracking Worksheets.
2. Adhesives & Sealants (EQc4.1):
a. Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standard.
3. Submit R-value of insulation.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:
   1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
   3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following/;
      a. DiversiFoam Products.
      b. Dow Chemical Company (The).
      c. Owens Corning.
      d. Pactiv Building Products.
   2. Type VI, 40 psi.
   3. Min 8% pre-consumer Recycled Content.

B. Geotextile-Faced Wall Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type VI, 40-psi minimum compressive strength; fabricated with tongue-and-groove edges and with one side having grooved drainage channels faced with nonwoven geotextile filter fabric.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   2. Owens Corning.

2.2 MINERAL-WOOL BOARD INSULATION

A. Unfaced, Mineral-Wool Board Insulation: ASTM C 612; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
   1. Nominal density of 8 lb/cu. ft., Type III, thermal resistivity of 4.35 deg F x h x sq. ft./Btu x in. at 75 deg F.
   2. Fiber Color: Darkened, where indicated.

B. Manufacturers: Subject to compliance with requirements, provide RockBoard 80 by Roxul, Inc., or a comparable product by Thermafiber.

2.3 SPRAY-APPLIED CELLULOSIC INSULATION

A. Self-Supported, Spray-Applied Cellulosic Insulation: ASTM C 1149, Type I (materials applied with liquid adhesive; suitable for either exposed or enclosed applications, chemically treated for flame-resistance, processing, and handling characteristics.
   1. Manufacturers: Subject to compliance with requirements, provide BioBased 501 Insulation by BioBased Technologies.
   2. Spray foam insulation shall be a spray-applied semi-rigid, low-density, air impenetrable cellular polyurethane foam plastic insulation produced in the field by combining a part A polymeric isocyanurate component with a part B resin-based component. The material shall be job-site mixed in and spray applied by and through equipment designed especially for this purpose.
   3. 1.7 lb/ft^3 spray foam, a two-part, soy-based product, shall conform to the following

TEST STANDARD	DESCRIPTION	VALUE
ASTM C518-02	Thermal Resistance 1" nominal 2" nominal 2.5" nominal 3" nominal 3.5" nominal 5" nominal 7" nominal 8" nominal 9" nominal	 **R – 5.9** **R – 12** **R – 15** **R – 18** **R – 19** **R – 28** **R – 39** **R – 44** **R – 50**
ASTM D2856	Closed Cell Content	**>90%**
ASTM D1622	Core Density (nominal)	**1.7 lbs/ft^3**
ASTM D1623	Tensile Strength	**19 p.s.i.**
ASTM D1621	Compressive Strength	**23 p.s.i.**
ASTM C1338	Criteria for Fungi Resistance	**Pass**
ASTM E84-04	Surface Burning Characteris-tics Flame Spread Smoke Development Index	**1.625"** **<25** **<450**
ASTM D2126-04	Dimensional Stability 82°C, Ambient Humidity 23°C, 50% Relative Humidity -20°C, Ambient Humidity	 **Less than 1%** **Less than 1%** **Less than 1%**
ASTM E96	Water Vapor Permeability 1" Thick Foam 2.5" Thick Foam	 **2.06 perms** **0.73 perms**
ASTM D2842-01	Water Absorption	**0.2%**

2.4 VAPOR RETARDERS

A. Reinforced-Polyethylene Vapor Retarders: Two outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 25 lb/1000 sq. ft., with maximum permeance rating of 0.0507 perm.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Raven Industries Inc.; DURA-SKRIM 6WW.
      b. Reef Industries, Inc.; Griffolyn T-65.

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

D. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.

E. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical footing and foundation wall surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
   1. If not otherwise indicated, extend insulation a minimum of 36 inches below exterior grade line.

B. On horizontal surfaces under slabs, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
   1. If not otherwise indicated, extend insulation a minimum of 36 inches in from exterior walls.

3.4 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Foam-Plastic Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
   1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.5 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
   1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
   2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
   3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
   4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.6 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.
   1. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.
   2. Before installing vapor retarders, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
   3. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.7 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Fluid-applied membrane air barrier, vapor permeable.

B. Related Sections include the following:
   1. Division 06 Section "Sheathing" for wall sheathings, wall sheathing joint-and-penetration treatments, building paper, and building wraps.
   2. Division 07 Section "Thermal Insulation" for rock wool board insulation.
   3. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashings.
   4. Division 07 Section "Joint Sealants" for joint-sealant materials and installation.

1.3 DEFINITIONS AND REFERENCES

A. ABAA: Air Barrier Association of America.

B. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

C. References
   1. ASTM C1135 - Test Method for Determining Tensile Adhesion Properties of Structural Sealants.
   2. ASTM D2247 - Practice for Testing Water Resistance of Coatings in 100 Percent Relative Humidity.
   3. ASTM D4541 - Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
   4. ASTM E72 - Test Methods of Conducting Strength Tests of Panels for Building Construction.
   5. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
   6. ASTM E96 - Test Method for Water Vapor Transmission of Materials.
   7. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
   8. ASTM E331 - Test Method for Water Penetration by Uniform Static Air Pressure Difference.
   9. ASTM E695 - Method for Measuring Relative Resistance to Impact Loading.
   10. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials.
   11. ASTM E2485 - Standard Test Method for Freeze/Thaw Resistance of Exterior Insulation and Finish Systems (EIFS) and Water Resistive Barrier Coatings.
   12. ASTM B117 - Test Method for Salt Spray (Fog) Testing.
   13. ASTM G155 and G153 - Accelerated Weathering for Exposure of Nonmetallic Materials.

1.4 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor-permeable air barrier . Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. System to meet the performance and testing requirements of the International Code Council Acceptance Criteria AC 212 and ASTM E2570.

	Method	**ICC and ASTM E2570 Criteria**	**Results**
Accelerated Weathering	AC 212	25 Cycles followed by Hydrostatic Pressure Test: No water penetration on the plane of the exterior facing side of the substrate.	Pass: no water penetration
Air Infiltration	ASTM E2178	Calculated flow Rate at 75 Pa (1.57 lb/ft^2, 0.3 in H_2O) = < 0.02 L/m^2*s (< 0.004 cfm/ft^2)	< .00001 L/m^2*s (0.00001 cfm/ft^2) at 75 Pa (1.57 lb/ft^2, 0.3 in H_2O)
Air Leakage	ASTM E283	No Criteria	< 0.004 cfm/ft^2
Freeze-Thaw Resistance	ASTM E 2485	10 Cycles	Pass – No Deleterious Effects
Hydrostatic Pressure Test	AATCC 127 (Water Column)	Resist 21.6 in (55 cm) water for 5 hours before and after aging	Pass: no water penetration
Elongation	ASTM D412	No Criteria	360%
Flexibility	ASTM D522	No Criteria	No Cracking at 1/8" (3 mm)
Nail Seal ability, Head of Water	ASTM D1970	No Criteria	Pass 5 inches of water
Racking	ASTM E72	Deflection at 1/8 in (3.2 mm)	Pass -No cracking at field, joints or flashing connection
Restrained Environmental	ICC ES AC 212 / ASTM E2570	5 Cycles of wetting and drying	Pass -No cracking at field, joints or flashing connection
Structural Loading	ASTM E1233 Procedure A	10 Cycles @ 80% design load	Pass -No cracking at field, joints or flashing connection
Surface Burning Charac-teristics	ASTM E84	ICC and ASTM E2568 Flame Spread <25 Smoke Developed <450	Flame Spread =0 Smoke Developed =0
Tensile Bond Strength	ASTM E 2134/ ASTM C 297	Minimum 15 psi (104 kPa)	Pass all listed substrates and flashing materials
Water Resistance	ASTM D 2247	14 Days	Pass – No Deleterious Effects.
Water Penetration	ASTM E331	2.86 psf (137 Pa) for 15 minutes	Pass 25.4 psf (1216 Pa) for 165 minutes
Water Penetration	ASTM E331	Tested after Structural Loading, Racking and Restrained Environ-mental Cycling at 2.86 psf (137 Pa) for 15 minutes	No Water Penetration
Water vapor transmission	ASTM E96 Pro-cedure B	Vapor Permeable	7 perms
Weathering	ICC ES AC 212 / ASTM E2570	210 hours of UV Exposure, 25 cycles of accelerated weatherin, 21.6 in (549 mm) water column for 5 hours	Pass
Wind Driven Rain	F.S. TT-C-555B	No Criteria	Pass
VOC	EPA Reference Test Method 24	US EPA, South Coast AQMD and Greenseal Standard	10 g/L
Regional Harvest		LEED MRc 5.1	100% at all facilities

1.5 SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.

B. LEED Submittals:
   1. Adhesives & Sealants (EQc4.1):
      a. Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standard.

   2. Low-Emitting Paints and Coatings (EQc4.2):
      a. Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standards.

C. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
   1. Include details of interfaces with other materials that form part of air barrier.

D. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with the barrier; signed by product manufacturer.

E. Qualification Data: For Applicator.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers.

G. Warranty: Provide documents required.

1.6 QUALITY ASSURANCE

A. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance and that is an ABAA-licensed contractor, employs certified and registered installers, and complies with ABAA's Quality Assurance Program.
   1. Applicator shall have attended Manufacturer’s Educational Seminar
   2. Applicator shall possess a current certificate of having successfully completed the Seminar
   3. Applicator shall be experienced and competent in installation of plaster-like materials.

B. Mockups: Before beginning installation of air barrier, build mockups of exterior wall assembly incorporating backup wall construction, external cladding, window, door frame and sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.
   1. Coordinate construction of mockup to permit inspection by Owner's testing agency of air barrier before external insulation and cladding is installed.
   2. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
   3. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
   4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Preinstallation Conference: Conduct conference at Project site.

1. Include installers of other construction connecting to air barrier, including roofing, waterproofing, architectural precast concrete, masonry, sealants, windows, glazed curtain walls, and door frames.
2. Review air barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and sheet flashings, mockups, installation procedures, sequence of installation, testing and inspecting procedures, and protection and repairs.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.

B. Remove and replace liquid materials that cannot be applied within their stated shelf life.

C. Store rolls according to manufacturer's written instructions.

D. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 FLUID-APPLIED MEMBRANE AIR BARRIER

A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier.
1. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    a. Basis of Design: Parex USA, Inc., 4125 E. LaPalma Ave., Suite 250, Anaheim, CA 92807
        1) Parex USA Weatherseal Spray & Roll-On: A non-cementitious, 100% acrylic trowelable air/weather barrier.
        2) Parex 396 Sheathing Tape: Non-woven synthetic fiber tape to reinforce Weatherseal Spray & Roll-On at sheathing board joints, into rough openings and other terminations into dissimilar materials
        3) Flashing Membrane: Self sealing, Polyester faced, rubberized asphalt membrane, 30 mils (0.76 mm) thick
        4) Approved equal by Henry Company; Air-Bloc 31

2.2 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid waterborne primer recommended for substrate by manufacturer of air barrier material.

C. Adhesives & Sealants (EQc4.1):

1. Adhesives and Sealants applied on site within the weather proofing exterior in this section must comply with South Coast Air Quality Management District Rule 1168 OR Green Seal Standard GS-36. Refer to LEED Specification 01 81 13 for specific VOC requirements.

D. Paints & Coatings (EQc4.2):
1. Paints and coatings applied on site within the weather proofing exterior in this section must comply with Green Seal Standard GS-11, Green Seal Standard GC-03, OR South Coast Air Quality Management District Rule 1113. Refer to LEED Specification 01 81 13 for specific VOC requirements.

E. Counterflashing Strip: Modified bituminous, 40-mil- thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil- thick, crosslaminated polyethylene film with release liner backing.

F. Butyl Strip: Vapor-retarding, 30- to 40-mil- thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive with release liner backing.

G. Joint Reinforcing Strip: Air barrier manufacturer's glass-fiber-mesh tape.

H. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

I. Adhesive and Tape: Air barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

J. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, **0.0187 inch** thick, and Series 300 stainless-steel fasteners.

K. Sprayed Polyurethane Foam Sealant: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

L. Modified Bituminous Transition Strip: Vapor-retarding, 40-mil- thick, smooth-surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick polyethylene film with release liner backing.

M. Adhesive-Coated Transition Strip: Vapor-permeable, 17-mil- thick, self-adhering strip consisting of an adhesive coating over a permeable laminate with a permeance of 37 perms.

N. Elastomeric Flashing Sheet: ASTM D 2000, 2BC415 to 3BC620, minimum 50- to 65-mil- thick, cured sheet neoprene with manufacturer's recommended contact adhesives and lap sealant with galvanized steel termination bars and fasteners.

O. Preformed Silicone-Sealant Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

P. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Division 07 Section "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane.

D. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

E. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

F. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.
   1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

G. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials recommended by Manufacturer.

H. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

I. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

J. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply modified bituminous transition strip so that a minimum of 3 inches of coverage is achieved over both substrates. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.
   1. Modified Bituminous Transition Strip: Roll firmly to enhance adhesion.
   2. Elastomeric Flashing Sheet: Apply adhesive to wall, frame, and flashing sheet. Install flashing sheet and termination bars, fastened at 6 inches o.c. Apply lap sealant over exposed edges and on cavity side of flashing sheet.
   3. Preformed Silicone-Sealant Extrusion: Set in full bed of silicone sealant applied to walls, frame, and membrane.

K. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.

L. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

M. Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, counterflashing strip.

N. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

O. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.3 TRANSITION STRIP INSTALLATION

A. Install strips, transition strips, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

3.4 AIR BARRIER MEMBRANE INSTALLATION

A. Apply air barrier membrane to form a seal with strips and transition strips and to achieve a continuous air barrier according to air barrier manufacturer's written instructions.

B. Apply air barrier membrane within manufacturer's recommended application temperature ranges.

C. Flash all rough openings with liquid membrane and embed with sheathing tape or polyester backed peel and stick flashing membrane.

D. Treat all sheathing joints with liquid water-resistive barrier sheathing tape.

E. Apply liquid water-resistive barrier to the surface of the substrate (Minimum 2 coats on plywood, OSB, concrete and masonry)

F. Ensure that the liquid barrier laps onto all tracks and flashing to allow for any water to be drained into the tracks/flashing

G. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

H. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:
   1. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
   2. Continuous structural support of air barrier system has been provided.
   3. Site conditions for application temperature and dryness of substrates have been maintained.

4. Maximum exposure time of materials to UV deterioration has not been exceeded.
5. Surfaces have been primed, if applicable.
6. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
7. Termination mastic has been applied on cut edges.
8. Strips and transition strips have been firmly adhered to substrate.
9. Compatible materials have been used.
10. Transitions at changes in direction and structural support at gaps have been provided.
11. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
12. All penetrations have been sealed.

C. Tests: Testing to be performed will be determined by Owner's testing agency from among the following tests:
1. Qualitative Testing: Air barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, smoke pencil with pressurization or depressurization.
2. Quantitative Air Leakage Testing: Testing not to exceed the test pressure differential, positive and negative, indicated in "Performance Requirements" Article for air barrier assembly air leakage according to ASTM E 783.
3. Adhesion Testing: Air barrier assemblies will be tested for adhesive bond according to ASTM D4541.

D. Remove and replace deficient air barrier components and retest as specified above.

E. Project / Site Conditions
1. Installation Ambient Air Temperature: Minimum of 40 °F (4 °C) and rising, and remain so for 24 hours thereafter
2. Substrate Temperature: Do not materials to substrates whose temperature are below 40 °F (4 °C) or contain frost or ice
3. Inclement Weather: Do not apply materials during inclement weather, unless appropriate protection is employed
4. Materials shall not be applied if ambient temperature exceeds 120ºF (49ºC) or falls below 40 °F (4 °C) within 24 hours of application. Protect base coat from uneven and excessive evaporation during hot, dry weather.
5. Prior to installation, the wall shall be inspected for surface contamination, or other defects that may adversely affect the performance of the materials and shall be free of residual moisture

3.6 CLEANING AND PROTECTION

A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than 30 days.
2. Protect air barrier from contact with creosote, uncured coal-tar products, TPO, EPDM, flexible PVC membranes, and sealants not approved by air barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION 072726

SECTION 074213 - METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Standing Seam metal panels.
   2. Roof Edge Flashing and Coping

B. Related Sections:
   1. Division 05 Section "Cold-Formed Metal Framing" for support framing, including girts, studs, and bracing.
   2. Division 07 Section "Air Barriers" for continuous air barrier systems.
   3. Division 07 Section "Sheet Metal Flashing and Trim" for flashing and other sheet metal work that is not part of metal wall panel assemblies.

1.3 DEFINITION

A. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight wall system.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at the following test-pressure difference:
   1. Test-Pressure Difference: 1.57 lbf/sq. ft.

D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
   1. Test-Pressure Difference: 6.24 lbf/sq. ft.

E. Water Penetration under Dynamic Pressure: No evidence of water leakage when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft.and not more than 12 lbf/sq. ft.
   1. Water Leakage: As defined according to AAMA 501.1.
   2. Water Leakage: Uncontrolled water infiltrating the system or appearing on system's normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and

gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

F. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:
1. Wind Loads: Determine loads based on the wind pressuresindicated on Drawings.
2. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/240 of the span.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

H. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of wall panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop- and field-assembled work.
1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
   a. Flashing and trim.
   b. Anchorage systems.

C. Samples: For each type of exposed finish required, prepared on Samples of size indicated below.
1. Metal Wall: 12 inches long by actual panel width. Include fasteners, closures, and other metal wall panel accessories.
2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
3. Accessories: 12-inch- long Samples for each type of accessory.

D. Leed Submittals:
1. Credit MR 4: Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).
2. Credit IEQ 4.1: Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standard.

E. Delegated-Design Submittal: For metal wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and wall-mounted items. Show the following:
1. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
2. Penetrations of wall by pipes and utilities.

G. Maintenance Data: For metal wall panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

C. Source Limitations: Obtain each type of metal wall panel from single source from single manufacturer.

D. Fire-Resistance Ratings: Where indicated, provide metal wall panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

E. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

G. Build mockup of typical wall and corner panel, as shown on Drawings; by full thickness, including insulation, supports, attachments, and accessories.
   1. Conduct water spray test of mockup of metal wall panel assembly, testing for water penetration according to AAMA 501.2.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

H. Preinstallation Conference: Conduct conference at Project site.

I. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels, including installers of doors, windows, and louvers.
   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
   3. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
   4. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
   5. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
   6. Review temporary protection requirements for metal wall panel assembly during and after installation.
   7. Review wall panel observation and repair procedures after metal wall panel installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.

B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal wall panel for period of metal wall panel installation.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication, and indicate measurements on Shop Drawings.

1.9 COORDINATION

A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including rupturing, cracking, or puncturing.
      b. Deterioration of metals and other materials beyond normal weathering.
   2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL

A. Building materials in this section must have post- and/or pre-consumer recycled content by weight of total product.

B. Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standards.

2.2 PANEL MATERIALS

A. Concealed Fastener Wall Panels:
   1. Basis of design:
      a. Manufacturer/Product: Morin, CF Series Panels, U12.
      b. Panel Depth: 1-1/2”.
      c. Cover Width: 12”.
      d. Finish: Architect to select from full range of colors.

A. Standing Seam Panels:
   1. Basis of design:
      a. Manufacturer/Product: Morin, Profile SWL.
      b. Panel Height: 1-3/4”
      c. Panel Width: As indicated.
      d. Texture: Smooth
      e. Finish: Architect to select from full range of colors.

2.3 MISCELLANEOUS MATERIALS

A. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

2.4 ACCESSORIES

A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.

B. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
   1. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
   2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Formed from 0.018-inch minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

2.5 FABRICATION

A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, and that will minimize noise from movements within panel assembly.

E. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

F. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
   2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
   4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
      a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.

B. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
   1. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
   2. Verify that weather-resistant sheathing paper has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
   3. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

C. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

3.3 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

B. Fasteners:
   1. Aluminum Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

E. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
   1. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

F. Lap-Seam Metal Wall Panels: Fasten metal wall panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

G. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
   1. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal wall panels.
   2. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
   3. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
   4. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.
   5. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps; on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weathertight.
   6. At panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

3.4 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

B. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

C. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

D. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
   1. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Water Penetration: Test areas of installed system indicated on Drawings for compliance with system performance requirements according to ASTM E 1105 at minimum differential pressure of 20 percent of inward-acting, wind-load design pressure as defined by SEI/ASCE 7, but not less than 6.24 lbf/sq. ft..

C. Water-Spray Test: After completing the installation of 75-foot- by-2-story minimum area of metal wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by Architect.

D. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect and test completed metal wall panel installation, including accessories.

E. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.

F. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.

B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213

SECTION 075400 - THERMOPLASTIC MEMBRANE ROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes:
   1. Mechanically fastened membrane roofing system.
   2. Roof insulation.
   3. Roof expansion joint cover.

B. Related Sections:
   1. Division 01 Section "Sustainable Design Requirements" for additional Leadership in Energy & Environmental Design (LEED) requirements.
   2. Division 05 Section "Steel Decking" for furnishing acoustical deck rib insulation.
   3. Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
   4. Division 07 Section "Sheet Metal Flashing and Trim" for flashings and counterflashings.
   5. Division 07 Section "Joint Sealants."

1.03 DEFINITIONS

A. Roofing Terminology: Refer to ASTM International (ASTM) D 1079 "Standard Terminology Relating to Roofing and Waterproofing," and glossary of National Roofing Contractor's Association (NRCA)'s "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.04 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

C. Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to American Society of Civil Engineers (ASCE)/Structural Engineering Institute (SEI) 7 "Minimum Design Loads for Buildings and Other Structures."
   1. Corner Uplift Pressure: 90 lbf/sq. ft.
   2. Perimeter Uplift Pressure: 60 lbf/sq. ft.
   3. Field-of-Roof Uplift Pressure: 30 lbf/sq. ft.

D. FM Global (FMG) Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 "Approval Standard for Class 1 Insulated Steel Deck Roofs," and FMG 4470 "Approval Standard for Class 1 Roof Covers," as part of a membrane roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
   1. Fire/Windstorm Classification: Class 1A-60.
   2. Hail Resistance: SH.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.
   1. Base flashings and membrane terminations.
   2. Tapered insulation, including slopes.
   3. Insulation fastening patterns.

C. Samples: For the following products:
   1. 12-by-12-inch square of sheet roofing, of color specified, including T-shaped side and end lap seam.
   2. Full-size concrete roof paver in each color and texture required.

D. LEED Submittals:
   1. Credit SS 7.2: Heat Island Effect - Roof:
      a. Product Test Reports for roof membrane, documentation indicating blend results in minimum 78 Solar Reflectance Index (SRI) for 75 percent of roof surface.

E. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
   1. Attach certificate to Special Warranty, and include in "Warranties" binder.

F. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
   1. Submit evidence of meeting performance requirements.
   2. Attach certificate to Special Warranty, and include in "Warranties" binder.

G. Maintenance Data: For roofing system to include in maintenance manuals.
   1. Include installer's and manufacturer's certificates.

H. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.

B. Manufacturer Qualifications: A qualified manufacturer that has FMG approval for membrane roofing system identical to that used for this Project.

C. Source Limitations: Obtain components for membrane roofing system approved by roofing membrane manufacturer.

D. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by Underwriter's Laboratory (UL), FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
   1. Exterior Fire-Test Exposure: Class A; ASTM E 108 "Standard Test Methods for Fire Tests of Roof Coverings," for application and roof slopes indicated.
   2. Fire-Resistance Ratings: ASTM E 119 "Standard Test Methods for Fire Tests of Building Construction and Materials," for fire-resistance-rated roof assemblies of which roofing system is a part.

E. Fire-Test-Response Characteristics, Expansion Joint Cover: Provide fire-barrier assemblies with fire-test-response characteristics not less than that of adjacent construction, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Assemblies shall be capable of anticipated

movement while maintaining fire rating. Identify assemblies with appropriate markings of applicable testing and inspecting agency.

1. Fire-Resistance Ratings: UL 2079 "Tests for Fire Resistance of Building Joint Systems."
2. Fire-Resistance Ratings: ASTM E 119.

F. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to roofing system including, but not limited to, the following:

1. Meet with roofing installer, roofing system manufacturer's representative, deck installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.08 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.09 WARRANTY

A. Special Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.

1. Special warranty includes roofing membrane, base flashings, roofing membrane, accessories, roof insulation, fasteners, cover boards, walkway products, and other components of membrane roofing system.

2. Warranty Period: 15 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, signed by Installer, covering Work of this Section, including all components of membrane roofing system such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:
1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 THERMOPLASTIC POLYOLEFIN ROOFING MEMBRANE

A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: Uniform, flexible sheet formed from a thermoplastic polyolefin, internally fabric or scrim reinforced, and as follows:
1. Manufacturers:
a. Carlisle SynTec Incorporated.
b. Firestone Building Products Company.
c. GAF Materials Corporation.
d. GenFlex Roofing Systems.
e. Johns Manville International, Inc.
f. Sarnafil Inc.
g. Stevens Roofing Systems; Div. of JPS Elastomerics.

2. Thickness: 60 mils, nominal.
3. Exposed Face Color: White.
a. Solar Reflectance Index: Provide membrane with Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980, based on testing of identical products by a qualified testing agency.

4. Physical Properties:
a. Breaking Strength: 225 lbf; ASTM D 751 "Standard Test Methods for Coated Fabrics," grab method.
b. Elongation at Break: 15 percent; ASTM D 751.
c. Tearing Strength: 55 lbf minimum; ASTM D 751, Procedure B.
d. Brittleness Point: Minus 22 deg F.
e. Ozone Resistance: No cracks after sample, wrapped around a 3-inch- diameter mandrel, is exposed for 166 hours to a temperature of 104 deg F and an ozone level of 100 pphm; ASTM D 1149 "Standard Test Methods for Rubber Deterioration-Cracking in an Ozone Controlled Environment."
f. Resistance to Heat Aging: 90 percent minimum retention of breaking strength, elongation at break, and tearing strength after 166 hours at 240 deg F; ASTM D 573 "Standard Test Method for Rubber—Deterioration in an Air Oven."
g. Water Absorption: Less than 4 percent mass change after 166 hours' immersion at 158 deg F; ASTM D 471 "Standard Test Method for Rubber Property-- Effect of Liquids."
h. Linear Dimension Change: Plus or minus 2 percent; ASTM D 1204 "Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature."

2.02 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
1. Liquid-type auxiliary materials shall meet volatile organic compound (VOC) limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard unreinforced thermoplastic polyolefin sheet flashing, 55 mils thick, minimum, of same color as sheet membrane.

C. Bonding Adhesive: Manufacturer's standard VOC-compliant bonding adhesive for membrane, and manufacturer's standard bonding adhesive for base flashings.

D. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

E. Metal Battens: Manufacturer's standard aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.

F. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.

2.03 ROOF INSULATION

A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289 "Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board," Type II, felt or glass-fiber mat facer on both major surfaces.

1. Manufacturers:
    a. AlliedSignal Inc.; Commercial Roofing Systems.
    b. Apache Products Company.
    c. Atlas Roofing Corporation.
    d. Carlisle SynTec Incorporated.
    e. Celotex Corporation.
    f. Firestone Building Products Company.
    g. GAF Materials Corporation.
    h. GenFlex Roofing Systems.
    i. Hunter Panels, LLC.
    j. Johns Manville International, Inc.
    k. Koppers Industries.
    l. RMAX.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches, unless otherwise indicated.

D. Provide preformed drain sumps, saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.04 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

C. Cold Fluid-Applied Adhesive: Manufacturer's standard VOC-compliant cold fluid-applied adhesive formulated to adhere roof insulation to substrate.

D. Cover Board: ASTM C 1177, glass-mat, water-resistant gypsum substrate, 1/2 inch thick.

1. Product: Subject to compliance with requirements, provide "Dens-Deck" by Georgia-Pacific Corporation.

2.05 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick, and acceptable to membrane roofing system manufacturer.
   1. Color: Match membrane color.
      a. Do not provide "edge-warning" graphics.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
   1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   3. Verify that surface plane flatness and fastening of steel roof deck comply with requirements in Division 05 Section "Steel Decking."
   4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
   5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.03 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Mechanically Fastened and Adhered Insulation: Install each layer of insulation and secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
   1. Fasten first layer of insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
   2. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
   3. Install subsequent layers of insulation in a cold fluid-applied adhesive.

H. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Stagger joints from joints in insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck.
   1. Fasten according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
   2. Fasten to resist uplift pressure at corners, perimeter, and field of roof.

3.04 MECHANICALLY FASTENED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.
   1. Install sheet according to ASTM D 5082 "Standard Practice for Application of Mechanically Attached Poly(Vinyl Chloride) Sheet Roofing."

B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

C. Accurately align roofing membranes and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Mechanically or adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.

E. Apply roofing membrane with side laps shingled with slope of roof deck where possible.

F. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.
   1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.
   2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
   3. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.

G. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.
   1. In-Splice Attachment: Secure one edge of roofing membrane using fastening plates or metal battens centered within membrane splice and mechanically fasten roofing membrane to roof deck. Field-splice seam.
   2. Through-Membrane Attachment: Secure roofing membrane using fastening plates or metal battens and mechanically fasten roofing membrane to roof deck. Cover battens and fasteners with a continuous cover strip.

H. Install roofing membrane and auxiliary materials to tie in to existing roofing.

3.05 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply solvent-based bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with sheet flashing.

D. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings.

3.06 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.07 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
   1. Notify Architect and Owner 48 hours in advance of date and time of inspection.

B. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

3.08 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.09 CONSTRUCTION WASTE MANAGEMENT

A. Manage construction waste in accordance with provisions of Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 075400

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes:
1. Roof curbs.
2. Equipment supports.
3. Roof hatches.

B. Related Sections:
1. Division 05 Section "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
2. Division 06 Section "Miscellaneous Rough Carpentry" for roof sheathing, wood cants, and wood nailers.
3. Division 07 steep-slope roofing Sections for ridge vents.
4. Division 07 low-slope roofing Sections for roofing accessories.
5. Division 07 Section "Metal Roof Panels" for preformed metal roofing, ridge vents, and snow guards.
6. Division 07 Section "Sheet Metal Flashing and Trim" for shop- and field-fabricated metal flashing and counterflashing, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
7. Division 07 Section "Roof Specialties" for fascia, copings, and gravel stops.
8. Division 07 Section "Manufactured Roof Expansion Joints" for manufactured roof expansion-joint covers.
9. Division 08 Section "Unit Skylights" for small individual skylights.
10. Division 23 Section "HVAC Power Ventilators" for power roof-mounted ventilators.
11. Division 26 Sections for power supply and final connections for automatically operated heat and smoke vents.
12. Division 28 Section "Fire Detection and Alarm" for interconnects to automatically operated heat and smoke vents.

1.03 SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.

C. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.
3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.

1.04 QUALITY ASSURANCE

A. Sheet Metal Standard: Comply with Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)'s "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.07 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
   1. With Architect's approval, adjust location of roof accessories that would interrupt roof drainage routes.

PART 2 - PRODUCTS

2.01 METAL MATERIALS

A. Galvanized Steel Sheet: ASTM International (ASTM) A 653 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process," G90 coated and mill phosphatized for field painting.

B. Steel Shapes: ASTM A 36 "Standard Specification for Carbon Structural Steel," hot-dip galvanized to comply with ASTM A 123 "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products," unless otherwise indicated.

C. Steel Tube: ASTM A 500 "Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes," round tube, baked-enamel finished.

D. Galvanized Steel Tube: ASTM A 500, round tube, hot-dip galvanized to comply with ASTM A 123/A 123M.

E. Galvanized Steel Pipe: ASTM A 53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless."

2.02 MISCELLANEOUS MATERIALS

A. Cellulosic-Fiber Board Insulation: ASTM C 208 "Standard Specification for Cellulosic Fiber Insulating Board," Type II, Grade 1, 1 inch thick.

B. Wood Nailers: Softwood lumber, fire-retardant-treated; not less than 1-1/2 inches thick.

C. Bituminous Coating: Cold-applied asphalt mastic, Society for Protective Coatings (SSPC)-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

D. Felt: ASTM D 226 "Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing," Type II (No. 30), asphalt-saturated organic felt, nonperforated.
   1. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft.

E. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed

fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.

F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

G. Sealants: As specified in Division 07 Section "Joint Sealants."

H. Roofing Cement: ASTM D 4586 "Standard Specification for Asphalt Roof Cement, Asbestos-Free," fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.03 ROOF CURBS

A. Roof Curbs: Provide metal roof curbs, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Fabricate with welded or sealed mechanical corner joints, with stepped integral metal cant raised the thickness of roof insulation and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1. Manufacturers:
   a. Colony Custom Curbs.
   b. Commodity Products Company, Inc.
   c. Conn-Fab Sales, Inc.
   d. Curbs Plus Inc.
   e. Custom Curb, Inc.
   f. LM Curbs.
   g. Loren Cook Company.
   h. Metallic Products Corporation.
   i. Pate Company (The).
   j. Roof Products & Systems Corporation.
   k. Roof Products, Inc.
   l. Thaler Metal Industries Ltd.
   m. ThyCurb; Div. of Thybar Corporation.
   n. Uni-Curb, Inc.
   o. Vent Products Company, Inc.
2. Load Requirements: as indicated on Drawings.
3. Material: Galvanized steel sheet, thickness as required to support loads.
   a. Finish: Prime painted.
4. Liner: Same material as curb, of manufacturer's standard thickness and finish.
5. Factory install wood nailers at tops of curbs.
6. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
7. Factory insulate curbs with 1-1/2-inch- thick, cellulosic -fiber board insulation.
8. Curb height may be determined by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer. Fabricate units to minimum height of 12 inches, unless otherwise indicated.
9. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

2.04 EQUIPMENT SUPPORTS

A. Equipment Supports: Provide metal equipment supports, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Fabricate with welded or sealed mechanical corner joints, with stepped integral metal cant raised the thickness of roof insulation and integral formed mounting flange at perimeter

1. Manufacturers:
   a. Colony Custom Curbs.
   b. Commodity Products Company, Inc.
   c. Conn-Fab Sales, Inc.
   d. Curbs Plus Inc.
   e. Custom Curb, Inc.
   f. LM Curbs.
   g. Loren Cook Company.
   h. Metallic Products Corporation.
   i. Pate Company (The).
   j. Roof Products & Systems Corporation.
   k. Roof Products, Inc.
   l. Thaler Metal Industries Ltd.
   m. ThyCurb; Div. of Thybar Corporation.
   n. Uni-Curb, Inc.
   o. Vent Products Company, Inc.
2. Load Requirements: as indicated on Drawings.
3. Material: Galvanized steel sheet, thickness as required to support loads.
   a. Finish: Prime painted.
4. Factory-install continuous wood nailers 3-1/2 inches wide at tops of equipment supports.
5. Metal Counterflashing: Manufacturer's standard removable counterflashing, fabricated of same metal and finish as equipment support.
6. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
7. Fabricate units to minimum height of 12 inches, unless otherwise indicated.
8. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

2.05 ROOF HATCHES

A. Roof Hatches: Fabricate roof hatches with insulated double-wall lids and insulated double-wall curb frame with integral deck mounting flange and lid frame counterflashing. Fabricate with welded or mechanically fastened and sealed corner joints. Provide continuous weather-tight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware.
   1. Manufacturers:
      a. Babcock-Davis; a Cierra Products Inc. Company.
      b. Bilco Company (The).
      c. Bristolite Skylights.
      d. Dur-Red Products.
      e. Hi Pro International, Inc.
      f. J. L. Industries, Inc.
      g. Lane-Aire Manufacturing Corporation.
      h. Metallic Products Corporation.
      i. Milcor Inc.; a Gibraltar Company.
      j. Nystrom, Inc.
      k. O'Keeffe's Inc.
      l. Precision Ladders, LLC.
      m. Roof Products & Systems Corporation.
      n. Wasco Products, Inc.
      o. Western Canwell.
   2. Loads: Fabricate roof hatches to withstand 40-lbf/sq. ft. external and 20-lbf/sq. ft. internal loads.
   3. Type and Size: Single-leaf lid, 30 by 36 inches.

4. Curb and Lid Material: Galvanized steel sheet, 0.079 inch thick.
   a. Finish: Prime painted.
5. Insulation: Cellulosic-fiber board.
6. Interior Lid Liner: Manufacturer's standard metal liner of same material and finish as outer metal lid.
7. Exterior Curb Liner: Manufacturer's standard metal liner of same material and finish as metal curb.
8. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
9. Fabricate units to minimum height of 12 inches, unless otherwise indicated.
10. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate hatch curbs with height tapered to match slope to level tops of units.
11. Hardware: Galvanized steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.
    a. Provide 2-point latch on covers larger than 84 inches.
    b. Lift Assistance: Compression spring operators enclosed in telescopic tubes. Automatic hold-open arm with grip handle release.
12. Ladder Safety Post: Manufacturer's standard ladder safety post. Post to lock in place on full extension. Provide release mechanism to return post to closed position.
    a. Height: 42 inches above finished roof deck.
    b. Material and Finish: Steel tube, galvanized .
    c. Diameter: Pipe with 1-5/8-inch OD tube.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
   1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
   2. Verify dimensions of roof openings for roof accessories.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Install roof accessories to fit substrates and to result in watertight performance.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   1. Coat concealed side of roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
   3. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.

D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

E. Roof Curb Installation:
   1. Set roof curb so top surface of roof curb is level.

F. Equipment Support Installation:
   1. Set equipment support so top surface of equipment support is level.

G. Roof Hatch Installation:
   1. Check roof hatch for proper operation. Adjust operating mechanism as required. Clean and lubricate joints and hardware.
   2. Attach safety railing system to roof hatch curb.
   3. Attach ladder safety post according to manufacturer's written instructions.

H. Seal joints with elastomeric or butyl sealant as required by manufacturer of roof accessories.

3.03 TOUCH UP

A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Division 09 painting Sections.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.04 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

3.05 CONSTRUCTION WASTE MANAGEMENT

A. Manage construction waste in accordance with provisions of Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 077200

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

B. Related Sections include the following:
   1. Division 07 Section "Fire-Resistive Joint Systems."
   2. Division 21 Sections specifying fire-suppression piping penetrations.
   3. Division 22 and 23 Sections specifying duct and piping penetrations.
   4. Division 26, 27, and 28 Sections specifying cable and conduit penetrations.

1.02 PERFORMANCE REQUIREMENTS

A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM International (ASTM) E 814, "Standard Test Method for Fire Tests of Through-Penetration Fire Stops" or Underwriters Laboratory (UL) 1479 "Fire Tests of Through-Penetration Firestops:"
   1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
   2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
      a. Penetrations located outside wall cavities.
      b. Penetrations located outside fire-resistance-rated shaft enclosures.

C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
   1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
   2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
   3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84 "Standard Test Method for Surface Burning Characteristics of Building Materials."

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include

firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

C. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global (FMG) according to FMG 4991, "Approval of Firestop Contractors."

B. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Omega Point Laboratories (OPL), Intertek Testing Services (ITS), or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:
    a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
    b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:
        1) UL's "Fire Resistance Directory."
        2) OPL's "Directory of Listed Building Products, Materials, & Assemblies."
        3) ITS' "Directory of Listed Products."

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.07 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.

D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by Owner's inspecting agency and building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application in the Through-Penetration Firestop System Schedule that are produced by one of the following manufacturers:
1. A/D Fire Protection Systems Inc.
2. Grace, W. R. & Co. - Conn.
3. Hilti, Inc.
4. Johns Manville.
5. Nelson Firestop Products.
6. NUCO Inc.
7. RectorSeal Corporation (The).
8. Specified Technologies Inc.
9. 3M; Fire Protection Products Division.
10. Tremco; Sealant/Weatherproofing Division.
11. USG Corporation.

2.02 FIRESTOPPING, GENERAL

A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated.

2.03 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time,

and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:
   1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.03 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for firestop systems by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 IDENTIFICATION

A. Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the firestop systems so that

labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:

1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Through-penetration firestop system designation of applicable testing and inspecting agency.
4. Date of installation.
5. Through-penetration firestop system manufacturer's name.
6. Installer's name.

3.05 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified, independent inspecting agency to inspect through-penetration firestops. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.

B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

3.06 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.07 CONSTRUCTION WASTE MANAGEMENT

A. Manage construction waste in accordance with provisions of Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 078413

SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes fire-resistive joint systems for the following:
   1. Floor-to-floor joints.
   2. Floor-to-wall joints.
   3. Head-of-wall joints.
   4. Wall-to-wall joints.
   5. Perimeter fire-resistive joint systems consisting of floor-to-wall joints between perimeter edge of fire-resistance-rated floor assemblies and exterior curtain walls.

B. Related Sections:
   1. Division 01 Section "Sustainable Design Requirements" for additional Leadership in Energy & Environmental Design (LEED) requirements.
   2. Division 07 Section "Penetration Firestopping" for systems installed in openings in walls and floors with and without penetrating items.
   3. Division 07 Section "Joint Sealants" for non-fire-resistive joint sealants.

1.03 PERFORMANCE REQUIREMENTS

A. General: Determine required locations for and provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed.

B. Joint Systems in and between Fire-Resistance-Rated Constructions: Provide systems with assembly ratings equaling or exceeding the fire-resistance ratings of construction that they join, and with movement capabilities indicated as determined by Underwriters Laboratory (UL) 2079.
   1. Load-bearing capabilities as determined by evaluation during the time of test.

C. For fire-resistive systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM International (ASTM) E 84.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition and location in which joints are installed; also show relationships to adjoining construction. Include fire-resistive joint system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.
   1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for elements to be joined.
   2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular fire-resistive joint condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's

fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

C. Fire Resistive Joint System Schedule: Indicate locations of each fire resistive joint system, along with the following information:
   1. Types of construction joined, including fire-resistance ratings and, where applicable, thicknesses of construction materials and assemblies.
   2. Fire resistive joint systems for each location identified by design designation of qualified testing and inspecting agency.

D. LEED Submittals:
   1. Credit IEQ 4.1 - Low Emitting Materials - Adhesives and Sealants: Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standard.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors."

B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.

C. Source Limitations: Obtain fire-resistive joint systems, for each kind of joint and construction condition indicated, through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
   1. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for fire-resistive joint systems acceptable to authorities having jurisdiction.
   2. Fire-resistive joint systems are identical to those tested per methods indicated in Part 1 "Performance Requirements" Article and comply with the following:
      a. Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.
      b. Fire-resistive joint systems correspond to those indicated by referencing system designations of the qualified testing and inspecting agency.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

1.08 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Notify Owner's inspecting agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on days preceding each series of installations.

D. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector of authorities having jurisdiction have examined each installation.

PART 2 - PRODUCTS

2.01 GENERAL

A. Adhesives and Sealants applied on site within the weather proofing exterior in this section must comply with South Coast Air Quality Management District Rule 1168 OR Green Seal Standard GS-36. Refer to LEED Specification 01 81 13 for specific VOC requirements.

2.02 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the fire resistive joint systems indicated for each application in the Fire Resistive Joint System Schedule that are produced by one of the following manufacturers:
   1. A/D Fire Protection Systems Inc.
   2. Grace, W. R. & Co. - Conn.
   3. Hilti, Inc.
   4. Johns Manville.
   5. Nelson Firestop Products.
   6. NUCO Inc.
   7. RectorSeal Corporation (The).
   8. Specified Technologies Inc.
   9. 3M; Fire Protection Products Division.
   10. Tremco; Sealant/Weatherproofing Division.
   11. USG Corporation.

2.03 FIRE-RESISTIVE JOINT SYSTEMS

A. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.

B. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of work.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates or damaging adjoining surfaces.

3.03 INSTALLATION

A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.

B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
   2. Apply fill materials so they contact and adhere to substrates formed by joints.
   3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified independent inspecting agency to inspect fire-resistive joint systems and prepare inspection reports.

B. Testing Services: Inspecting of completed installations of fire-resistive joint systems shall take place in successive stages as installation of fire-resistive joint systems proceeds. Do not proceed with installation of joint systems for the next area until inspecting agency determines completed work shows compliance with requirements.
   1. Inspecting agency shall state in each report whether inspected fire-resistive joint systems comply with or deviate from requirements.

C. Remove and replace fire-resistive joint systems where inspections indicate that they do not comply with specified requirements.

D. Additional inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and fire-resistive joint systems comply with requirements.

3.05 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.06 CONSTRUCTION WASTE MANAGEMENT

A. Manage construction waste in accordance with provisions of Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 078446

SECTION 079 00 - JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section is general in nature. Sealants are specified for various applications that may or may not be encountered in the Work.
   1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:
      a. Construction joints in cast-in-place concrete.
      b. Joints between metal components.
      c. Joints between different materials listed above.
      d. Perimeter joints between materials listed above and frames of doors windows and louvers.
      e. Other joints as indicated.
   2. Exterior joints in the following horizontal traffic surfaces:
      a. Isolation and contraction joints in cast-in-place concrete slabs.
      b. Joints between different materials listed above.
      c. Other joints as indicated.
   3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
      a. Control and expansion joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints of exterior openings where indicated.
      c. Tile control and expansion joints.
      d. Vertical joints on exposed surfaces of walls and partitions.
      e. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
      f. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      g. Other joints as indicated.
   4. Interior joints in the following horizontal traffic surfaces:
      a. Isolation joints in cast-in-place concrete slabs.
      b. Control and expansion joints in tile flooring.
      c. Other joints as indicated.

B. Related Sections include the following:
   1. Division 01 Section "Sustainable Design Requirements" for additional Leadership in Energy & Environmental Design (LEED) requirements.
   2. Division 07 Section "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
   3. Division 08 Section "Glazing" for glazing sealants.

1.03 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.04 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. LEED Submittals:

1. Credit IEQ 4.1 - Low Emitting Materials - Adhesives and Sealants: Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standard.

E. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.

F. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

G. Field Test Report Log: For each elastomeric sealant application.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
1. Use manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than nine pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:
1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each application indicated below:
   a. Each type of elastomeric sealant and joint substrate indicated.
   b. Each type of nonelastomeric sealant and joint substrate indicated.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
   a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM International (ASTM) C 1193 "Standard Guide for Use of Joint Sealants."

1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

E. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.06 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.07 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Adhesives and Sealants applied on site within the weather proofing exterior in this section must comply with South Coast Air Quality Management District Rule 1168 OR Green Seal Standard GS-36. Refer to LEED Specification 01 81 13 for specific VOC requirements.

B. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range**.**

2.02 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 "Standard Specification for Elastomeric Joint Sealants," and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C 1248 "Standard Test Method for Staining of Porous Substrate by Joint Sealants," and have not stained porous joint substrates indicated for Project.

C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with United States Code of Federal Regulations 21 CFR 177.2600.

D. Single-Component Neutral- and Basic-Curing Silicone Sealant:
   1. Products:
      a. Dow Corning Corporation; 790.
      b. GE Silicones; SilPruf LM SCS2700.
      c. Tremco; Spectrem 1 (Basic).
   2. Type and Grade: S (single component) and NS (nonsag).
   3. Class: 100/50.
   4. Use Related to Exposure: NT (nontraffic).
   5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
   6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.
   7. Use for:
      a. Exterior vertical and horizontal nontraffic construction joints in cast-in-place concrete.
      b. Exterior butt joints between metal components.
      c. Exterior vertical joints between different materials listed above.

E. Single-Component Mildew-Resistant Acid-Curing Silicone Sealant :
   1. Products:
      a. Dow Corning Corporation; 786 Mildew Resistant.
      b. GE Silicones; Sanitary SCS1700.
      c. Tremco; Tremsil 200 Clear.
   2. Type and Grade: S (single component) and NS (nonsag).
   3. Class: 25.
   4. Use Related to Exposure: NT (nontraffic).
   5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.
   6. Use for:
      a. Interior joints between plumbing fixtures and adjoining walls, floors, and counters.
      b. Interior joints at intersections of tile wall surfaces.
      c. Interior joints between countertops and backsplashes and backsplashes and adjacent wall surfaces

F. Multicomponent Pourable Urethane Sealant:
   1. Products:
      a. Bostik Findley; Chem-Calk 550.
      b. Meadows, W. R., Inc.; POURTHANE.
      c. Pacific Polymers, Inc.; Elasto-Thane 227 High Shore Type I (Self Leveling).
      d. Pacific Polymers, Inc.; Elasto-Thane 227 Type I (Self Leveling).
      e. Pecora Corporation; Urexpan NR-200.
      f. Polymeric Systems Inc.; PSI-270SL.

g. Schnee-Morehead, Inc.; Permathane SM 7201.
h. Tremco; THC-901.
i. Tremco; THC-900.
j. Tremco; Vulkem 245.

2. Type and Grade: M (multicomponent) and P (pourable).
3. Class: 25 .
4. Use Related to Exposure: T (traffic).
5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.
6. Use for:
   a. Exterior horizontal nontraffic and traffic isolation and contraction joints in cast-in-place concrete slabs.
   b. Interior control, expansion, and isolation joints in horizontal traffic surfaces of concrete flooring.

G. Single-Component Nonsag Urethane Sealant :
1. Products:
   a. Sika Corporation, Inc.; Sikaflex - 1a.
   b. Sonneborn, Division of ChemRex Inc.; Ultra.
   c. Sonneborn, Division of ChemRex Inc.; NP 1.
   d. Tremco; Vulkem 116.
2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.
6. Use for: Metal panel seams, metal flashings and reglet joints.

H. Single-Component Pourable Urethane Sealant :
1. Products:
   a. Bostik Findley; Chem-Calk 950.
   b. Pecora Corporation; Urexpan NR-201.
   c. Polymeric Systems Inc.; Flexiprene 952.
   d. Schnee-Morehead, Inc.; Permathane SM7101.
   e. Tremco; Tremflex S/L.
   f. Tremco; Vulkem 45.
2. Type and Grade: S (single component) and P (pourable).
3. Class: 25.
4. Use Related to Exposure: T (traffic).
5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.
6. Use for: Interior ceramic tile expansion, control, contraction, and isolation joints in horizontal traffic surfaces.

2.03 SOLVENT-RELEASE JOINT SEALANTS

A. Butyl-Rubber-Based Solvent-Release Joint Sealant : Comply with ASTM C 1311 "Standard Specification for Solvent Release Sealants."
1. Products:
   a. Bostik, Inc.; Chem-Calk 300.
   b. Pecora Corporation; BC-158.
   c. Tremco Incorporated; Tremco Butyl Sealant.
2. Use for:
   a. Concealed joints in exterior sheet metal work.
   b. Under exterior door thresholds.

2.04 LATEX JOINT SEALANTS

A. Latex Sealant: Comply with ASTM C 834 "Standard Specification for Latex Sealants," Type P, Grade NF.

B. Products:
1. Bostik Findley; Chem-Calk 600.
2. Pecora Corporation; AC-20+.
3. Schnee-Morehead, Inc.; SM 8200.
4. Sonneborn, Division of ChemRex Inc.; Sonolac.
5. Tremco; Tremflex 834.

C. Use for:
1. Vertical control and expansion joints on exposed interior surfaces of exterior walls.
2. Interior perimeter joints of exterior openings.
3. Vertical joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
4. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.

2.05 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints : Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:
1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90 "Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements."
2. Products:
a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
b. Grabber Construction Products; Acoustical Sealant GSC.
c. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
e. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
3. Use for: Joints for acoustical partitions.

2.06 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330 "Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants," Type C (closed-cell material with a surface skin), O (open-cell material), B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.07 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 "Standard Practice for Use of Sealants in Acoustical Applications," for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Install bond-breaker tape behind sealants where space available is inadequate for cylindrical sealant backings.

F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.04 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
   1. Extent of Testing: Test completed elastomeric sealant joints as follows:
      a. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.
   2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab in Appendix X1 in ASTM C 1193, as appropriate for type of joint-sealant application indicated.
      a. For joints with dissimilar substrates, verify adhesion to each substrate separately; do this by extending cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
   3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
   4. Inspect tested joints and report on the following:
      a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
      b. Whether sealants filled joint cavities and are free of voids.
      c. Whether sealant dimensions and configurations comply with specified requirements.

5. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
6. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.05 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.06 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.07 CONSTRUCTION WASTE MANAGEMENT

A. Manage construction waste in accordance with provisions of Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 079200

SECTION 081113 - CUSTOM HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes:
   1. Custom hollow metal doors and frames.

B. Related Sections:
   1. Division 01 Section "Sustainable Design Requirements" for additional Leadership in Energy & Environmental Design (LEED) requirements.
   2. Division 08 Section "Flush Wood Doors" for wood doors using hollow metal frames.
   3. Division 08 Section "Door Hardware" for door hardware for hollow metal doors.
   4. Division 08 Section "Glazing" for glazing materials used in hollow metal doors.
   5. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
   6. Division 26 Sections for electrical connections including conduit and wiring for door controls and operators.

1.03 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Custom Hollow Metal Work: Hollow metal work fabricated according to American National Standards Institute (ANSI)/National Association of Architectural Metal Manufacturers (NAAMM)/Hollow Metal Manufacturers Association (HMMA) 861.

1.04 SUBMITTALS

A. Submit Product Data, Shop Drawings, and Schedules for Custom Hollow Metal Doors and Frames concurrently with submittals for Division 08 door Sections and Division 08 Section "Door Hardware."

B. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.

C. Shop Drawings: Include the following:
   1. Elevations of each door design.
   2. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   3. Locations of reinforcement and preparations for hardware.
   4. Details of each different wall opening condition.
   5. Details of anchorages, joints, field splices, and connections.
   6. Details of accessories.
   7. Details of moldings, removable stops, and glazing.
   8. Details of conduit and preparations for power, signal, and control systems.

D. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

E. LEED Submittals:
   1. Credit MR 5 - Regional Materials: For each type of product indicated, product data or other published information verifying the location of manufacturing facility including

name, address, and distance between manufacturing facility and the project site. Provide manufacturer's documentation indicating location where the base materials were extracted, mined, quarried, harvested, etc. and the distance between this location and the project site. Also include material costs (excluding costs of installation).

2. Credit IEQ 4.2 - Low Emitting Materials - Paints and Coatings: For each type of product indicated, submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standards.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Fire-Rated Door Assemblies: Assemblies complying with National Fire Protection Association (NFPA) 80 "Standard for Fire Doors and Other Opening Protectives," that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 "Standard Methods of Fire Tests of Door Assemblies," or Underwriter's Laboratory (UL) 10C "Positive Pressure Fire Tests of Door Assemblies."

C. Preinstallation Conference: Conduct conference at Project site.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
1. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Do not store in a manner that traps excess humidity.
1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.
1. Where filed measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating custom steel frames without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.08 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 GENERAL

A. Building materials in this section must be extracted, harvested, or recovered, and manufactured and assembled within five hundred (500) miles of the jobsite.

B. Use interior paints and coatings that comply with Green Seal Standard GS-11 "Paints and Coatings," summarized by the VOC content limits specified in Division 01 Section "Sustainable Design Requirements."

2.02 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Curries Company; an Assa Abloy Group company.
   2. Gateway Metal Products, Inc.
   3. Rocky Mountain Metals, Inc.
   4. Southwest Hollow Metal.
   5. West Central Manufacturing.

2.03 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM International (ASTM) A 1008 "Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable," Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011 "Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength," Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process," Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

D. Frame Anchors: ASTM A 879 "Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface, Commercial Steel (CS)," 40Z coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008 or ASTM A 1011, hot-dip galvanized according to ASTM A 153, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153.

F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

G. Grout: ASTM C 476 "Standard Specification for Grout for Masonry," except with a maximum slump of 4 inches, as measured according to ASTM C 143 "Standard Test Method for Slump of Hydraulic-Cement Concrete."

H. Mineral-Fiber Insulation: ASTM C 665 "Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing," Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 "Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C," for combustion characteristics.

I. Glazing: Comply with requirements in Division 08 Section "Glazing."

J. Bituminous Coating: Cold-applied asphalt mastic, Society for Protective Coatings (SSPC)-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.04 CUSTOM HOLLOW METAL DOORS

A. General: Provide doors not less than 1-3/4 inches thick, of seamless hollow construction unless otherwise indicated. Construct doors with smooth surfaces without visible joints or seams on exposed faces. Comply with ANSI/NAAMM-HMMA 861 "Guide Specifications for Commercial Hollow Metal Doors and Frames."

B. Exterior Door Face Sheets: Fabricated from metallic-coated steel sheet, minimum 0.053 inch thick.

C. Interior Door Face Sheets: Fabricated from cold-rolled steel sheet minimum 0.042 inch thick.

D. Core Construction: Provide thermal-resistance-rated cores for exterior doors.
   1. Steel-Stiffened Core: 0.026-inch- thick, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart, spot welded to face sheets a maximum of 5 inches o.c. Spaces filled between stiffeners with glass- or mineral-fiber insulation.
      a. Fire Door Core: As required to provide fire-protectionratings indicated.
      b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 4.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363 "Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus."

E. Vertical Edges for Single-Acting Doors: Beveled 1/8 inch in 2 inches.

F. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch radius.

G. Top and Bottom Channels: Closed with continuous channels, minimum 0.053 inch thick, of same material as face sheets and spot welded to both face sheets.

H. Hardware Reinforcement: Fabricate according to ANSI/NAAMM-HMMA 861 with reinforcing plates from same material as door face sheets.

2.05 CUSTOM HOLLOW METAL FRAMES

A. General: Fabricate frames of construction indicated. Close contact edges of corner joints tight with faces mitered and stops butted or mitered. Continuously weld faces and soffits and finish faces smooth. Comply with ANSI/NAAMM-HMMA 861.
   1. Door Frames for Openings 48 Inches Wide or Less: Fabricated from 0.053-inch- thick steel sheet.
   2. Door Frames for Openings More Than 48 Inches Wide: Fabricated from 0.067-inch-thick steel sheet.
   3. Sidelight and Transom Frames: Fabricated from same thickness material as adjacent door frame.
   4. Borrowed-Light Frames: Fabricated from 0.053-inch- thick steel sheet.

B. Exterior Frames: Formed from metallic-coated steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet.

D. Hardware Reinforcement: Fabricate according to ANSI/NAAMM-HMMA 861 with reinforcing plates from same material as frame.

E. Head Reinforcement: Provide minimum 0.093-inch- thick, steel channel or angle stiffener for opening widths more than 48 inches.

2.06 FRAME ANCHORS

A. Jamb Anchors:
   1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
   1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.07 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.08 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- wide steel.

C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.09 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/NAAMM-HMMA 861.

C. Hollow Metal Doors:
   1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
   2. Glazed Lites: Factory cut openings in doors.
   3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
   2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
   3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
   5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
   6. Jamb Anchors: Provide number and spacing of anchors as follows:
      a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
         1) Two anchors per jamb up to 60 inches high.
         2) Three anchors per jamb from 60 to 90 inches high.
         3) Four anchors per jamb from 90 to 120 inches high.

4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
1) Three anchors per jamb up to 60 inches high.
2) Four anchors per jamb from 60 to 90 inches high.
3) Five anchors per jamb from 90 to 96 inches high.
4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.

c. Compression Type: Not less than two anchors in each jamb.
d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/NAAMM-HMMA 861.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/Steel Door Institute (SDI) A250.6 "Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames," and ANSI/Door and Hardware Institute (DHI) A115 Series "Installation Guide Hardware Preparation" specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.10 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
   1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with HMMA 840 "Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames."
   1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. At fire-protection-rated openings, install frames according to NFPA 80.
      b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
      c. Install frames with removable glazing stops located on secure side of opening.
      d. Install door silencers in frames before grouting.
      e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
      f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
      g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
   2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Fire-rated Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
5. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Steel Doors:
   a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
   b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
   c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
   d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.04 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

3.05 CONSTRUCTION WASTE MANAGEMENT

A. Manage construction waste in accordance with provisions of Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Solid-core doors medium-density-overlay faces - Paint Grade.
   2. Sound Control Door Assemblies - for Studio.
   3. Shop priming.

B. Related Sections:
   1. Division 08 Section "Glazing" for glass view panels in flush wood doors.
   2. Division 09 Sections “Hollow Metal Doors and Frames”.

1.3 SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction louvers, and trim for openings. Include factory-finishing specifications.

B. LEED Submittals:
   1. Credit MR 7 - Certified Wood:
      a. Forest Stewardship Council (FSC): Provide letter of certification signed by lumber supplier. Indicate compliance with FSC "Principles for Natural Forest Management" and identify certifying organization.
         1) Submit FSC certification numbers; identify each certified product on a line-item basis.
         2) Submit copies of invoices bearing the FSC certification numbers and verification of if the product is “FSC Pure,” “FSC Mixed Sources,” or “FSC Mixed XX%.”
   2. Credit IEQ 4.4 - Low Emitting Materials - Composite Wood and Agrifiber Products: For each type of product indicated, including associated laminating adhesive if applicable, submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standard.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
   1. Indicate dimensions and locations of mortises and holes for hardware.
   2. Indicate dimensions and locations of cutouts.
   3. Indicate doors to be factory finished and finish requirements.
   4. Indicate fire-protection ratings for fire-rated doors.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Source Limitations: Obtain flush wood doors from single manufacturer.

C. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated.""Architectural Wood Flush Doors."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect doors during transit, storage, and handling to prevent damage, soiling and deteration. Doors are to be shipped from the manufacturer in individual polypags, and shall be inspected immediately upon arrival at jobsite for any damage of defects.

B. Identify each door with individual opening numbers that correlate with designations system used on shop drawings and contract drawings for door, frames and hardware. Use only temporary, removable or concealed markings.

C. Do not deliver or install doors until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy level in storage and installation areas during the remainder of the construction period.

1.6 WARRANTY

A. Warranties shall be in addition to, and not a limitation of other rights the Owner may have under the contract documents.

B. Submit written warranty on manufacturer’s standard form signed by the manufacturer agreeing to replace or repair defective doors which have:
1. Delimitation in any degree.
2. Warp or twist of ¼ inch or more in any 3’x 6” x7’ plane of door face.
3. Telegraphing of stile, rail or core through face to cause surface variations in excess of 1/100 inch in any 3inch span.
4. Any defect which may, in any way, impair or affect performance of the door for the purpose which it is intended.
5. Contractor shall replace or refinish doors where contractor’s work contributed to rejection or voiding of manufacturer’s warranty.
6. Solid core interior doors shall be warranted for the life of their installation.

PART 2 - PRODUCTS

2.1 GENERAL

A. Recycled Content (MRc4): Building materials in this section must have post and or pre-consumer recycled content by weight of total product.

B. Certified Wood (MRc7): Building materials in this section must be FSC certified.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Algoma Hardwoods, Inc.
   2. Eggers Industries.
   3. Marshfield Door Systems, Inc.
   4. Oshkosh Architectural Door Company.
   5. VT Industries Inc.

2.3 DOOR CONSTRUCTION, GENERAL

A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

B. WDMA I.S.1-A Performance Grade:
   1. Heavy Duty unless otherwise indicated.

C. Particleboard-Core Doors:
   1. Particleboard: ANSI A208.1, Grade LD-1 or Grade LD-2 made with binder containing no urea-formaldehyde resin.
   2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
   3. Provide doors with either glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

2.4 DOORS FOR PAINT FINISH

A. Interior Solid-Core Doors
   1. Core: Particleboard.
   2. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before priming and painting.

2.5 SOUND-CONTROL ASSEMBLIES

A. Solid-core Wood Doors: Flush design, 2-1/4 inches (44 mm) thick.
   1. Grade, faces, veneer matching, fabrication, and finishing to match Division 08 Section "Flush Wood Doors."

B. Sound-control panels to match door construction.

C. Steel Frames: Full-welded unit construction.

D. Door Hardware: Sound-control system, including head and jamb seals, door bottoms, cam-lift hinges, and thresholds:
   1. Seals: Appropriate seals are as follows (alternatives from Pemko or Reese are acceptable also):
      a. Head and Jamb: Zero International (Bronx NY) Model 475 or 485
      b. Door Bottom: Zero Model 369 or 364
      c. Astragal: Zero Model 155/55
   2. Door Bottoms: Automatic.

E. Wood Finishes: Paint to match adjacent wall.

2.6 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
   1. Comply with requirements in NFPA 80 for fire-rated doors.
   2. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
   3. Factory machine doors for hardware that is not surface applied.
   4. Openings: Cut and trim openings through doors in factory.
      a. Trim openings with moldings of material and profile indicated.
   5. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."
   6. Louvers: Factory install louvers in prepared openings.

PART 3 - EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Section 017419-Construction Waste Management and Disposal.

3.2 EXAMINATION

A. Examine doors and installed door frames before hanging doors.
   1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Hardware: For installation, see Division 08 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
   1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.4 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 08 36 13 - SECTIONAL DOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes electrically operated sectional overhead doors.
   1. Division 05 Section "Metal Fabrications" for miscellaneous steel supports.
   2. Division 08 Section "Door Hardware" for lock cylinders and keying.
   3. Division 26 Sections for electrical service and connections for powered operators and accessories.

1.03 DEFINITIONS

A. Operation Cycle: One cycle of a door is complete when it is moved from the closed position to the fully open position and returned to the closed position.

1.04 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide sectional overhead doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
   1. Air Infiltration: Maximum rate not more than indicated when tested according to ASTM International (ASTM) E 283 "Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen."
      a. Maximum Rate: 0.08 cfm at 15 mph.

B. Operation-Cycle Requirements: Provide sectional overhead door components and operators capable of operating for not less than 10,000 cycles.

1.05 SUBMITTALS

A. Product Data: For each type and size of sectional overhead door and accessory. Include the following:
   1. Summary of forces and loads on walls and jambs.
   2. Motors: Show nameplate data and ratings, characteristics, and mounting arrangements.

B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's product data.

C. Samples: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Frame: 6 inches long.
   2. Panel: 6 inches square.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain sectional overhead doors through one source from a single manufacturer.
   1. Obtain operators and controls from sectional overhead door manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of sectional overhead doors and accessories and are based on the specific system indicated. Other manufacturers' systems with equal performance and dimensional characteristics may be considered. Refer to Division 01 Section "Product Requirements."

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in National Fire Protection Association (NFPA) 70 "National Electrical Code," Article 100.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Aluminum Doors with Glazed Panels:
      a. Clopay Building Products Company; a Griffon Company.
      b. Haas Door; a Nofziger Company.
      c. Martin Door Manufacturing.
      d. Overhead Door Corp.
      e. Raynor.
      f. Windsor Door; a MAGNATRAX Corporation.

2.02 ALUMINUM DOOR SECTIONS

A. Construct door sections with extruded-aluminum shapes, complying with ASTM B 221 "Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes," alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, with wall thickness not less than 0.065 inch for door section 1-3/4 inches deep. Fabricate sections with stile and rail dimensions and profiles shown. Join stiles and rails by welding or with concealed, 1/4-inch- minimum diameter, aluminum or nonmagnetic stainless-steel through bolts, full height of door section. Form meeting rails to provide a weathertight-seal joint. Provide reinforcement for hardware attachment.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611 "Voluntary Specification for Anodized Architectural Aluminum."

2.03 TRACKS, SUPPORTS, AND ACCESSORIES

A. Tracks: Manufacturer's standard, galvanized steel track system, sized for door size and weight, designed for lift type indicated and clearances shown, and complying with ASTM A 653 for minimum G60 zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track spaced at 2 inches apart for door-drop safety device. Slope tracks at proper angle from vertical or design to ensure tight closure at jambs when door unit is closed. Weld or bolt to track supports.
   1. Provide tracks configured for the following lift types:
      a. Low headroom.

B. Track Reinforcement and Supports: Galvanized steel track reinforcement and support members, complying with ASTM A 36 "Standard Specification for Carbon Structural Steel," and ASTM A 123 " "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products." Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.

1. Support and attach tracks to opening jambs with continuous angle welded to tracks and attached to wall. Support horizontal (ceiling) tracks with continuous angle welded to track and supported by laterally braced attachments to overhead structural members at curve and end of tracks.
    a. Repair galvanized coating on tracks according to ASTM A 780 "Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings."

C. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of overhead door.
1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.
2. Provide continuous flexible seals at door jambs for a weathertight installation.

D. Full-Vision Panels: Manufacturer's standard, tubular, aluminum-framed section fully glazed with 6-mm-thick, clear acrylic glazing set in vinyl, rubber, or neoprene glazing channel and with removable extruded-vinyl or aluminum stops.

2.04 HARDWARE

A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.

B. Hinges: Heavy-duty galvanized steel hinges of not less than 0.0747-inch- thick, uncoated steel at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges where required, for doors exceeding 16 feet in width, unless otherwise recommended by door manufacturer.

C. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch- diameter roller tires for 3-inch- wide track and 2-inch-diameter roller tires for 2-inch- wide track.
1. Tire Material: Case-hardened steel.

D. Push/Pull Handles: For push-up-operated or emergency-operated doors, provide galvanized steel lifting handles on each side of door.

E. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.
1. Locking Bars: Full-disc cremone type, both jamb sides operable from inside and outside.
2. Lock cylinder is specified in Division 08 Section "Door Hardware."

F. If door unit is power operated, provide safety interlock switch to disengage power supply when door is locked.

2.05 COUNTERBALANCE MECHANISM

A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from oil-tempered-steel wire complying with ASTM A 229 "Standard Specification for Steel Wire, Oil-Tempered for Mechanical Springs," Class II, mounted on a cross-header tube or steel shaft. Connect to door with galvanized aircraft-type lift cables with cable safety factor of at least 5 to 1. Provide springs calibrated for a minimum of 10,000 cycles.

B. Cable Drums: Cast-aluminum or gray-iron casting cable drums grooved to receive cable. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of shaft. Provide one additional midpoint bracket for shafts up to 16 feet long and two additional brackets at one-third points to support shafts more than 16 feet long unless closer spacing is recommended by door manufacturer.

C. Cable Safety Device: Include a spring-loaded, steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either cable breaks.

D. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level shaft and prevent sag.

E. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

2.06 ELECTRIC DOOR OPERATORS

A. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycle requirements specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

B. Comply with NFPA 70.

C. Disconnect Device: Hand-operated disconnect device or mechanism for automatically engaging chain-and-sprocket operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount disconnect device and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

D. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.

E. Provide control equipment complying with National Electrical Manufacturers Association Industrial Control and Systems (NEMA ICS) 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70, Class 2 control circuit, maximum 24-V, ac or dc.

F. Door-Operator Type: Unit consisting of electric motor and the following:
   1. Trolley or drawbar type, with V-belt primary drive, chain-and-sprocket secondary drive, and quick release for manual operation.

G. Electric Motors: High-starting torque, reversible, continuous-duty, Class A insulated, electric motors complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate door in either direction from any position, at not less than 2/3 fps and not more than 1 fps, without exceeding nameplate ratings or service factor.
   1. Type: Polyphase, medium-induction type.
   2. Service Factor: Comply with NEMA MG 1, unless otherwise indicated.
   3. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
   4. Provide open dripproof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.
   5. Provide totally enclosed, nonventilated or fan-cooled motor, fitted with plugged drain, and controller with NEMA ICS 6, Type 4 enclosure where indicated.

H. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
   1. Provide full-guarded, surface-mounted, heavy-duty-type interior unit with general-purpose, NEMA ICS 6, Type 1 enclosure.

I. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of sensor immediately stops and reverses downward door travel.
   1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
      a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained pressure on close button.

2. Pressure-Sensor Edge: Provide each motorized door with an automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward door travel. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
   a. Provide electrically actuated automatic bottom bar.
      1) Self-Monitoring Type: Four-wire configured device.

J. Limit Switches: Adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install door, track, and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.

B. Fasten vertical track assembly to framing, spaced not less than 24 inches apart. Hang horizontal track from structural overhead framing with angle or channel hangers fastened to framing by welding or bolting or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

3.02 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup services.
1. Complete installation and startup checks according to manufacturer's written instructions.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.03 ADJUSTING

A. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and with weathertight fit around entire perimeter.

B. Adjust belt-driven motors as follows:
1. Use adjustable motor-mounting bases for belt-driven motors.
2. Align pulleys and install belts.
3. Tension belt according to manufacturer's written instructions.

C. Touch-up Painting: Immediately after welding galvanized track to track supports, clean field welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional overhead doors. Refer to Division 01 Section "Demonstration and Training."

3.05 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 083613

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Agreement and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Exterior and interior storefront framing.
   2. Storefront framing for window walls.
   3. Interior light shelf.
   4. Exterior and interior manual-swing entrance doors and door-frame units.

B. Related Sections:
   1. Division 08 Section "Automatic Entrances."
   2. Division 08 Section "Door Hardware" for entrance door hardware.
   3. Division 08 Section "Glazing," for glass to be installed in system.

1.3 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
   1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
   2. Dimensional tolerances of building frame and other adjacent construction.
   3. Failure includes the following:
      a. Deflection exceeding specified limits.
      b. Thermal stresses transferring to building structure.
      c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
      d. Glazing-to-glazing contact.
      e. Noise or vibration created by wind and by thermal and structural movements.
      f. Loosening or weakening of fasteners, attachments, and other components.
      g. Sealant failure.
      h. Failure of operating units.

B. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.

D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
1. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
2. Test Durations: 10 seconds.

E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft.of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft.

F. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

G. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 53 when tested according to AAMA 1503.

H. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor for the assembly of not more than 0.30 Btu/sq. ft. x h x deg Fwhen tested according to AAMA 1503.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.

B. Sustainability Submittal:
1. Product Data: For adhesives and sealants used inside of the weatherproofing system, including printed statement of VOC content.
2. Recycled Content (MRc4):
   a. Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).
   b. Include information on Material Tracking Worksheets.

C. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

F. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

G. Other Action Submittals:
1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

H. Delegated-Design Submittal: For aluminum-framed systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Detail fabrication and assembly of aluminum-framed systems.
2. Include design calculations.

I. Field quality-control reports.

J. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

K. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

C. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

D. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

E. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

F. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

G. Preinstallation Conference: Conduct conference at Project site .

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration caused by thermal movements.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. Adhesive or cohesive sealant failures.
      e. Water leakage through fixed glazing and framing areas.
      f. Failure of operating components.
   2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.
   1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Exterior System Basis-of-Design Product: Subject to compliance with requirements, provide series 403 2” x 4 1⁄2” Thermal Storefront Framing wall by EFCO Corporation or comparable product by one of the following:
   1. Arcadia, Inc.
   2. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.
   3. YKK AP America Inc.
   4. Kawneer North America; an Alcoa company

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Sheet and Plate: ASTM B 209.
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
   3. Extruded Structural Pipe and Tubes: ASTM B 429.
   4. Structural Profiles: ASTM B 308/B 308M.
   5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
   6. Minimum 50% total recycled content for aluminum products

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
   1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   1. Construction:
      a. Interior: Non thermal
      b. Exterior: Thermal
   2. Glazing System: Retained mechanically with gaskets on four sides.
   3. Glazing Plane: As indicated.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   2. Reinforce members as required to receive fastener threads.

D. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

E. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.
   1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 GLAZING SYSTEMS

A. Provide interior Glazed Assemblies as indicated on drawings.

B. Glazing: As specified in Division 08 Section "Glazing."

C. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

D. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

E. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

F. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:
   1. Structural Sealant: ASTM C 1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.
      a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
      b. Color: As selected by Architect from manufacturer's full range of colors.
   2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.

a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
b. Color: Matching structural sealant.

2.5 LIGHT SHELF

A. Product: "E-Lite" by EFCO Corporation, or comparable product by listed manufacturers.
1. Supporting Extrusions:
a. Minimum wall thickness: 0.063”.
2. Receiver Extrusions
a. Minimum wall thickness: 0.125”.
3. Struts:
a. Minimum wall thickness: 0.094”.
4. Shading Device:
a. Horizontal components mechanically fastened by means of aluminum sheets.

2.6 ENTRANCE DOOR SYSTEMS (DA. 02)

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
1. Door Construction: Thickness to match storefront system, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
2. Door Design: As indicated.
a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.
3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
a. Provide nonremovable glazing stops on outside of door.

B. Entrance Door Hardware: As specified in Division 08 Section "Door Hardware."

2.7 ENTRANCE DOOR HARDWARE

A. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section.

B. Weather Stripping: Manufacturer's standard replaceable components.
1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
2. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

C. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

D. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

2.8 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants."
   1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil thickness per coat.

2.9 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends coped or mitered.
   3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
   4. Physical and thermal isolation of glazing from framing members.
   5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   6. Provisions for field replacement of glazing from exterior. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Storefront Framing: Fabricate components for assembly using shear-block system.

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
   1. At exterior doors, provide compression weather stripping at fixed stops.
   2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
   1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
   2. At exterior doors, provide weather sweeps applied to door bottoms.

H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:
   1. Comply with manufacturer's written instructions.
   2. Do not install damaged components.
   3. Fit joints to produce hairline joints free of burrs and distortion.
   4. Rigidly secure nonmovement joints.
   5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
   6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:
   1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
   2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing as specified in Division 08 Section "Glazing."

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
   1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
   2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

3.3 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:
   1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
   2. Alignment:
      a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.

b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.4 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

END OF SECTION 084113

SECTION 084229 - AUTOMATIC ENTRANCES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Exterior and interior, sliding, power-operated automatic entrances.

B. Related Sections:
   1. Division 08 Section "Door Hardware" for locking devices.
   2. Division 26 Sections for electrical connections including conduit and wiring for automatic entrance operators.

1.03 DEFINITIONS

A. AAADM: American Association of Automatic Door Manufacturers.

B. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to open the door.

C. IBC: International Building Code.

D. Safety Device: Device that, to avoid injury, prevents a door from opening or closing.

E. For automatic door terminology, refer to American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA) A156.10 "Standard for Power Operated Pedestrian Doors," and ANSI/BHMA A156.19 "Standard for Power Assist And Low Energy Power Operated Doors," for definitions of terms.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design automatic entrances, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Automatic entrances shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to Structural Engineering Institute (SEI)/American Society of Civil Engineers (ASCE) 7.
   1. Wind Loads: As indicated on Drawings.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Operating Temperature Range: Provide automatic entrances that operate within minus 20 to plus 122 deg F.

E. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 1.25 cfm/sq. ft. of fixed entrance system area when tested according to ASTM E 283 "Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen," at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.

F. Opening-Force Requirements:

1. Power-Operated Doors: Not more than 50 lbf required to manually set door in motion if power fails, and not more than 15 lbf required to open door to minimum required width.
2. Breakaway Device for Power-Operated Doors: Not more than 50 lbf required for a breakaway door or panel to open.

G. Entrapment Force Requirements:
1. Power-Operated Sliding Doors: Not more than 30 lbf required to prevent stopped door from closing.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic entrances. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For automatic entrances. Include plans, elevations, sections, details, hardware mounting heights, and attachments to other work.
1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Wiring Diagrams: For power, signal, and control wiring.
3. Activation and safety devices.
4. Include hardware schedule and indicate hardware types, functions, quantities, and locations.

C. Samples: For each type of exposed finish required, in manufacturer's standard sizes.

D. Delegated-Design Submittal: For automatic entrances indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Design Calculations: Calculate requirements for seismic restraints.

E. Maintenance Data: For automatic entrances, safety devices, and control systems to include in maintenance manuals.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer with company certificate issued by AAADM.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project .
1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

C. Certified Inspector Qualifications: Certified by AAADM.

D. Source Limitations for Automatic Entrances: Obtain automatic entrances from single source from single manufacturer.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Power-Operated Door Standard: BHMA A156.10.

G. Power-Assist and Low-Energy Door Standard: BHMA A156.19.

H. Emergency-Exit Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrances serving as a required means of egress.

I. Preinstallation Conference: Conduct conference at Project site .
1. Review methods and procedures related to automatic entrances including, but not limited to, the following:

a. Structural load limitations.
b. Construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
c. Coordination with electrical, glazing, and other trades.
d. Required testing, inspecting, and certifying procedures.

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings to receive automatic entrances by field measurements before fabrication.

1.08 COORDINATION

A. Templates: Obtain templates for doors, frames, and other work specified to be factory prepared for installing automatic entrances, and distribute to parties involved. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic entrances to comply with indicated requirements.

B. Coordinate hardware with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish. Coordinate hardware for automatic entrances with hardware required for rest of Project.

C. Electrical System Roughing-in: Coordinate layout and installation of automatic entrances with connections to power supplies.

1.09 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of automatic entrances that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Structural failures including, but not limited to, excessive deflection.
b. Faulty operation of operators, controls, and hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
2. Warranty Period: Two years from date of Substantial Completion.

1.10 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of automatic entrance Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper automatic entrance operation at rated speed and capacity. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.
1. Engage a certified inspector to perform safety inspection after each adjustment or repair and at end of maintenance period. Furnish completed inspection reports to Owner.
2. Perform maintenance, including emergency callback service, during normal working hours.
3. Include 24-hour-per-day, 7-day-per-week, emergency callback service.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 "Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes."

2. Sheet and Plate: ASTM B 209 "Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate."

B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with Society for Protective Coatings (SSPC)-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
1. Structural Shapes, Plates, and Bars: ASTM A 36 "Standard Specification for Carbon Structural Steel ."
2. Cold-Rolled Sheet and Strip: ASTM A 1008 "Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable ."
3. Hot-Rolled Sheet and Strip: ASTM A 1011 "Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength ."

C. Glazing: As specified in Division 08 Section "Glazing."

D. Sealants and Joint Fillers: As specified in Division 07 Section "Joint Sealants."

E. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout; complying with ASTM C 1107 "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink);" of consistency suitable for application.

F. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos; formulated for 30-mil thickness per coat.

G. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.02 SLIDING AUTOMATIC ENTRANCES

A. General: Provide manufacturer's standard automatic entrances including doors[**, sidelites**], framing, headers, carrier assemblies, roller tracks, door operators, activation and safety devices, and accessories required for a complete installation.

B. Sliding Automatic Entrance:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Biparting-Sliding Units:
1) Besam Automated Entrance Systems, Inc.; an ASSA ABLOY Group company.
2) DORMA Automatics; Div. of DORMA Group North America.
3) Gildor, Inc.
4) Horton Automatics; Div. of Overhead Door Corporation.
5) KM Systems, Inc.
6) Nabco Entrances Inc.
7) Sierra Automatic Doors, Inc.
8) Stanley Access Technologies; Div. of The Stanley Works.
9) Tormax Technologies, Inc.

2. Configuration: Biparting-sliding doors, with two sliding leaves and sidelites on each side.
a. Traffic Pattern: 2 way.
b. Emergency Breakaway Capability: [Sliding leaves only.
c. Mounting: Surface.

3. Operator Features:
a. Power opening and closing.
b. Drive System: Chain or belt.
c. Adjustable opening and closing speeds.

d. Adjustable hold-open time between 0 and 30 seconds.
e. Obstruction recycle.
f. On-off/hold-open switch to control electric power to operator.
g. Energy-conservation switch that reduces door-opening width.

4. Sliding Door Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered, ball-bearing-center steel wheels operating on a continuous roller track, or ball-bearing-center steel wheels operating on a nylon- or delrin-covered, continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly.
   a. Rollers: Minimum of two ball-bearing roller wheels and two antirise rollers for each active leaf.
5. Sliding Door Threshold: Manufacturer's standard threshold members and bottom-guide track system, with stainless-steel, ball-bearing-center roller wheels.
6. Combination Activation and Safety Device: Combination motion/presence sensor.
7. Activation Device: Motion sensor mounted on each side of door header to detect pedestrians in activating zone and to open door.
8. Safety Devices: Two photoelectric beams mounted in sidelite jambs to detect pedestrians in presence zone and to prevent door from closing.
9. Finish: Finish framing, doors and header with Class I, clear anodic finish.

2.03 ENTRANCE COMPONENTS

A. Framing Members: Manufacturer's standard extruded aluminum, minimum 0.125 inch thick and reinforced as required to support imposed loads.
   1. Nominal Size: **2 by 4-1/2 inches**.
   2. Extruded Glazing Stops and Applied Trim: Minimum 0.062-inch wall thickness.

B. Stile and Rail Doors: Manufacturer's standard 1-3/4-inch- thick, glazed doors with minimum 0.125-inch- thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie-rods that span full length of top and bottom rails.
   1. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and manufacturer's standard preformed gaskets.
   2. Stile + Rail Design: Match swinging entrance doors.

C. Headers: Fabricated from minimum 0.125-inch- thick, extruded aluminum and extending full width of automatic entrance units to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
   1. Mounting: Surface mounted.
   2. Capacity: Capable of supporting doors up to 175 lb per leaf over spans up to 14 feet without intermediate supports.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Signage: Affixed to both sides of each door as required by BHMA A156.10 and BHMA A156.19 for type of door and its operation.
   1. Application Process: Door manufacturer's standard process.
   2. Provide sign materials with instructions for field application after glazing is installed.

2.04 DOOR OPERATORS AND ACTIVATION AND SAFETY DEVICES

A. Door Operators: Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.

1. Door Operator Performance: Provide door operators that will open and close doors and maintain them in fully closed position when subjected to Project's design wind loads.
2. Electromechanical Operators: Concealed, self-contained, overhead unit powered by fractional-horsepower, permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor; with solid-state microprocessor controller; UL 325; and with manual operation with power off.

B. Motion Sensors: Self-contained, K-band-frequency, microwave-scanner units with metal or plastic housing; adjustable to provide detection field sizes and functions required by BHMA A156.10; with relay hold time of not less than 2 to 10 seconds.
1. Provide capability for switching between bidirectional and unidirectional detection.
2. For one-way-traffic entrances, sensor on egress side shall not be active when doors are fully closed.

C. Presence Sensors: Self-contained, infrared-scanner units with metal or plastic housing; adjustable to provide detection field sizes and functions required by BHMA A156.10; with relay hold time of not less than 2 to 10 seconds. Sensors shall remain active at all times.

D. Photoelectric Beams: Pulsed infrared, sender-receiver assembly for recessed mounting. Beams shall not be active when doors are fully closed.

E. Push-Plate Switch: Momentary-contact door control switch with flat push-plate actuator.
1. Configuration: Rectangular push plate with 2-by-4-inch junction box.
   a. Mounting: Recess mounted, semiflush in wall.
2. Push-Plate Material: Plastic as selected by Architect from manufacturer's full range.

F. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

G. Opening-Width Control: Two-position switch that in the normal position allows sliding doors to travel to full opening width and in the alternate position reduces opening to a selected partial opening width.

2.05 HARDWARE

A. General: Provide units in sizes and types recommended by automatic entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish.

B. Manual Opening for Power-Operated Swinging Doors: Provide hardware that in a power failure allows door to open with a manual force not to exceed 30 lbf according to BHMA A156.10.

C. Breakaway Device for Power-Operated Doors: Provide breakaway device that allows door to swing out in direction of egress to full 90 degrees from any operating position. Maximum force to open door shall be 50 lbf according to BHMA A156.10. Interrupt powered operation of door operator while in breakaway mode.

D. Weather Stripping: Manufacturer's standard replaceable components.
1. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
2. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
3. Weather Sweeps: Manufacturer's standard nylon brush sweep mounted to underside of door bottom.

2.06 FABRICATION

A. General: Factory fabricate automatic entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.
1. Form aluminum shapes before finishing.

2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
3. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match framing.
   a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
   b. Reinforce members as required to receive fastener threads.
4. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.

B. Framing: Provide automatic entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.
1. Fabricate tubular and channel frame assemblies with manufacturer's standard welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support required loads.
2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
3. Form profiles that are sharp, straight, and free of defects or deformations.
4. Provide components with concealed fasteners and anchor and connection devices.
5. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
6. Fabricate exterior components to drain water passing joints and condensation and moisture occurring or migrating within system to the exterior.
7. Provide anchorage and alignment brackets for concealed support of assembly from building structure.
8. Allow for thermal expansion of exterior units.

C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.

D. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.

E. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA's "Glazing Manual."

F. Hardware: Factory install hardware to greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.
1. Provide sliding-type weather stripping, mortised into door, at perimeter of doors.
2. Provide compression-type weather stripping at fixed stops of exterior doors. At locations without fixed stops, provide sliding-type weather stripping retained in adjustable strip mortised into door edge.
3. Provide weather sweeps mounted to underside of door bottoms of exterior doors.

G. Activation and Safety Devices:
1. General: Factory install devices in doors and headers as required by BHMA A156.10 for type of door and direction of travel.
2. Install photoelectric beams in sides of guide rails, with dimension above finished floor not less than 24 inches.

2.07 GENERAL FINISH REQUIREMENTS

A. Comply with National Association of Architectural Metal Manufacturers (NAAMM)'s "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.08 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
   1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
   2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
   1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
   2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
   3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior.
   4. Level recesses for recessed thresholds using nonshrink grout.

C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 26 Sections.

D. Activation and Safety Devices: Install and adjust devices to provide detection field and functions indicated.

E. Glazing: Install glazing as specified in Division 08 Section "Glazing."

F. Sealants: Comply with requirements specified in Division 07 Section "Joint Sealants" to provide weathertight installation.
   1. Set framing members and flashings in full sealant bed.
   2. Seal perimeter of framing members with sealant.

G. Signage: Apply signage on both sides of each door as required by referenced door standards.

H. Wiring within Automatic Entrance Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's written limitations on bending radii. Provide and use lacing bars and distribution spools.

3.03 ADJUSTING

A. Adjust door operators, controls, and hardware for smooth and safe operation and for weathertight closure; comply with requirements in BHMA A156.10 and BHMA A156.19.

B. Lubricate operating hardware and other moving parts as recommended by manufacturer.

C. Readjust door operators and controls after repeated operation of completed installation equivalent to 3 days' use by normal traffic (100 to 300 cycles). Lubricate hardware, operating equipment, and other moving parts.

D. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to 2 visits to Project during other-than-normal occupancy hours for this purpose.

3.04 CLEANING AND PROTECTION

A. Clean glass and metal surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.
   1. Comply with requirements in Division 08 Section "Glazing" for cleaning and maintaining glass.

3.05 DEMONSTRATION

A. Engage a certified inspector to train Owner's maintenance personnel to adjust, operate, and maintain automatic entrances.

3.06 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Construction waste shall be managed in accordance with provisions of Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 084229

SECTION 084513 - STRUCTURED-POLYCARBONATE-PANEL ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes aluminum-framed assemblies glazed with structured-polycarbonate panels as follows:
   1. Wall assemblies.
   2. Roof assemblies.

B. Related Sections:
   1. Division 05 Section “Structural Steel Framing” for Structural Steel.
   2. Division 07 Section “Roof Specialties” for Manufactured Coping, Roof Edge Flashing and Drainage Systems.
   3. Division 08 Section "Fiberglass-Sandwich-Panel Assemblies" for translucent fiberglass-sandwich-panel assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Structured-polycarbonate-panel assemblies shall withstand the effects of the following forces without failure due to defective manufacture, fabrication, installation, or other defects in construction:
   1. Structural loads.
   2. Thermal movements.
   3. Movements of supporting structure.
   4. Dimensional tolerances of building frame and other adjacent construction.
   5. Failure includes, but is not limited to, the following:
      a. Deflection exceeding specified limits.
      b. Water leakage.
      c. Thermal stresses transferred to building structure.
      d. Noise or vibration created by wind, thermal, or structural movements.
      e. Loosening or weakening of fasteners, attachments, and other components.

B. Structural Loads:
   1. Seismic Loads: As indicated on Drawings Wind Loads: As indicated on Drawings**.**

C. Deflection Limits:
   1. Vertical Panel Assemblies: Limited to 1/100 of clear span for each assembly component.
   2. Overhead Panel Assemblies: Limited to 1/180 of clear span for each assembly component.

D. Structural-Test Performance: Provide panel assemblies tested according to ASTM E 330, as follows:
   1. When tested at positive and negative wind-load design pressures, assemblies do not show evidence of deflection exceeding specified limits.
   2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not show evidence of material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
   3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Windborne-Debris-Impact-Resistance Performance: As required by IBC.

F. Water Penetration under Static Pressure: Provide panel assemblies that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
   1. Maximum Water Leakage: According to AAMA 501.1 and No uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water that is controlled by flashing and gutters and drained to the exterior, or water that cannot damage adjacent materials or finishes.

G. Roof-Covering Classification: Class B per ASTM E 108 or UL 790.

H. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

I. Energy Performance: Provide panel assemblies with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. Thermal Transmittance (U-Factor): Fixed glazing and framing areas shall have U-factor of not more than 0.65 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
   2. Solar-Heat-Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.6 as determined according to NFRC 200.
   3. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum components of panel assemblies.

B. LEED Submittals:
   1. Product Data for Credit EQ 4.1: For sealants used inside the weatherproofing system, documentation including printed statement of VOC content and chemical components.

C. Shop Drawings: For panel assemblies. Include plans, elevations, sections, details, and attachments to other work.
   1. Include details of provisions for assembly expansion and contraction and for draining moisture within the assembly to the exterior.
   2. Preconstruction Testing Shop Drawings: Prepared by a qualified preconstruction testing agency, showing details of laboratory mockup.
      a. Resubmit Shop Drawings with changes made to details of laboratory mockup to successfully complete preconstruction testing.

D. Samples: For each type of exposed finish required, in manufacturer's standard sizes.

E. Fabrication Samples: Of each framing system intersection and adjacent panels, made from 12-inch lengths of full-size framing members and showing details of the following:
   1. Joinery.
   2. Anchorage.
   3. Expansion provisions.
   4. Structured-polycarbonate panels.

5. Flashing and drainage.
6. Sloped roof to Wall Connection

F. Delegated-Design Submittal: For panel assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

G. Maintenance Data: For panel assemblies to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of panel assemblies required for this Project.

B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

C. Product Options: Information on Drawings and in Specifications establishes requirements for panel assemblies' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including testing conducted by an independent testing agency and in-service performance.
1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Preconstruction Testing: Provide panel assemblies that comply with test-performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard panel assemblies] [based on Project-specific preconstruction testing by a qualified independent testing agency.
1. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on laboratory mockups of panel assemblies.
2. Build laboratory mockups at testing agency facility; use personnel, materials, and methods of construction that will be used at Project site.
3. Notify Architect 7 days in advance of the dates and times when laboratory mockups will be tested.
4. Preconstruction Testing Sequence: Test laboratory mockups according to AAMA 501, using the following sequence of tests:
    a. Structural-performance preloading at one-half of the specified maximum test load (ASTM E 330).
    b. Air infiltration (ASTM E 283).
    c. Water penetration under static pressure (ASTM E 331).
    d. Water penetration under dynamic pressure (AAMA 501.1).
    e. Structural performance at design load (ASTM E 330).
    f. Repeat air filtration (ASTM E 283).
    g. Repeat water penetration under static pressure (ASTM E 331).
    h. Structural performance at specified maximum test load (ASTM E 330).

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
1. Build mockup of typical panel assemblies as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Preinstallation Conference: Conduct conference at Project site.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of panel assemblies that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Deterioration of metal finishes and other materials beyond normal weathering.
      c. Water leakage.
   2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Structured-Polycarbonate-Panel Warranty: Manufacturer's standard form in which manufacturer agrees to replace panels that exhibit defects in materials or workmanship..
   1. Defects include, but are not limited to, the following:
      a. Delamination.
      b. Color changes exceeding requirements.
      c. Losses in light transmission beyond 6 percent from original when measured per ASTM D 1003.
      d. Thermal aging - the light transmission and the color shall not change after exposure to heat of 300 degrees F for 25 minutes when measured per ASTM D-1003 and ASTM D-2244 respectively.
   2. Warranty Period: 10 years from date of Substantial Completion.

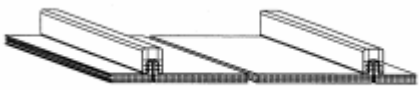
C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
   1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
   2. Warranty Period: 10years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements of Basis of design: CPI Daylighting refer to schedule below for description, provide equal products by one of the following:
   1. CO-EX Corp.
   2. CPI Daylighting, Inc.
   3. EXTECH/Exterior Technologies Inc.

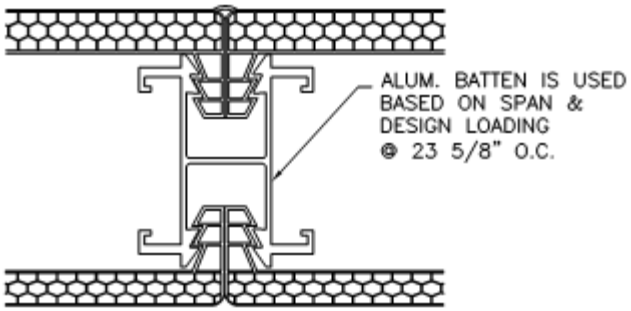
B. Schedule:
   1. 8.06 SINGLE LAYER POLYCARBONATE ON LIGHT GAUGE MTL FRAMING:
      a. Pentaglas, 12mm Single Panel System
      b. For Interior to Interior conditions.
      c. UV Protection: NOT REQUIRED.
      d. Color:
      e. Cross Section: Nano-Cell Honeycomb, hexagon cells, 3 cells thick.
      f. Attached to metal stud framing as indicated on drawings.



   2. 8.04 SINGLE LAYER POLYCARBONATE CURTAIN WALL SYSTEM

a. Pentaglas, 12mm Single Panel System:
b. For Interior to Exterior Conditions.
c. UV Protection Co-extruded both sides
d. Color:
e. Cross Section: Nano-Cell Honeycomb, hexagon cells, 3 cells thick.
f. Attached to metal stud framing as indicated on drawings.

3. 8.05 DOUBLE LAYER POLYCARBONATE CURTAIN WALL SYSTEM
   a. Pentaglas 10 mm, 2.75" Quadwall, Double Panel, Alum. Batten System
   b. For Interior to Exterior Conditions.
   c. UV Protection Co-extruded exterior face
   d. Color:
   e. Cross Section: Nano-Cell Honeycomb, hexagon cells, (2) 3 cells thick
   f. Flush without Vertical Mullions



2.2 ALUMINUM FRAMING SYSTEMS

A. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.
   1. Construction: Thermally broken, extruded aluminum.

B. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
   1. Sheet and Plate: ASTM B 209.
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
   3. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
   4. Structural Profiles: ASTM B 308/B 308M.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.

D. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding fasteners and accessories; compatible with adjacent materials.
   1. At closures, retaining caps, or battens, use ASTM A 193/A 193M, 300 series stainless-steel screws.

2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.

E. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

F. Anchor Bolts: ASTM A 307, Grade A, galvanized steel.

G. Concealed Flashing: Corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

H. Exposed Flashing and Closures: Aluminum sheet not less than 0.040 inch thick, finished to match framing.

I. Framing Gaskets: Manufacturer's standard gasket system with low-friction surface treatment designed specifically for retaining structured-polycarbonate panels.

J. Framing Sealants: As recommended in writing by manufacturer.
1. Provide sealants for use inside the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

K. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STRUCTURED-POLYCARBONATE PANELS

A. Description: Translucent, extruded-polycarbonate sheet with cellular cross section that provides isolated airspaces and that is coextruded with a UV-protective layer.
1. Plastic Self-Ignition Temperature: 650 deg F or more per ASTM D 1929.
2. Smoke-Developed Index: 450 or less per ASTM E 84, or 75 or less per ASTM D 2843.
3. Flame-Spread Index: Not more than 25 per ASTM E 84.
4. Combustibility Classification: Class CC1per ASTM D 635.
5. Interior Finish Classification: Class B per ASTM E 84.
6. Color Change: Not more than 3.0 units Delta E when measured according to ASTM D 2244 after outdoor weathering compliant with procedures in ASTM D 1435.
    a. Outdoor Weathering Conditions: 60 months in Arizona or 120 months in a moderate North American climate.
7. Impact Resistance: No failure at impact of 200 ft. x lbf according to freefalling-ball impact test using a 3-1/2-inch- diameter, 6.3-lb ball.

B. Panel Thickness: Refer to schedule.

C. Panel Color: Refer to schedule

2.4 FABRICATION

A. Fabricate aluminum components before finishing.

B. Fabricate aluminum components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.

3. Internal guttering systems or other means to drain water passing through joints, condensation occurring within components, and moisture migrating within assembly to exterior.

C. Fabricate aluminum sill closures with weep holes and for installation as continuous component.

D. Reinforce aluminum components as required to receive fastener threads.

2.5 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:
1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and immobilization of moving joints.
6. Seal joints watertight unless otherwise indicated.

B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with corrosion-resistant coating or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.

C. Install continuous aluminum sill closures with weatherproof expansion joints and locked and sealed corners. Locate weep holes at rafters.

D. Install components to drain water passing through joints, condensation occurring within aluminum members, and moisture migrating within assembly to exterior.

E. Install components plumb and true in alignment with established lines and elevations.

F. Erection Tolerances: Install panel assemblies to comply with the following maximum tolerances:
1. Alignment: Limit offset from true alignment to 1/32 inch where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches; otherwise, limit offset to 1/8 inch.
2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet, but no greater than 1/2 inch over total length.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
   1. Water-Spray Test: Before installation of interior finishes has begun, panel assemblies shall be tested according to AAMA 501.2 and shall not show evidence of water penetration.
   2. Water Penetration under Static Pressure: Before installation of interior finishes has begun, areas shall be tested according to ASTM E 1105.
      a. Test Procedures: Test under uniform and cyclic static-air pressure.

B. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

END OF SECTION 084513

SECTION 086200 - TUBULAR SKYLIGHTS (ADDITIVE ALTERNATE)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Tubular skylights with integral curbs.
   2. Glazing: Polycarbonate clear dome.

B. Related Sections:
   1. Division 06 Section “Miscellaneous Rough Carpentry" for wood framing and blocking at unit skylights.
   2. Division 07 Section "Sheet Metal Flashing and Trim" for flashing at unit skylights.
   3. Division 26 Sections for electrical service and connections for motor operators, controls, limit switches, and other powered devices and for system disconnect switches for unit skylight operating system.

1.3 PERFORMANCE REQUIREMENTS

A. AAMA/WDMA Performance Requirements: Provide unit skylights of performance class and grade indicated that comply with AAMA/WDMA 101/I.S.2/NAFS
   1. Performance Class and Grade: Performance Class and Grade: SKG-C30/30-1200x1200.

B. Windborne-Debris-Impact-Resistance Performance: Provide unit skylights that pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 or AAMA 506
   1. Large-Missile Impact: For unit skylights located within 30 feet of grade.

1.4 SUBMITTALS

A. Product Data: For each type of unit skylight indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for unit skylights.

B. LEED Submittals
   1. Glazing properties:
      a. U-value winter
      b. U-value summer
      c. Exterior reflectance
      d. Solar heat gain coefficient
      e. Visible Light Transmittance

C. Shop Drawings: For tubular skylight work. Include plans, elevations, sections, details, and connections to supporting structure and other adjoining work.

D. Samples for Initial Selection: For tubular skylights with factory-applied color finishes.

E. Samples for Verification: For each type of exposed finish required, in a representative section of each unit skylight in manufacturer's standard size.

F. Product Schedule: For tubular skylights.

G. Qualification Data: For qualified Installer and manufacturer.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type and size of tubular skylight.

I. Field quality-control reports.

J. Maintenance Data: For tubular skylights to include in maintenance manuals.

K. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating unit skylights that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

B. Installer Qualifications: An installer acceptable to unit skylight manufacturer for installation of units required for this Project.

C. Source Limitations: Obtain tubular skylights from single source from single manufacturer.

D. Surface-Burning Characteristics of Plastic Glazing: Provide plastic glazing sheets identical to those tested for fire-exposure behavior per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Self-Ignition Temperature: 650 deg F or more for plastic sheets in thickness indicated when tested per ASTM D 1929.
   2. Smoke-Production Characteristics: Comply with either requirement below:
      a. Smoke-Developed Index: 450 or less when tested per ASTM E 84 on plastic sheets in manner indicated for use.
      b. Smoke Density: 75 or less when tested per ASTM D 2843 on plastic sheets in thickness indicated for use.
   3. Burning Characteristics: Tested per ASTM D 635.
      a. Acrylic Glazing: Class CC2, burning rate of 2-1/2 inches per minute or less for nominal thickness of 0.060 inch or thickness indicated for use.
      b. Polycarbonate Glazing: Class CC1, burning extent of 1 inch or less for nominal thickness of 0.060 inch or thickness indicated for use.
      c. Polycarbonate-Insulating-Panel Glazing: Class CC2, burning rate of 2-1/2 inches per minute or less for nominal thickness of 0.060 inch or thickness indicated for use.

E. Unit Skylight Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for minimum standards of performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
   1. Provide AAMA-certified tubular skylights with an attached label.

F. Pre installation Conference: Conduct conference at Project site

1.6 COORDINATION

A. Coordinate tubular skylight flashing requirements with roofing system.

B. Coordinate sizes and locations of prefabricated curbs with actual tubular skylights provided.

C. Provide anchors and inserts to be placed in adjacent construction in proper sequence so as not to delay the Work.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of unit skylights that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Uncontrolled water leakage.
      b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      c. Yellowing of acrylic glazing.
      d. Breakage of polycarbonate glazing.
      e. Deterioration of insulating-glass hermetic seal.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
   1. Manufacturer: Solatube International, Inc., 2210 Oak Ridge Way, Vista, CA 92081-8341.
   2. Series: SolaMaster 330.
   3. Dome: DS.
   4. Flashings: Self Mounted, 11 inch height.
   5. Extension Tubes: Spectralight Infinity.
   6. Diffuser: OptiView Diffuser.

2.2 TUBULAR SKYLIGHTS

A. General: Factory-assembled units that include glazing, aluminum flashing that are capable of withstanding design loads indicated.

B. Unit Shape and Size: Circular, 21 inch Diameter.

C. Polycarbonate Glazing: Thermoformable, extruded monolithic sheets, UV resistant, burglar resistance rated per UL 972, and with average impact strength of diameter. 12 to 16 ft-lb/in. Single-Glazing Color: Clear. of width when tested per ASTM D 256, Test Method A (Izod).
   1. Single- Glazing Color: Clear.

D. U-Value: Maximum 0.60.

E. Aluminum Components: Not less than the strength and durability of alloy 6063-T52, alloy and temper to suit forming operations and finish requirements but with not less than the strength and durability of alloy 3005-H25.

F. Fasteners: Same metal as metal being fastened, nonmagnetic stainless steel, or other noncorrosive metal as recommended by manufacturer. Finish exposed fasteners to match material being fastened.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with tubular skylight installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate installation of tubular skylight with installation of substrates, vapor retarders, roof insulation, roofing membrane, and flashing as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight.
   1. Unless otherwise indicated, install tubular skylights according to construction details of
   2. NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Comply with recommendations in AAMA 1607 and with manufacturer's written instructions for installing tubular skylights.

C. Install tubular skylights level, plumb, and true to line, without distortion.

D. Anchor tubular skylights securely to supporting substrates.

E. Where metal surfaces of tubular skylights will contact incompatible metal or corrosive substrates, including preservative-treated wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation recommended in writing by tubular skylight manufacturer.

F. Set tubular skylight flanges in thick bed of roofing cement to form a seal unless otherwise indicated.

G. Where cap flashing is indicated, install to produce waterproof overlap with roofing or roof flashing. Seal with thick bead of mastic sealant except where overlap is indicated to be left open for ventilation.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. After completion of installation and nominal curing of sealant and glazing compounds but before installation of interior finishes, test for water leaks according to AAMA 501.2.

C. Perform test for total area of each tubular skylight.

D. Work will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.4 CLEANING

A. Clean exposed tubular skylight surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes.

B. Remove excess sealants, glazing materials, dirt, and other substances.

C. Remove and replace glazing that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect tubular skylight surfaces from contact with contaminating substances resulting from construction operations.

E. Tubular Skylight Operating System: Clean and lubricate joints and hardware. Adjust for proper operation.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain unit skylight operating system.

3.6 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 086200

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

   a. Commercial door hardware for the following:

      a. Swinging doors.
      b. Non-fire-rated sliding doors.
      c. Non-fire-rated folding doors.
      d. Other doors to the extent indicated.

   b. Cylinders for doors specified in other Sections.
   c. Electrified door hardware.

B. Related Sections include the following:

   a. Division 08 Section "Hollow Metal Doors and Frames"
   b. Division 08 Section "Flush Wood Doors" for integral intumescent seals provided as part of fire-rated labeled assemblies.
   c. Division 08 Section "Aluminum-Framed Entrances and Storefronts" for entrance door hardware.

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

   a. Pivots/Hinges, thresholds, and weather stripping specified in other Sections.

1.3 SUBMITTALS

A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Verification: For exposed door hardware of each type, in specified finish, full size. Tag with full description for coordination with the door hardware sets. Submit Samples before, or concurrent with, submission of the final door hardware sets.

a. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

C. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware schedule.

D. Warranty: Special warranty specified in this Section.

E. Other Action Submittals:

a. Door Hardware Sets: Prepared by or under the supervision of Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

a. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
b. Content: Include the following information:
1) Identification number, location, hand, fire rating, and material of each door and frame.
2) Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
3) Complete designations of every item required for each door or opening including name and manufacturer.
4) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
5) Explanation of abbreviations, symbols, and codes contained in schedule.
6) Mounting locations for door hardware.
7) Door and frame sizes and materials.
c. Submittal Sequence: Submit initial draft of final schedule along with essential Product Data to facilitate the fabrication of other work that is critical in Project construction schedule. Submit the final door hardware sets after Samples, Product Data, coordination with Shop Drawings of other work, delivery schedules, and similar information has been completed and accepted.
d. Keying Schedule: Include the following information:
1) Identification number and location.
2) Explanation of abbreviations, symbols, and codes contained in schedule.

1.4 QUALITY ASSURANCE

A. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

a. Electrified Door Hardware Consultant Qualifications: A qualified Architectural Hardware Consultant who is experienced in providing consulting services for electrified door hardware installations.

B. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

D. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." In addition to Owner**,** Contractor, and Architect, conference participants shall also include Architectural Hardware Consultant and Owner's security consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

a. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
b. Review sequence of operation for each type of electrified door hardware.
c. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.

1.6 COORDINATION

A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

a. Failures include, but are not limited to, the following:
   a. Faulty operation of operators and door hardware.
   b. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

b. Warranty Period: One (1) years from date of Substantial Completion, except as follows:
   a. Lock and Latch Sets: Ten (10) years mechanical, Two (2) years electronic integral components.
   b. Exit Devices: Ten (10) years mechanical, Two (2) years electronic integral components and accessories.
   c. Manual Closers: Twenty-Five (25) years.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in door and frame schedule and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:

a. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.

C. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   a. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified in Part 3 “Door Hardware Sets” Article.”

2.2 HINGES, GENERAL

A. Quantity: Provide the following, unless otherwise indicated:

a. Three Hinges: For doors with heights 61 to 90 inches.
b. Four Hinges: For doors with heights 91 to 120 inches.
c. For doors with heights more than 120 inches (provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

C. Hinge Weight: Unless otherwise indicated, provide the following:

a. Entrance Doors: Heavy-weight hinges.
b. Interior Doors: Standard-weight ball bearing hinges.

D. Hinge Base Metal: Unless otherwise indicated, provide the following:

a. Exterior Hinges: Stainless steel, with stainless-steel pin.
b. Interior Hinges: Steel, with steel pin
c. Hinges for Fire-Rated Assemblies: Steel, with steel pin.

E. Hinge Options: Where indicated in door hardware sets or on Drawings:

a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for exterior doors and interior out-swinging doors with locksets.

F. Fasteners: Comply with the following:

a. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
b. Wood Screws: For wood doors and frames.
c. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
d. Screws: Phillips flat-head; Finish screw heads to match surface of hinges.

2.3 HINGES

A. Butts and Hinges: BHMA A156.1.

B. Template Hinge Dimensions: BHMA A156.7.

C. Manufacturers: As list in Part 3 “Door Hardware Sets.”

2.4 CONTINUOUS HINGES

A. Standard: BHMA A156.26.

a. Listed under Category N in BHMA's "Certified Product Directory."

B. General: Minimum 0.120-inch- thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

a. Fire Pins: Steel pins to hold labeled fire doors in place if required by tested listing.

C. Continuous, Barrel-Type Hinges: Hinge with knuckles formed around a pin that extends entire length of hinge.

D. Manufacturers: As list in Part 3 “Door Hardware Sets.”

2.5 LOCKS AND LATCHES, GENERAL

A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG), ANSI A117.1

B. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf .

C. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

D. Lock Trim:
a. Lockset Designs: If sets are provided by another manufacturer, provide designs that match those designated.

E. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
a. Mortise Locks: Minimum 3/4-inch latchbolt throw.

F. Backset: 2-3/4 inches, unless otherwise indicated.

G. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set.

2.6 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:

a. Cylindrical Locks: BHMA A156.2.

B. Cylindrical Locks: Stamped steel case with steel or brass parts; BHMA A156.2**,** Grade 1; Series 4000.

C. Manufacturers: As list in Part 3 “Door Hardware Sets.”

2.7 DOOR BOLTS

A. Bolt Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

a. Mortise Flush Bolts: Minimum 1 ½" throw.

B. Dustproof Strikes: BHMA A156.16**,** Grade 1.

C. Manual Flush Bolts: BHMA A156.16**,** Grade 1 designed for mortising into door edge.

2.8 EXIT DEVICES

A. Exit Devices: BHMA A156.3**,** Grade 1

B. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

a. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf .

C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

E. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

F. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

a. Operation: Rigid.

G. Outside Trim: Lever with cylinder**;** material and finish to match locksets, unless otherwise indicated.

a. Match design for locksets and latchsets, unless otherwise indicated.

H. Through Bolts: For exit devices and trim on non-fire-rated wood doors and fire-rated wood doors.

I. Manufacturer: As list in Part 3 "Door Hardware Sets."

2.9 LOCK CYLINDERS

A. Standard Lock Cylinders: BHMA A156.5**,** Grade 1

B. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

a. Number of Pins: Seven
b. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
c. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.

C. Construction Keying: Comply with the following:

a. Construction Master Keys: Provide cylinders temporary, keyed alike. Provide 10 construction master keys.

D. Manufacturer: Same manufacturer as for locks and latches.

2.10 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference, and as follows:

B. Keys: Nickel silver.

a. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

1. Notation: Do Not Duplicate

b. Quantity:

1. Construction Master Keys – 10 each.

2. Construction Control Keys – 2 each

3. Grand and/or Master keys – 10 each

4. Keys per lock – 2 each

2.11 OPERATING TRIM

A. Standard: BHMA A156.6.

B. Materials: Fabricate from brass, bronze or stainless steel, unless otherwise indicated.

C. Manufacturers: As list in Part 3 “Door Hardware Sets.”

2.12 ACCESSORIES FOR PAIRS OF DOORS

A. Carry-Open Bars: Provide carry-open bars for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.

a. Material: Polished brass or bronze, with strike plate.

B. Manufacturers: As list in Part 3 “Door Hardware Sets.”

2.13 CLOSERS

A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." ANSI A117.1.

a. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.

C. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

D. Surface Closers: BHMA A156.**,** Grade 1 Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.

E. Coordinators: BHMA A156.3.

F. Manufacturers: As list in Part 3 “Door Hardware Sets.”

2.14 PROTECTIVE TRIM UNITS

A. Size: 2 inches less than door width on push side and 1 inch less than door width on pull side, by height specified in door hardware sets.

B. Fasteners: Manufacturer's standard machine or self-tapping screws.

C. Metal Protective Trim Units: BHMA A156.6; beveled top and 2 sides; fabricated from the following material:

a. Material: 0.050-inch- thick stainless steel.

b. Manufacturers:

a. As list in Part 3 “Door Hardware Sets.”

2.15 STOPS AND HOLDERS

A. Stops and Bumpers: BHMA A156.16**,** Grade 1.

a. Provide floor stops for doors unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.

B. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch; fabricated for drilled-in application to frame.

C. Manufacturers: As list in Part 3 “Door Hardware Sets.”

2.16 DOOR GASKETING

A. Standard: BHMA A156.22.

B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

a. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
b. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
c. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

C. Air Leakage: Not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

D. Fire-Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

E. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

F. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

G. Gasketing Materials: ASTM D 2000 and AAMA 701/702.

H. Manufacturers: As list in Part 3 “Door Hardware Sets.”

2.17 THRESHOLDS

A. Standard: BHMA A156.21.

B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." ANSI A117.1.

a. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.

C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch high.

D. Manufacturers: As list in Part 3 “Door Hardware Sets.”

2.18 FOLDING DOOR HARDWARE

A. General: BHMA A156.14; consisting of complete sets including rails, hangers, supports, bumpers, floor guides, and accessories indicated.

a. Exterior Door Hardware: Galvanized steel or anodized aluminum.

B. Horizontal Sliding Door Hardware: Grade 1;

C. Manufacturers: As list in Part 3 “Door Hardware Sets.”

2.19 MISCELLANEOUS DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.1.

B. Manufacturers: As list in Part 3 “Door Hardware Sets.”

2.20 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

a. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to

commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

a. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
b. Steel Machine or Wood Screws: For the following fire-rated applications:

    a. Mortise hinges to doors.
    b. Strike plates to frames.
    c. Closers to doors and frames.

c. Steel Through Bolts: For the following fire-rated applications unless door blocking is provided:

    a. Surface hinges to doors.
    b. Closers to doors and frames.
    c. Surface-mounted exit devices.

d. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
e. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.21 FINISHES

A. Standard: BHMA A156.18, as indicated in door hardware sets.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 Series.

   a. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.

B. Wood Doors: Comply with DHI A115-W Series.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.

   a. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
   b. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

   a. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   b. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

   a. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to

operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

a. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DOOR HARDWARE SETS

Legend:

Products:	Manufacturer:	Approved Substitute:
Hinges	(BO) Bommer	Hager, McKinney, Stanley
Locks/Latches	(BE) Best	Dorma, Sargent
Cylinders	(BE) Best	No Substitution
Exit Devices	(BE) Best	Precision, Sargent, Von Duprin
Closers	(BE) Best	LCN, Ryobi, Sargent
O'Head Stop/Holders	(BE) Best	ABH, Glynn-Johnson, Rixson
Misc. Door Trim	(TR) Trimco/BBW	Ives, Rockwood
Weatherstripping	(NG) National Guard	Hager, Pemko
Sliding Door Hardware	(PE) Pemko	Hager, Stanley

Furnish all items in US26D/626, Dull/Satin Chrome, except as indicated in the schedule. Thresholds to be Mill Finish Aluminum. Weatherstripping to be Clear Anodized Aluminum. Closers to be Sprayed Aluminum/689 Finish. Miscellaneous door trim may be furnished in US32D/630, Dull/Satin Stainless Steel.

Furnish glass bead kits at exit devices where required.

Door Jambs must be cleaned of all dirt, grease, oil, solvents or solvent residue and dust before applying Pressure-Sensitive Adhesive backed Gasketing, Smoke Seal or Weatherstripping.

Hdw Set 1 – SLIDING ALUMINUM ENTRY

Door: 101A, 102A
Each Door to Have:

2 ea.	Cylinders	(BE)	1E74 x C181
2 ea.	Door Position Switch	(--)	By Security Contractor

Balance of Hardware by Door Supplier

Hdw Set 2 – SLIDING ALUMINUM ENTRY

Door: 101B, 102B, 133A, 133B, 222, 223, 224, 225, 226
Each Door to Have:

All Hardware by Door Supplier

Hdw Set 3 – ALUMINUM ENTRY – EXIT ONLY - DELAYED EGRESS

Door: 141
Each Door to Have:

1 ea.	Continuous Hinge	(BO)	FM95SLF-HD-PT
1 ea.	Power Transfers	(DO)	ES105
1 ea.	Exit Device	(DO)	9700 ALD DE LC
1 ea.	Cylinder	(BE)	1E74 x C4
1 ea.	Door Closer/Stop	(DO)	8916 S-DS
1 ea.	Threshold	(NG)	513 x DW *
1 ea.	Door Sweep	(--)	Door Mfg Standard
1 set	Gasketing	(--)	Door Mfg Standard
1 ea.	Power Supply	(DO)	ES100
1 ea.	Door Position Switch	(--)	By Security Contractor

* Threshold Width to Match Frame Profile Width

Operation: Door normally closed and locked. No entry from exterior is allowed. When existing the exit device push bar is depressed and held will start an irreversibly delay cycle of 15 seconds, exiting is allowed after 15 seconds. If the push bar is depressed but not held a local nuisance alarm will sound for 1 or 3 seconds (pre-set) and then terminate. Authorized exiting is control by interior key to disarm the delayed egress function or set the device for a bypass function which rearms in 10 seconds.

Hdw Set 4 – ALUMINUM ENTRY - CLASSROOM FUNCTION

Door: 210, 210A
Each Door to Have:

1 ea.	Continuous Hinge	(BO)	FM95SLF-HD
1 ea.	Exit Device	(DO)	9700 ALD LC x ZC08
1 ea.	Cylinder	(BE)	1E72 or 1E74 as required
1 ea.	Door Closer/Stop	(DO)	TS9315 ST
1 ea.	Door Sweep	(--)	Door Mfg Standard
1 set	Gasketing	(--)	Door Mfg Standard
1 ea.	Door Position Switch	(--)	By Security Contractor

Operation: Interior of door locked or unlocked by key for entry into outdoor reading room. Reading room side always unlocked for re-entry into library.

Hdw Set 5 – ALUMINUM ENTRY - NON-LOCKING FUNCTION

Door: 220
Each Door to Have:

1 ea.	Continuous Hinge	(BO)	FM95SLF-HD
2 ea.	Door Pulls	(TR)	1195-2 BTB Mounted
1 ea.	Door Closer	(DO)	8916 T
1 ea.	Wall Stop	(TR)	1270WV
1 set	Gasketing	(--)	Door Mfg Standard

Hdw Set 6 – EXTERIOR HOLLOW METAL – STOREROOM FUNCTION

Door 152, 153
Each Door to Have:

4 ea.	Hinges	(BO)	BB5006 4.5 x 4.5
1 ea.	Storeroom Lock	(BE)	93K-7-D-14D
1 ea.	Door Closer/Stop/Holder	(DO)	8916 S-DST
1 ea.	Kickplate	(TR)	K0050 8” High
1 ea.	Threshold	(NG)	513 x DW *
1 ea.	Door Sweep	(NG)	96V x DW
1 set	Gasketing	(NG)	155S Head and Jambs
1 ea.	Drip Cap	(NG)	16A x DW + 4”
1 ea.	Door Position Switch	(--)	By Security Contractor

* Threshold Width to Match Frame Profile Width

Hdw Set 7 – EXTERIOR HOLLOW METAL – EXIT ONLY - DELAYED EGRESS

Door: 130C, 130D
Each Door to Have:

al johnson 12/13/11 6:08 PM
Deleted: A

4 ea.	Hinges	(BO)	BB5006 4.5 x 4.5
1 ea.	Power Transfers	(DO)	ES105
1 ea.	Exit Device	(DO)	9300 DE LC
1 ea.	Cylinder	(BE)	1E74 x C4
1 ea.	Door Closer/Stop	(DO)	8916 S-DS
1 ea.	Kickplate	(TR)	K0050 8” High
1 ea.	Threshold	(NG)	513 x DW *
1 ea.	Door Sweep	(NG)	96V x DW
1 set	Gasketing	(NG)	155S Head and Jambs
1 ea.	Drip Cap	(NG)	16A x DW + 4”
1 ea.	Power Supply	(DO)	ES100
1 ea.	Door Position Switch	(--)	By Security Contractor

* Threshold Width to Match Frame Profile Width

Operation: Door normally closed and locked. No entry from exterior is allowed. When existing the exit device push bar is depressed and held will start an irreversibly delay cycle of 15 seconds, exiting is allowed after 15 seconds. If the push bar is depressed but not held a local nuisance alarm will sound for 1 or 3 seconds (pre-set) and then terminate. Authorized exiting is control by interior key to disarm the delayed egress function or set the device for a bypass function which rearms in 10 seconds.

Hdw Set 8 – EXTERIOR HOLLOW METAL – DELAYED EGRESS – CARD ACCESS

Door: 121. Note this door shall have access with master key
Each Door to Have:

al johnson 12/13/11 6:11 PM
Deleted: 122A

4 ea.	Hinges	(BO)	BB5006 4.5 x 4.5
1 ea.	Power Transfers	(DO)	ES105
1 ea.	Exit Device	(DO)	9300 DE LC x YC03R
1 ea.	Electric Strike	(DO)	ES-110-4
2 ea.	Cylinder	(BE)	1E74 x C4
1 ea.	Door Closer/Stop	(DO)	8916 S-DS
1 ea.	Kickplate	(TR)	K0050 8” High
1 ea.	Threshold	(NG)	513 x DW *
1 ea.	Door Sweep	(NG)	96V x DW
1 set	Gasketing	(NG)	155S Head and Jambs
1 ea.	Drip Cap	(NG)	16A x DW + 4”
1 ea.	Power Supply	(DO)	ES100
1 ea.	Door Position Switch	(--)	By Security Contractor
2 ea.	Card Readers	(--)	By Security Contractor**

* Threshold Width to Match Frame Profile Width
** Exterior Reader for Entry, Interior Reader to Shunt Delay Egress for Employee Exiting

Operation: Door normally closed and locked. Entry allowed by key or exterior card reader. When existing the exit device push bar is depressed and held will start an irreversibly delay cycle of 15 seconds, exiting is allowed after 15 seconds. If the push bar is depressed but not held a local nuisance alarm will sound

for 1 or 3 seconds (pre-set) and then terminate. Authorized exiting is control by interior key to disarm the delayed egress function or set the device for a bypass function which rearms in 10 seconds. The bi-pass function can also be set by interior card reader.

Hdw Set 9 – INTERIOR – FIRE RATED – STOREROOM FUNCTION

Door: 154
Each Door to Have:

1 ea.	Hinges	(BO)	BB5000 4.5 x 4.5 – Top
2 ea.	Spring Hinges	(BO)	LB4310C 4.5 x 4.5
1 ea.	Storeroom Lock	(BE)	93K-7-D-14D
1 ea.	Wall Stop	(TR)	1270WV
1 set	Gasketing	(NG)	5050 Head and Jambs

Hdw Set 10A – INTERIOR – NON-LOCKING FUNCTION

Door: 246A
Each Door to Have:

3 ea.	Hinges	(BO)	BB5000 4.5 x 4.5
1 ea.	Latch Set	(BE)	93K-0-N-14D
1 ea.	Wall Stop	(TR)	1270WV
3 ea.	Silencers	(TR)	1229A

Hdw Set 10B – INTERIOR – CLASSROOM FUNCTION

Door: 254
Each Door to Have:

3 ea.	Hinges	(BO)	BB5000 4.5 x 4.5
1 ea.	Classroom Lock	(BE)	93K-7-R-14C
1 ea.	Wall Stop	(TR)	1270WV
3 ea.	Silencers	(TR)	1229A

Hdw Set 11 – INTERIOR – NON-LOCKING FUNCTION – STC RATED DOOR

Door: 252. Note: provide Occupancy Indicator (single use restroom)
Each Door to Have:

3 ea.	Hinges	(BO)	BB5000 4.5 x 4.5
1 ea.	Latch Set	(BE)	93K-0-N-14D
1 ea.	Wall Stop	(TR)	1270WV
1 ea.	Threshold	(--)	By Door Manufacture
1 ea.	Automatic Door Bottom	(--)	By Door Manufacture
1 set	Sound Gasketing	(--)	By Door Manufacture

Hdw Set 12 – INTERIOR – PRIVACY FUNCTION - CLOSER

Door: 115, 244, 246
Each Door to Have:

3 ea.	Hinges	(BO)	BB5000 4.5 x 4.5
1 ea.	Privacy Set	(BE)	93K-0-L-14D
1 ea.	Door Closer	(DO)	8916 AF89
1 ea.	Wall Stop	(TR)	1270WV
1 ea.	Kickplate	(TR)	K0050 8” High
3 ea.	Silencers	(TR)	1229A

Hdw Set 13 – INTERIOR – STOREROOM FUNCTION

Door: 116, 135, 261
Each Door to Have:

3 ea.	Hinges	(BO)	BB5000 4.5 x 4.5
1 ea.	Storeroom Lock	(BE)	93K-7-D-14C
1 ea.	Wall Stop	(TR)	1270WV
1 ea.	Kickplate	(TR)	K0050 8” High
3 ea.	Silencers	(TR)	1229A

Hdw Set 14 – INTERIOR – STOREROOM FUNCTION – OVERHEAD STOP

Door: 131
Each Door to Have:

3 ea.	Hinges	(BO)	BB5000 4.5 x 4.5
1 ea.	Storeroom Lock	(BE)	93K-7-D-14C
1 ea.	Overhead Stop	(DO)	900S Series
3 ea.	Silencers	(TR)	1229A

Hdw Set 15 – INTERIOR – CLASSROOM FUNCTION - EXIT DEVICE

Door: 130H, 130J
Each Door to Have:

3 ea.	Hinges	(BO)	BB5000 4.5 x 4.5
1 ea.	Exit Device	(DO)	9300 x YC08
1 ea.	Cylinder	(BE)	1E74 x C4
1 ea.	Door Closer	(DO)	8916 AF89 or AF89P as required
1 ea.	Wall Stop	(TR)	1270WV
1 ea.	Kickplate	(TR)	K0050 8” High
3 ea.	Silencers	(TR)	1229A

Hdw Set 16 – INTERIOR – CLASSROOM FUNCTION

Door: 113, 114
Each Door to Have:

3 ea.	Hinges	(BO)	BB5000 4.5 x 4.5
1 ea.	Classroom Lock	(BE)	93K-7-R-14C
1 ea.	Door Closer	(DO)	8916 AF89 or AF89P as required
1 ea.	Wall Stop	(TR)	1270WV
1 ea.	Kickplate	(TR)	K0050 8” High
3 ea.	Silencers	(TR)	1229A

Hdw Set 17 – INTERIOR – ACCESS CONTROLLED AND MONITORED

Door: 134, 251, 255, 257
Each Door to Have:

3 ea.	Hinges	(BO)	BB5000 4.5 x 4.5
1 ea.	Storeroom Lock	(BE)	93K-7-D-14C
1 ea.	Electric Strike	(DO)	ES-111-A
1 ea.	Door Closer	(DO)	8916 AF89 or AF89P as required
1 ea.	Wall Stop	(TR)	1270WV
1 ea.	Kickplate	(TR)	K0050 8” High
3 ea.	Silencers	(TR)	1229A
1 ea.	Card Reader	(--)	By Security Contractor
1 ea.	Door Position Switch	(--)	By Security Contractor

Operation: Door normally closed and locked; entry into room by key or card reader. Interior always unlocked for free egress. Note Doors 134, 251, and 255 shall remain locked if power fails. Note Doors 251 and 257 shall have Classroom Function so access with master key is allowed.

Hdw Set 18 – INTERIOR – ACCESS CONTROLLED AND MONITORED – DOOR HOLDER

Door: 120
Each Door to Have:

3 ea.	Hinges	(BO)	BB5000 4.5 x 4.5
1 ea.	Storeroom Lock	(BE)	93K-7-D-14C
1 ea.	Electric Strike	(DO)	ES-111-A
1 ea.	Door Closer/Holder	(DO)	8916 PH
1 ea.	Wall Stop	(TR)	1270WV
1 ea.	Kickplate	(TR)	K0050 8” High
3 ea.	Silencers	(TR)	1229A
1 ea.	Card Reader	(--)	By Security Contractor
1 ea.	Door Position Switch	(--)	By Security Contractor

Operation: Door normally closed and locked; entry into room by key or card reader. Interior always unlocked for free egress. Closer will hold door open for passage of carts and other materials.

Hdw Set 19 – INTERIOR – FIRE RATED - DELAYED EGRESS – NON-LOCKING FUNCTION

Door: 221
Each Door to Have:

3 ea.	Hinges	(BO)	BB5000 4.5 x 4.5
1 ea.	Power Transfers	(DO)	ES105
1 ea.	Exit Device	(DO)	9300 DE x YC23
1 ea.	Cylinder	(BE)	1E74 x C4
1 ea.	Door Closer/Stop	(DO)	8916 S-DS
1 ea.	Kickplate	(TR)	K0050 8” High
1 ea.	Power Supply	(DO)	ES100
1 ea.	Door Position Switch	(--)	By Security Contractor
1 ea.	Card Readers	(--)	By Security Contractor

Operation: Door normally closed. Entry from Stair B is always allowed. When existing the exit device push bar is depressed and held will start an irreversibly delay cycle of 15 seconds, exiting is allowed after 15 seconds. If the push bar is depressed but not held a local nuisance alarm will sound for 1 or 3 seconds (pre-set) and then terminate. Authorized exiting is control by interior key to disarm the delayed egress function or set the device for a bypass function which rearms in 10 seconds.

Hdw Set 20 – MISC.

1 ea.	Key Cabinet	(LU)	1204B
1 ea.	Knox Box	(KN)	3200 x RMK

Hdw Set 21

Door: 102E, 130B, 130K
Each Door to Have:

All Hardware by Door Supplier

Hdw Set 22 – INTERIOR – FIRE RATED - NONLOCKING FUNCTION - CLOSER

Door: 122. Note access shall be provide with master key.
Each Door to Have:

3 ea.	Hinges	(BO)	BB5000 4.5 x 4.5
1 ea.	Latch Set	(BE)	93K-0-N-14D
1 ea.	Exit Device	(DO)	9300 DE x YC23
1 ea.	Door Closer	(DO)	8916 AF89P
1 ea.	Wall Stop	(TR)	1270WV
1 ea.	Kickplate	(TR)	K0050 8” High
1 set	Smoke Seal	(NG)	5050B Head and Jambs

Hdw Set 23 – INTERIOR – FIRE RATED - STOREROOM FUNCTION

Door: 153B
Each Door to Have:

3 ea.	Hinges	(BO)	BB5000 4.5 x 4.5
1 ea.	Storeroom Lock	(BE)	93K-7-D-14D
1 ea.	Door Closer	(DO)	8916 AF89P
1 ea.	Wall Stop	(TR)	1270WV
1 ea.	Kickplate	(TR)	K0050 8” High
1 set	Smoke Seal	(NG)	5050B Head and Jambs

Hdw Set 24 – INTERIOR – FIRE RATED - ACCESS CONTROLLED AND MONITORED

Door: 221A
Each Door to Have:

3 ea.	Hinges	(BO)	BB5000 4.5 x 4.5
1 ea.	Storeroom Lock	(BE)	93K-7-D-14C
1 ea.	Electric Strike	(DO)	ES-111-A
1 ea.	Exit Device	(DO)	9300 x YC23
1 ea.	Door Closer	(DO)	8916 AF89 or AF89P as required
1 ea.	Wall Stop	(TR)	1270WV
1 ea.	Kickplate	(TR)	K0050 8” High
1 set	Smoke Seals	(NG)	5050B Head and Jambs
1 ea.	Card Reader	(--)	By Security Contractor
1 ea.	Door Position Switch	(--)	By Security Contractor

Operation: Door normally closed and locked; entry into room by key or card reader. Interior always unlocked for free egress.

Hdw Set 25 – INTERIOR – CLASSROOM FUNCTION - STC RATED - ACCESS CONTROLLED AND MONITORED

Door: 228
Each Door to Have:

3 ea.	Hinges	(BO)	BB5000 4.5 x 4.5
1 ea.	Classroom Lock	(BE)	93K-7-R-14C
1 ea.	Electric Strike	(DO)	ES-111-A
1 ea.	Door Closer	(DO)	8916 AF89 or AF89P as required
1 ea.	Wall Stop	(TR)	1270WV
1 ea.	Kickplate	(TR)	K0050 8” High
1 ea.	Threshold	(--)	By Door Manufacturer
1 ea.	Automatic Door Bottom	(--)	By Door Manufacturer
1 set	Sound Gasketing	(--)	By Door Manufacturer
1 ea.	Card Reader	(--)	By Security Contractor
1 ea.	Door Position Switch	(--)	By Security Contractor

Operation: Door normally closed and locked; entry into room by key or card reader. Interior always unlocked for free egress.
Hdw Set 26

Door: 155A, 155B
Each Gate to Have:

1 ea.	Padlock	(BE)	11B 7 72 T

Balance of hardware by gate supplier

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Doors.
   2. Aluminum-framed entrances and storefronts.
   3. Automatic entrances.
   4. Skylights.
   5. Interior borrowed lites.

B. Related Sections:
   1. Division 05 Section "Architectural Railings" for glass panels in railings.
   2. Division 08 Section "Automatic Entrances."
   3. Division 08 Section "Mirrors."

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.4 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Design glass, including comprehensive engineering analysis according to ICC's 2009 International Building Code by a qualified professional engineer, using the following design criteria:
   1. Design Wind Pressures: As indicated on Drawings.
   2. Design Snow Loads: As indicated on Drawings.
   3. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
   4. Deflection requirements in first subparagraph below are examples only and apply only to glass supported on all four edges. The IBC does not contain any deflection limits for glass. ASTM E 1300 only requires that the deflection will not result in loss of edge support. Revise to suit Project.

5. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
6. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.5 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. LEED Submittals:
1. Product Data for Credit EQ 4.1: For glazing sealants used inside of the weatherproofing system, including printed statement of VOC content.
2. Glazing properties:
   a. U-value winter
   b. U-value summer
   c. Exterior reflectance
   d. Solar heat gain coefficient
   e. Visible Light Transmittance

C. Glass Samples: For each type of glass product other than clear monolithic vision glass 12 inches square.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Preconstruction adhesion and compatibility test report.

1.6 QUALITY ASSURANCE

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Preinstallation Conference: Conduct conference at Project site
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

2. Review temporary protection requirements for glazing during and after installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.9 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

C. Windborne-Debris-Impact Resistance: Provide exterior glazing that passes basic enhanced protection testing requirements in ASTM E 1996 for project specific Wind Zone when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on the Project and shall be installed in same manner as glazing indicated for use on the Project.
1. Large-Missile Test: For glazing located within 30 feet of grade.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.

3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

E. Glazing Performance Properties: (pending daylighting analysis)
1. U-value (winter): Maximum of .29.
2. Solar Heat Gain Coefficient: Minimum of 0.37
3. Visible Light Transmittance: Minimums below
   a. Vision Glazing
      1) North = 0.7
      2) East = 0.3
      3) South = 0.41
      4) West = 0.3
   b. Daylight Glazing
      1) North = 0.7
      2) East = 0.7
      3) South = 0.7
      4) West = 0.7

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

2.3 INSULATING GLASS

A. Manufacturers:
1. AFG Industries, Inc.
2. Cardinal Glass Industries.
3. Pilkington Norht America
4. PPG Industries, Inc.
5. Viracon.

B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
1. Spacer: Aluminum with powdered metal paint finish in color selected by Architect.

2.4 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
1. Neoprene complying with ASTM C 864.
2. EPDM complying with ASTM C 864.
3. Silicone complying with ASTM C 1115.
4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone, or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
   1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.5 GLAZING SEALANTS

A. General:
   1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   3. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D.
   4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

2.6 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
   1. AAMA 804.3 tape, where indicated.
   2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
   3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
   1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
   2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.8 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

2.9 INSULATING-GLASS TYPES

A. Glass Type GL-A**:** Grey silk screened low E 50% coverage insulating glass.
1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: ¼" (6.0 mm).
3. Outdoor Lite: Grey 60% coverage Float glass.
4. Interspace Content: Air.
5. Indoor Lite: Float glass.
6. Low-E Coating: Sputtered on third.
7. Winter Nighttime U-Factor: 0.29 maximum.
8. Summer Daytime U-Factor: 0.26 maximum.
9. Visible Light Transmittance: 39% percent minimum.
10. Solar Heat Gain Coefficient: 0.24 maximum.
11. Provide safety glazing labeling: As indicated on drawings.

B. Glass Type GL-B: Grey silk screened low E 60% coverage insulating glass.
1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: ¼" (6.0 mm).
3. Outdoor Lite: Grey 60% coverage float glass.
4. Interspace Content: Air.
5. Indoor Lite: Ultraclear float glass.
6. Low-E Coating: Pyrolytic on third.
7. Winter Nighttime U-Factor: 0.29 maximum.
8. Summer Daytime U-Factor: 0.26 maximum.
9. Visible Light Transmittance: 33% percent minimum.
10. Solar Heat Gain Coefficient: 0.22 maximum.
11. Provide safety glazing labeling.

C. Glass Type GL-C: Ultraclear insulating glass.
1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: ¼" (6.0 mm).
3. Outdoor Lite: Ultraclear: float glass.
4. Interspace Content: Air.
5. Indoor Lite: Ultraclear Float glass.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.26 maximum.

8. Visible Light Transmittance: 62% percent minimum.
9. Solar Heat Gain Coefficient: 0.29 maximum.
10. Provide safety glazing labeling.

D. Glass Type GL-D: Ultraclear insulating glass.
1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: ¼" (6.0 mm).
3. Outdoor Lite: Ultraclear: float glass.
4. Frosted Coating: S-54 100% sandblast on second surface.
5. Interspace Content: Air.
6. Indoor Lite: Ultraclear Float glass.
7. Low-E Coating: Sputtered on third.
8. Winter Nighttime U-Factor: 0.29 maximum.
9. Summer Daytime U-Factor: 0.26 maximum.
10. Visible Light Transmittance: 62% percent minimum.
11. Solar Heat Gain Coefficient: 0.29 maximum.
12. Provide safety glazing labeling.

E. Glass Type GL-E: clear insulating glass. <ADD ALT. 2>
1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: ¼" (6.0 mm).
3. Outdoor Lite: Ultraclear: float glass.
4. Interspace Content: Argon Gas Filled.
5. Indoor Lite: Clear LOF Pyro Low-E #4
6. Winter Nighttime U-Factor: 0.21 maximum.
7. Summer Daytime U-Factor: 0.17 maximum.
8. Visible Light Transmittance: 25% percent minimum.
9. Solar Heat Gain Coefficient: 0.35 maximum.

F. Glass Type GL-F: <GLASS FOR STAIR A>
1. Overall Unit Thickness: 1 inch.
2. Provide safety glazing labeling.
3. Color: from full range of standard colors

G. Glass Type GL-2: clear insulating glass.
1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: ¼" (6.0 mm).
3. Outdoor Lite: Ultraclear float glass.
4. Interspace Content: Air.
5. Indoor Lite: Ultraclear laminated float glass.
6. Provide safety glazing labeling.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

3.8 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

SECTION 088300 - MIRRORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes annealed monolithic glass mirrors.

B. Related Sections include the following:
   1. Division 10 Section "Toilet, Bath, and Laundry Accessories" for metal-framed mirrors.

1.03 DEFINITIONS

A. Deterioration of Mirrors: Defects developed from normal use that are attributable to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning mirrors contrary to mirror manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1.04 PERFORMANCE REQUIREMENTS

A. Provide mirrors that will not fail under normal usage. Failure includes glass breakage and deterioration attributable to defective manufacture, fabrication, and installation.

1.05 SUBMITTALS

A. Product Data: For the following:
   1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
   2. Mirror mastic.
   3. Mirror hardware.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.

C. Samples: For each type of mirror product required, in the form indicated below:
   1. Mirrors, 12 inches square, including edge treatment on 2 adjoining edges.
   2. Mirror trim, 12 inches long.

D. LEED Submittals:
   1. Credit MR 5 - Regional Materials: For each type of product indicated, product data or other published information verifying the location of manufacturing facility including name, address, and distance between manufacturing facility and the project site. Provide manufacturer’s documentation indicating location where the base materials were extracted, mined, quarried, harvested, etc. and the distance between this location and the project site. Also include material costs (excluding costs of installation).

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed mirror glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in mirror installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under NGA's Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

B. Source Limitations for Mirrors: Obtain mirrors from one source for each type of mirror indicated.

C. Source Limitations for Mirror Glazing Accessories: Obtain mirror glazing accessories from one source for each type of accessory indicated.

D. Glazing Publications: Comply with the following published recommendations:
1. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
2. GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

E. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing, paint and substrates on which mirrors are installed.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors, protected from moisture including condensation.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.09 WARRANTY

A. Special Warranty: Manufacturer's standard form, made out to Owner and signed by mirror manufacturer agreeing to replace mirrors that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below:
1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 GENERAL

A. Building materials in this section must be extracted, harvested, or recovered, and manufactured and assembled within five hundred (500) miles of the jobsite.

2.02 MANUFACTURERS

A. Subject to compliance with requirements, provide mirrors by one of the following:
1. Arch Aluminum & Glass Co., Inc.
2. Gardner Glass Products.
3. Gilded Mirrors, Inc.
4. Guardian Industries Corp.
5. Independent Mirror Industries, Inc.
6. Lenoir Mirror Company.
7. Stroupe Mirror Co., Inc.
8. Sunshine Mirror.
9. Virginia Mirror Company, Inc.
10. Walker Glass Co., Ltd.

2.03 SILVERED FLAT GLASS MIRROR MATERIALS

A. Clear Glass Mirrors: ASTM International (ASTM) C 1503 "Standard Specification for Silvered Flat Glass Mirror," Mirror Select Quality.
   1. Nominal Thickness: 6.0 mm.

2.04 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Type A Shore durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Gunther Mirror Mastics.
      b. Palmer Products Corporation.

2.05 MIRROR HARDWARE

A. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.
   1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch in height, respectively, and a thickness of not less than 0.04 inch .
   2. Products: Subject to compliance with requirements, provide one of the following:
      a. Bottom Trim:
         1) Laurence, C. R. Co., Inc.; CRL Standard "J" Channel.
         2) Sommer & Maca Industries, Inc.; Medium Gauge Aluminum Shallow Nose "J" Moulding Lower Bar.

B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.06 FABRICATION

A. Mirror Sizes: To suit Project conditions, cut mirrors to final sizes and shapes.

B. Cutouts: Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: Flat polished edge.
   1. Seal edges of mirrors after edge treatment to prevent chemical or atmospheric penetration of glass coating.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance.

1. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.
2. Proceed with mirror installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.02 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating surfaces with mastic manufacturer's special bond coating where applicable.

3.03 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

B. Provide a minimum air space of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. For wall-mounted mirrors, install mirrors with mastic and mirror hardware.
   1. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
   2. For mirror hardware in the form of continuous J-channels at bottom, provide setting blocks 1/8 inch thick by 4 inches long at quarter points. To prevent trapping water, provide, between setting blocks, 2 slotted weeps not less than 1/4 inch wide by 3/8 inch long.
   3. Where indicated, install mirror hardware in the form of J-channels that are fabricated in single lengths to fit and cover bottom edges of mirrors.
   4. Install mastic as follows:
      a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
      b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
      c. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8 inch between back of mirrors and mounting surface.

3.04 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.

B. Do not permit edges of mirrors to be exposed to standing water.

C. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

3.05 CONSTRUCTION WASTE MANAGEMENT

A. Manage construction waste in accordance with provisions of Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 088300

SECTION 090600 – SCHEDULES FOR FINISHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Agreement and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Interior finish schedules.

PART 2 - PRODUCTS

2.1 TILE

A. Refer to Division 09 Section “Tiling” for additional requirements.

B. Ceramic Tile:
1. CT1 American Olean, Satinglo, White Ice D25
2. CT2 American Olean, Satinglo, Light Smoke D42
3. CT3 American Olean, Satinglo, Storm Gray D40
4. CT4 American Olean, Satinglo, Black D35
5. CT5 American Olean, Satinglo – Mosaic of CT1-4
6. CT6 American Olean, Satinglo, White Ice MT-6 (bull-nose base top)
7. CT7 American Olean, Satinglo, White Ice MT-6A (cove of base)
8. CT8 American Olean, Satinglo, Light Smoke MT-6 (bull-nose base top)
9. CT9 American Olean, Satinglo, Light Smoke MT-6A (cove of base)
10. CT10 American Olean, Satinglo, Storm Gray MT-6 (bullnose base top)
11. CT11 American Olean, Satinglo, Storm Gray MT-6A (cove of base)
12. CT12 American Olean, Satinglo, Black MT-6 (bullnose base top)
13. CT13 American Olean, Satinglo, Black MT-6A (cove of base)

2.2 RESILIENT FLOOR BASE AND ACCESSORIES

A. Refer to Division 09 Section “Resilient Base and Accessories” for addition requirements.

B. Rubber Base:
1. RB1 Roppe, 4" height, 193 Black Brown, rolled goods
2. RB2 Roppe, 4” height, 622 Brass, rolled goods

2.3 CARPET

A. Refer to Division 09 Section “Tile Carpet” for additional requirements.

B. Tile Carpet (all random installation and per finish plans and enlarged finish plans):
1. CPT1 Interface FLOR Raw Collection, 101057 Foundry
2. CPT2 Interface FLOR Flatiron Collection, 1st Avenue 8140 Charcoal
3. CPT3 Interface FLOR Flatiron Collection, 1st Avenue 8141 Flannel
4. CPT4 Interface FLOR Surreal Collection, Imago 100936 Magic
5. CPT5 Interface FLOR Flatiron Collection, 1st Avenue 8157 Orange

6. CPT6 Interface FLOR Flatiron Collection, 1st Avenue 8158 Peach
7. CPT7 Interface FLOR, Flatiron Collection, 1st Avenue 8149 Teal
8. CPT8 Interface FLOR, Flatiron Collection, 1st Ave 8142 Sharkskin

2.4 PAINT

A. Refer to Division 09 Section "Interior Painting" for additional requirements.

B. Paint Colors:
1. PT1 Kwal Howell to match Sherwin Williams 7006 Extra White, Eggshell
   a. All adjacent doors and door frames to be semi-gloss unless otherwise noted.
2. PT2 Kwal Howell to match Sherwin Williams 7043 Wordly Gray, Eggshell
   a. All adjacent doors and door frames to be semi-gloss unless otherwise noted.
3. PT3 Kwal Howell to match Sherwin Williams 7046 Anonymous, Eggshell
   a. All adjacent doors and door frames to be semi-gloss unless otherwise noted.
4. PT4 Kwal Howell to match Sherwin Williams 6695 Midday, Eggshell
5. PT5 NOT USED
6. PT6 Kwal Howell to match Sherwin Williams 6702 Lively Yellow, Semi-Gloss
7. PT7 Kwal Howell to match Sherwin Williams 6628 Robust Orange, Eggshell
8. PT8 Kwal Howell to match Sherwin Williams 6628 Robust Orange, Semi-Gloss
9. PT9 Kwal Howell to match Sherwin Williams 0033 Rembrandt Ruby, Eggshell
10. PT10 Kwal Howell to match Sherwin Williams 6489 Really Teal, Eggshell
11. PT11 Kwal Howell to match Sherwin Williams 7006 Extra White, Semi-Gloss
12. PT12 Kwal Howell to match Sherwin Williams 7006 Extra White, Flat
13. PT13 Kwal Howell to match Sherwin Williams 6489, Really Teal, High Gloss
14. PT14 Kwal Howell to match Sherwin Williams 6702 Lively Yellow, Eggshell
15. PT15 Kwal Howell to match Sherwin Williams 6702 Lively Yellow, High Gloss (lighting fixtures in Open Computing—see RCP)
16. PT16 Kwal Howell to match Sherwin Williams 6489 Really Teal, High Gloss (lighting fixtures in Open Computing—see RCP)
17. PT17 Kwal Howell to match Sherwin Williams 6684 Brittlebrush, Eggshell
18. PT18 Kwal Howell to match Sherwin Williams 6684 Brittlebrush, Semi-Gloss (large ceiling grille at Circulation adjacent to PT17 walls)
19. PT19 Kwal Howell to match Sherwin Williams 0033 Rembrandt Ruby, Semi-Gloss

2.5 SOLID SURFACE COUNTERTOP

A. Refer to Division 06 Section "Interior Architectural Woodwork" for additional requirements.

B. Solid Surfaces
1. SS1 Caesarstone 4600 White
2. SS2 Caesarstone 2710 Green
3. SS3 Caesarstone 4030 Pebble

2.6 PLASTIC LAMINATE

A. Refer to Division 06 Section "Interior Architectural Woodwork" for additional requirements.

B. Plastic Laminate:
1. PLAM1 Formica Colorcore2, 7223C-90 New White, Gloss
2. PLAM2 Formica Colorcore2, 923C-FV Surf, Velour
3. PLAM3 Formica Colorcore2, 927C-FV Folkstone, Velour

4. PLAM4 Formica Colorcore2, 7940C-FV Spectrum Yellow, Velour
5. PLAM5 Nevamar, S4022T Sunray, Textured
6. PLAM6 Formica, 1903-58 Café, Matte
7. PLAM7 Pionite, SY914 Primary Yellow, Suede
8. PLAM8 Formica, 2013-58 Fiesta, Matte
9. PLAM9 Formica, 7966-58 New Burgandy, Matte
10. PLAM10 Formica, 6902-58 Grenadine, Matte
11. PLAM11 Pionite, SB016 Deep Teal, Suede
12. NOT USED
13. PLAM13 Formica, 1097-58 Citadel, Matte
14. PLAM14 Formica, 837-58 Graphite, Matte

2.7 FOOT GRID

A. Refer to Division 12 section “Floor Mats and Frames” for additional requirements.

B. Recessed Walk-Off-Mat:
1. WM1 Mats Inc Nuway Foot Grid, Shallow Recessed, Color: Charcoal with Aluminum

2.8 RESILIENT TILE FLOORING

A. Refer to Division 09 Section “Resilient Tile Flooring” for additional requirements.

B. BioBased Tile:
1. BBT1 Armstrong Migrations BioBased Tile, Grouping of (4) 12 x 12 tiles in random pattern:
   a. T3511 Quartz White
   b. T3505 Powder Gray
   c. T3503 Ashen Gray
   d. T3504 Ice White

C. Rubber Tile: 12 x 12 (pattern shown in 24 x 24 groupings of 4):
1. RR1 Roppe Smooth Solid Rubber Tile, 163 Gingko
2. RR2 Roppe Smooth Solid Rubber Tile, 195 Light Gray (Add Alt)
3. RR3 Roppe Smooth Solid Rubber Tile, 150 Dark Gray (Add Alt)
4. RR4 Roppe Smooth Solid Rubber Tile, 123 Charcoal (Add Alt)
5. RR5 Roppe Smooth Solid Rubber Tile, 100 Black (Add Alt)
6. RR6 Roppe Smooth Solid Rubber Tile, 188 Brick

2.9 LINOLEUM FLOORING

A. Refer to Division 09 Section “Linoleum Flooring” for additional requirements.

B. Linoleum Flooring:
1. LF1 Armstrong Marmorette 19048 Firebird Red
2. LF2 Armstrong Colorette 19301 Lemon (desk and floor near desk)

2.10 Static Control Resilient Flooring

A. Refer to Division 09 Section “Static Control Resilient Flooring” for additional requirements.

B. Static Control Resilient Tile Flooring

1. SR1 Roppe ESD Static Control Vinyl Tile Flooring, Color 760 Safety Yellow

2.11 ACOUSTICAL PANELS

A. Refer to Division 09 Section “Fixed Sound-Absorptive panels” for additional requirements.

B. Fiberglass Acoustical Panels
1. AP1 Armstrong Soundscapes Shapes Acoustical Clouds, color Reef (RE), Circles 5443
2. AP2 Armstrong Soundscapes Shapes Acoustical Clouds, color Stone (SE), Rectangle 5448 (ADD ALT)
3. AP3 Armstrong Soundscapes Shapes Acoustical Clouds, color Tangerine (TG) Square 5440
4. AP4 Armstrong Soundscapes Shapes Acoustical Clouds, color Cranberry (CN) Square 5440

2.12 FABRIC WRAPPED PANELS

A. Refer to Division 09 Section “Acoustical Room Components” for additional requirements

B. Fabric Wrapped Panels
1. FB1 Knoll, Soliloquy, KT Collection, K1458/8, Citrus
2. FB2 Architex, Atlantic, Paprika

2.13 Acoustical Ceiling Tile

A. Refer to Division 09 Section “Acoustical Room Components” for additional requirements.

B. ACT1 USG Fineline 1/8DXFF, Eclipse ClimaPlus 2x4 panels

2.14 Corner Guards

A. Refer to Division 10 Section “Corner Guards” for additional requirements.

B. CG1 Pawling Corp Recycled Aluminum Corner Guards #CG-400, 90 degree angle, 1” x 1” x 4’, Undrilled, install with construction adhesive just above base at all outside corners in public areas as well as Sorting 120 and Storage 122.

2.15 Picture Rail

A. "Clear Tape System" by Gallery System Art Displays.
1. Track: Continuous aluminum.
   a. Finish: Anodized.
   b. Cut to fit tight against angled walls and perpendicular walls.
   c. Provide end caps at exposed ends.
2. Clear Tape Hangers with Locking Capsule/Sliders:
   a. Provide 4 packs of hooks, Security type.

2.16 EXECUTION (Not Used)

END OF SECTION 090600

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Agreement and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
   2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

B. Related Requirements:
   1. Division 05 Section "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainability Submittals:
   1. Product Data:
      a. For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
      b. Provide manufacturer’s documentation indicating location where the base materials were extracted, mined, quarried, harvested, etc and the distance between this location and the project site. Also include material costs, excluding cost of installation.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For dimpled steel studs and runners, from ICC-ES.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
   1. Minimum Thickness:
      a. Interior Partitions: 25 gauge unless indicated or required otherwise.
      b. Stud Jambs: 22 gauge unless indicated or required otherwise.
      c. Tiled Walls: Comply with TCNA recommendations. Minimum 20 gauge, 3 1/2 inch deep; spacing not to exceed 16 inches on center.
   2. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
   3. Protective Coating: ASTM A 653/A 653M, G60 hot-dip galvanized unless otherwise indicated.

C. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.
   1. Steel Studs and Runners:
      a. Minimum Base-Metal Thickness: 25 gauge unless indicated or required otherwise.
      b. Depth: As indicated on Drawings.
   2. Dimpled Steel Studs and Runners:
      a. Minimum Base-Metal Thickness: 25 gauge unless indicated or required otherwise.
      b. Depth: As indicated on Drawings.

D. Slip-Type Head Joints: Where indicated, provide the following:
   1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

E. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
   1. Minimum Base-Metal Thickness: As indicated on Drawings.

G. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.
   1. Depth: As indicated on Drawings.
   2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
   1. Minimum Base-Metal Thickness: 26 gauge unless indicated or required otherwise.
   2. Depth: As indicated on Drawings.

I. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
   1. Configuration: Hat shaped.

J. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges.
   1. Depth: As indicated on Drawings.
   2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
   3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

K. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.018 inch, and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

B. Hanger Attachments to Concrete:
   1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
      a. Type: Cast-in-place anchor, designed for attachment to concrete forms.
   2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

D. Flat Hangers: Steel sheet, in size as indicated on Drawings.

E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch- wide flanges.
   1. Depth: As indicated on Drawings.

F. Furring Channels (Furring Members):
   1. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
   2. Steel Studs and Runners: ASTM C 645.
      a. Minimum Base-Metal Thickness: As indicated on Drawings.
      b. Depth: As indicated on Drawings.
   3. Dimpled Steel Studs and Runners: ASTM C 645.
      a. Minimum Base-Metal Thickness: As indicated on Drawings.
      b. Depth: As indicated on Drawings.
   4. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
      a. Minimum Base-Metal Thickness: As indicated on Drawings.
   5. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.
      a. Configuration: Hat shaped.

G. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.
   1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.
1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to ASTM C 754, but not greater than spacings required by referenced installation standards for assembly types.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

a. Install two studs at each jamb unless otherwise indicated.
b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
   a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:
   a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
   b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:
1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Z-Furring Members:
1. Erect insulation, specified in Division 07 Section "Thermal Insulation," vertically and hold in place with Z-furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Hangers: 48 inches (1219 mm) o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 16 inches

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
   a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092400 - PORTLAND CEMENT PLASTERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Exterior portland cement plasterwork (stucco)
      a. Factory blended, fiber-reinforced cement plaster basecoat for jobsite mixing with sand and water to provide scratch and brown coats and an acrylic modified colored stucco finish with additional color stain.
      b. Embedment of a fiber glass mesh in a cement based skim and leveling coat applied over the fully cured brown coat for increased crack suppression.
   2. Graffiti resistance coating

B. Related Sections:
   1. Division 05 Section "Cold-Formed Metal Framing" for structural, load-bearing (transverse and axial) steel studs and joists that support lath and portland cement plaster.
   2. Division 06 Section "Rough Carpentry" for wood framing and furring included in portland cement plaster assemblies.
   3. Division 06 Section "Sheathing" for sheathing and water-resistant barriers included in portland cement plaster assemblies.
   4. Division 07 Section "Thermal Insulation" for thermal insulations and vapor retarders included in portland cement plaster assemblies.
   5. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support lath and portland cement plaster.
   6. Division 07 Section “Joint Sealants” for installation of joint sealants related to this Section. Joint sealant installer shall be experienced and competent in the installation of elastomeric construction sealants.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:
   1. Product Data for Credit MRc4: Building materials in this section must have post- and/or pre-consumer recycled content by weight or total product.
      a. Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).
      b. Include information on Material Tracking Worksheets.
   2. Product Data for Credit MRc5: Building materials in this section must be extracted, harvested, or recovered, and manufactured and assembled within five hundred (500) miles of the jobsite.
      a. Submit product data or other published information verifying the location of manufacturing facility including name, address, and distance between manufacturing facility and the project site. Provide manufacturer’s documentation indicating location where the base

materials were extracted, mined, quarried, harvested, etc. and the distance between this location and the project site. Also include material costs (excluding costs of installation).

b. Include information on Material Tracking Worksheets.

3. Product Data for Credit EQc4.1: Adhesives and Sealants applied on site within the weather proofing exterior in this section must comply with South Coast Air Quality Management District Rule 1168 OR Green Seal Standard GS-36. Refer to LEED Specification 01 81 13 for specific VOC requirements.
4. Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standard

C. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.

D. Color Samples for Initial Selection: Provide up to four different color samples for each of the Stucco Types indicated.
1. Architect to select colors from manufacturer’s standard color options
2. Texture samples will be part of mock-up.

E. Samples for Verification: For each type of factory-prepared color finish coat indicated; 12 by 12 inches, and prepared on rigid backing.

1.4 QUALITY ASSURANCE

A. Fire-Resistance Ratings: Where indicated, provide portland cement plaster assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

B. Sound-Transmission Characteristics: Where indicated, provide portland cement plaster assemblies identical to those of assemblies tested for STC ratings per ASTM E 90 and classified according to ASTM E 413 by a qualified testing agency.

C. Mockups: Before plastering, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Install mockups for each Stucco Type indicated.
2. Apply three coat stucco system per the requirements of this section to a four feet by four feet area for each Stucco Type required.
3. Include control joint, intersection of two perpendicular control joints, and an outside corner control joint condition.

D. Preinstallation Conference: Conduct conference at Project site

E. Applicator Qualifications: A firm experienced in applying stucco systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance and that employs certified and registered installers.
1. Provide proof of experience with list of at least 3 similar projects, including location and name and contact information for building owner. This is required for Stucco Type 1 and Stucco Type 2.
2. Provide photographs and/or written descriptions of similar completed work.
3. For Stucco Type 2 all finish work must be by the same applicator, unless shot on wall with powered hose. This will ensure the same appearance in all Type 2 locations

F. All applicators must be approved as qualified by manufacturer.Single Source Responsibility: All stucco base coats, primers, fiberglass mesh and finish coats are to be from a single stucco manufacturer.

G. Warranty
   1. Provide a minimum nine (9) year material warranty

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.6 PROJECT CONDITIONS

A. Comply with ASTM C 926 requirements.

B. Exterior Plasterwork:
   1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
   2. Apply plaster when ambient temperature is greater than 40 deg F.
   3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

PART 2 - PRODUCTS

2.1 METAL LATH

A. Expanded-Metal Lath: ASTM C 847 with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.
   1. Manufacturers: Basis of Design : Structalath No. 17 SF CR II, by Structa Wire Corporation. Subject to compliance with requirements, provide product listed or equal product by one of the following;
      a. Alabama Metal Industries Corporation; a Gibraltar Industries company.
      b. CEMCO.
      c. Clark Western Building Systems.
      d. Dietrich Metal Framing; a Worthington Industries company.
      e. MarinoWARE.
      f. Phillips Manufacturing Co.
      g. approved equal.
   2. Recycled Content: Provide steel products with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Water Resistive Barrier: See fluid applied Air and Water Barrier Specification and use an additional One layer of Grade D paper, over all substrates, between the lathing and the fluid applied water barriers
   1. Fluid Applied Air and Water Barrier: “Weather Seal”, A roll, blush, spray or trowel applied seamless water resistive and air barrier.
   2. Sheet good Water Resistive Barrier: Grade D, 15lb minimum asphalt saturated Kraft paper or equal

2.2 ACCESSORIES

A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Metal Accessories:
   1. Exterior components field walls: Minimum 3.4lb expanded metal self furred to lath to be used in accordance with ASTM C897.
   2. Terminations: J-Metal or Stucco stop, general purpose type with expanded or perforated flanges. Plaster stops to be utilized around all through wall penetrations with gaps between the back of the plaster stops and the window or door frames wide enough to installed backer rod and sealant. See manufactures publish details.
   3. Corner Reinforcement: galvanized welded wire, minimum 18 gage. Manufacturer's standard pre-formed corner reinforcement made from 1.7 lbs. (0.059 kg/m2) per square yard of diamond mesh lath
   4. Square Edge Corner Beads: expanded or flanged to suit application.
      a. All corners are to be square.
   5. Control Joints: Fabricated from zinc: Single component control joints with ¼ inch slots and ¾ inch grounds, or equal.
      a. at locations indicated on drawings
      b. See images below for desired corner joint and unacceptable corner joint.
   6. Expansion Joints: Fabricated from zinc: two piece adjustable expansion joints, free floating adjustments from ¼ inch to 5/8 inch
      a. Continuous expansion joints shall be installed at all areas of dissimilar materials, multiple story plate lines or existing engineered through wall expansion joints
   7. Weep Screeds: foundation weep screed, with perforations and minimum 3-1/2 inch vertical attachment flange.
   8. Fasteners: steel nail or screw of furring type with 1 inch cap of sufficient length for minimum ½ inch penetration into stud system
   9. 3.4lb. per square yard expanded metal strip-lath 4 inches wide to be used at around all windows, doorways, openings and through wall penetrations
   10. 3.4lb density expanded metal lath for use on all soffits and overhangs as shown on drawings

2.3 MISCELLANEOUS MATERIALS

A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Fiber for Base Coat : Basis of Design, included in the pre-mixed Fiber-47 basecoat

C. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.

D. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.

E. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter, unless otherwise indicated.

F. Rigid insulation board: As specified in Division 07 Section "Thermal Insulation"

G. Sealant: As specified in Division 07 Section "Joint Sealants"

2.4 PLASTER MATERIALS

A. Basis of Design: Parex 4125 E. La Palma Ave., Suite 250, Anaheim, CA 92807
   1. Approved equal by El Rey Stucco, Sto, or LaHabra

B. Colorants for Job-Mixed Finish Coats: Colorfast mineral pigments that produce finish plaster color to match approved mock-up.

C. Water: potable

D. Sand Aggregate: ASTM C 897.

E. Exposed Aggregates for Finish Coats: Basis of Design: Aged Limestone by Parex.

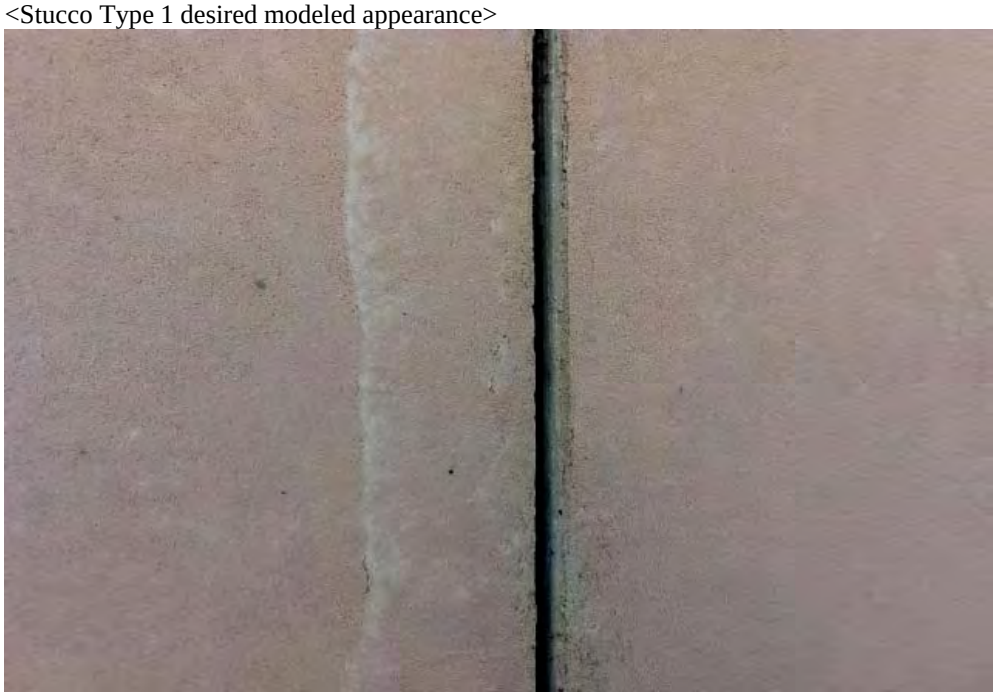
F. Fiber-reinforced Portland Cement Stucco Basecoat: Manufacturer's standard factory formulated, concentrate scratch and brown stucco basecoats consisting of Portland cement, lime, fibers, and other ingredients proprietary to manufacturer.
   1. Basis of Design : Parex Fiber-47® Concentrate

G. Primer and Surface Conditioner : Consisting of acrylic polymers and design for use over fully cured brown coats prior to the application of acrylic finish coats. To be tinted to the finish coat color, prior to the application of the finish coat
   1. Basis of Design : Parex Tintable primer

H. Skim Coat and fiberglass mesh for embedment
   1. Level Coat: Copolymer based, factory blend of cement and proprietary ingredients requiring addition of water.
   2. Secondary Fiberglass Mesh Reinforcement: A 4.5 oz mesh that has been treated for alkali resistance. To be embedded into the surface of the brown coat while it is still wet, or embedded into a skim coat applied over the fully cured brown coat

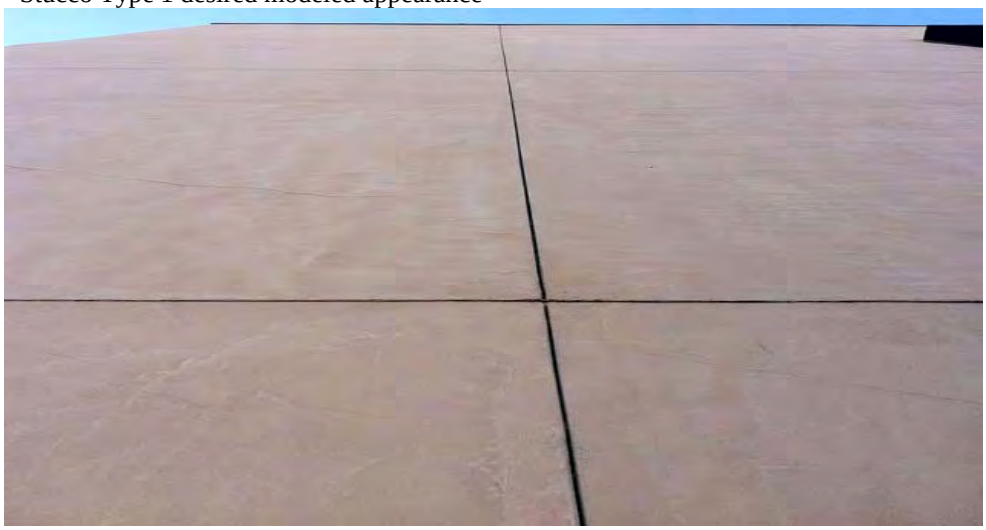
I. Finish coat, Acrylic Modified Cement Based Tinted Stucco Finish stucco finish coat, consisting of Portland Cement Acrylic Polymers, properly graded aggregate, colorant and other ingredients proprietary to manufacturer.
   1. Basis of Design : Parex, Select Finish Aged Limestone
   2. Colorant: To be applied over cured and dried finish coats in order to match approved samples.
   3. Texture and Color:
      a. Stucco Type 1
         1) Texture : Santa Barbara : see images below for desired appearance
         2) Color: Use colorant in finish coat as provided by Manufacturer and as selected by architect from full range of standard colors. Add colorant to achieve modeled appearance.

<Stucco Type 1 desired modeled appearance>



<Stucco Type 1 desired modeled appearance>

<Stucco Type 1 desired modeled appearance>



<Stucco Type 1 desired modeled appearance>

b. Stucco Type 2

1) Texture : heavily textured, see images below for desired appearance.

a) At contractor's option, either skip-trowel apply heavy texture or spray apply with Tommy Gun or similar equipment. This texture shall be heavier than

what is typically known as “heavy dash” and not as consistent. Suggest using 3/8” aggregate.

b) If applied by trowel, same applicator must apply all areas of Stucco Type 2 to ensure consistent appearance.

2) Color : Use colorant in finish coat as provided by Manufacturer and as selected by architect from full range of standard colors.

<Stucco Type 2 desired heavy texture appearance>

c. Stucco Type 3

1) Texture : Smooth

2) Color : Use colorant in finish coat as provided by Manufacturer and as selected by architect from full range of standard colors to achieve charcoal gray appearance.

J. Graffiti Resistance Sealer – Apply after 30 days and stucco is fully cured

1. One component, non sacrificial anti graffiti coating.
2. Products:
   a. For Exterior application only
      1) Block Guard and Grafitti Control by ProSoCo
      2) Apply to all Stucco Types eight feet above grade or less as indicated on drawings.

2.5 PLASTER MIXES

A. General: Comply with ASTM C 926 for applications indicated.

1. (Included in premixed basecoat concentrates).

B. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows: Follow printed instructions on bags for sand and water quantities.

1. Apply scratch coat to a thickness of 3/8 inch using sufficient trowel pressure or spray velocity to key stucco into lath or onto direct bond substrate.
2. Scratch horizontally and in order to provide for a key with the brown coat
3. Brown Coat: Install over scratch coat at a minimum thickness of 3/8”, then Darby, rod and float.

4. Float or lightly broom surface to provide bond with cement stucco finish coat, or trowel smooth in preparation for acrylic finish coat
5. Wet cure: Thoroughly wet cure scratch and brown coats by keeping materials moist by misting with water for two days. Air cure an additional 5-7 days, before application of leveling coat.
6. Level coat and Fiberglass mesh embedment: Mix and install the leveling coat materials at thickness required and in order to achieve complete coverage over brown coat.
7. While the leveling coat is still wet, embed the fiberglass mesh taking care to over lap all edges 3-4” and seams 2-3”. Remove all loose materials and wrinkles etc..

C. Factory formulated finish coats
1. Portland Cement Based Finish add water and acrylic admixture according to directions on bag. No other admixtures are allowed.
2. Acrylic Modified, Cement Based Finishes: Mix additives and water into powder mix according to instructions written on bag. No other additives are allowed.

D. Factory-Prepared Finish-Coat Mixes: Cement based, acrylic modified finishes, comply with manufacturer's written instructions.
1. Trowel, spray or pump apply cement based finish coat(s) over leveling coat in a number of coats and consistency to match approved samples in both color and texture.
2. Apply exterior wall finish coat to thickness recommended by manufacturer to achieve texture indicated, using sufficient trowel pressure or spray velocity to bond finish coat to basecoat
3. Apply exterior wall finish in number of coats and consistency required to achieve texture to match approved sample

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

B. Prepare solid substrates for plaster that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

3.3 INSTALLATION, GENERAL

A. Install fluid applied weather resistive barrier, sheet good barrier and flashing system in compliance with requirements.

B. Insulation board: install framing as shown on Documents, install insulation before installing lath, install foam tape onto framing for thermal resistance as shown on Drawings.

C. Installing Metal Lath:
1. Install according to ASTM C 1063
2. Flat-Ceiling and Horizontal Framing: Install 3/8-inch welded-wire lath

3. Install tight utilizing approved fasteners, properly secured, and that all accessories are properly set and secured

D. Isolation : Frame both sides of expansion and control joints separately and do not bridge joints with furring or lath

E. Examine substrates, grounds and accessories to insure that finished stucco work will be true to line, plane, level and plumb

F. Sealant: Seal joints between edges of plasterwork and abutting construction with sealant.

3.4 INSTALLING ACCESSORIES

A. Install according to ASTM C 1063 and at locations indicated on Drawings.

B. Reinforcement for External Corners:
1. Install lath-type, external-corner reinforcement at exterior locations.
2. Install cornerbead at exterior locations.

C. Control Joints: Install control joints at locations indicated on Drawings
1. As required to delineate plasterwork into areas (panels) according to the Stucco Types shown on drawings

3.5 PLASTER APPLICATION

A. General: Comply with ASTM C 926.
1. Do not deviate more than plus or minus 1/4 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed on surface.
2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Mixing: Mix products in accordance with manufacturer’s recommendations

C. Walls; Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork: 3/4-inch thickness.
1. Portland cement mixes.

D. Ceilings; Base-Coat Mix: Scratch coat for two-coat plasterwork,
1. Stucco Type 3

E. Color Wash Application on Finish Coat (for Stucco Type 1 ONLY): apply color wash gel in accordance with manufacturer’s instructions and in number of coats and consistency to match approved samples.
1. Dilute product concentrate to achieve desired appearance. Recommended dilution ratio is 1 part concentrate to 4 parts distilled, de-ionized or reverse osmosis water.
   a. Decreased dilution ratio (amount of water): increases color intensity and opacity.
   b. Increased dilution ratio : decreases color intensity and opacity.
2. Apply color wash to large areas via an airless paint sprayer using 65-70 pounds of pressure and a #13 tip. Use a pump sprayer, sea sponge or paintbrush for touchup or smaller areas.
   a. moisten entire wall surface to receive color wash with fog spray of clear water.
   b. Remove or mask fixtures and areas that are not to receive color wash

3. Ensure the surface is clean and dry. Remove loose particles, and efflorescence. Follow manufacturer's recommendations and instructions. Consult manufacturer before application and attend instruction class.
4. The ideal temperature for application is 70 degrees, but the range can be as low as 45 and as much as 90 degrees. Humidity slows drying time and its best to not apply paint in direct sunlight if temperatures are extremely high

F. Curing: Moist cure cement base coats with a fog spray of clear water with sufficiently frequent applications to maintain stucco uniformly moist for a minimum of 48 hours following applications. Allow an additional 5 days of air curing before the application of any primers or finish coats.
1. Air Cure acrylic finish coats only, do not wet cure

G. Cleaning
1. Patching : Repair damaged exterior wall finish coat to match surrounding finish
2. Clean up : Remove excess finish and protective materials from adjacent surfaces

H. Provide protection of installed stucco from dust, dirt, precipitation, and freezing during installation

I. Provide protection of installed finish from dust, dirt, precipitation, freezing and continuous high humidity until fully cured and dry

3.6 INSTALLING NON-SACRIFICIAL GRAFITTI RESISTANCE COATINGS

A. Exterior Application
1. Perform Rylem Tube test prior to and after mock-up of exterior coatings. More than one coat may be required if test fails

3.7 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.8 PROTECTION

A. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 092400

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Agreement and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Interior gypsum board.
   2. Exterior gypsum board for ceilings and soffits.
   3. Textured finishes.

B. Related Requirements:
   1. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
   2. Division 09 Section "Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Sustainability Submittals:
   1. Product Data:
      a. For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
      b. For adhesives used to laminate gypsum board panels to substrates, documentation including printed statement of VOC content.
   2. Certificates: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.
      a. Include statement indicating location of manufacturer and distance to Project for each regionally manufactured material.

C. Samples: For the following products:
   1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.
   2. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

1.4 QUALITY ASSURANCE

A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Install mockups for the following:
      a. Each level of gypsum board finish indicated for use in exposed locations.
      b. Each texture finish indicated.

2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Low Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 GYPSUM BOARD, GENERAL

A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 5% percent.

B. Regional Materials: Gypsum panel products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

C. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X: ASTM C 1396/C 1396M.
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered.

B. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
   1. Thickness: 1/2 inch.
   2. Long Edges: Tapered.

C. Abuse-Resistant Gypsum Board: ASTM C 1629/C 1629M, Level 2.
   1. Core: [5/8 inch, Type X.
   2. Long Edges: Tapered.
   3. Mold Resistance: ASTM D 3273, score of 10.

D. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
   1. Core: 5/8 inch, Type X.
   2. Long Edges: Tapered.
   3. Mold Resistance: ASTM D 3273, score of 10.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
   2. Shapes:
      a. Cornerbead.
      b. Bullnose bead.
      c. LC-Bead: J-shaped; exposed long flange receives joint compound.
      d. L-Bead: L-shaped; exposed long flange receives joint compound.
      e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
      f. Expansion (control) joint.
      g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
   1. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
   2. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
   1. Interior Gypsum Board: Paper.
   2. Exterior Gypsum Soffit Board: Paper.
   3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
   4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, and damaged surface areas, use setting-type taping compound.

2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
   a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
1. Laminating adhesive shall have a VOC content of 50g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
2. Recycled Content of Blankets: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

E. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Acoustical joint sealant shall have a VOC content of 250g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc., except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board, refer to wall types on Drawings.

B. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
      b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
   3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
   4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners unless otherwise indicated.
2. Bullnose Bead: Use where indicated.
3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where indicated.
5. U-Bead: Use at exposed panel edges.
6. Curved-Edge Cornerbead: Use at curved openings.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 3: Where indicated on Drawings.
4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
    a. Primer and its application to surfaces are specified in other Division 09 Sections.

5. Level 5: Where indicated on Drawings, and at walls indicated to receive dry erase coating.
   a. Primer and its application to surfaces are specified in other Division 09 Sections.

3.6 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093000 - TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

B. Ceramic tile.
   1. Waterproof membrane.
   2. Crack isolation membrane.
   3. Tile backing panels.
   4. Metal edge strips.

C. Related Sections:
   1. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028 "Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method:"
   1. Level Surfaces: Minimum 0.6.
   2. Step Treads: Minimum 0.6.
   3. Ramp Surfaces: Minimum 0.8.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:
   1. Credit IEQ 4.1: Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standard.

C. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

D. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

E. Samples for Verification:
   1. Full-size units of each type and composition of tile and for each color and finish required.
   2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than 4 tiles. Use grout of type and in color or colors approved for completed Work.
   3. Full-size units of each type of trim and accessory for each color and finish required.
   4. Metal edge strips in 6-inch lengths.

1.6 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.

B. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

D. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
   1. Waterproof membrane.
   2. Crack isolation membrane.
   3. Joint sealants.
   4. Cementitious backer units.
   5. Metal edge strips.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup of each type of floor tile installation.
   2. Build mockup of each type of wall tile installation.
   3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Preinstallation Conference: Conduct conference at Project site.

G. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

C. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. Provide tile complying with Standard grade requirements unless otherwise indicated.

C. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

A. Tile Type CT1, CT2, CT3: Factory-mounted glazed ceramic mosaic tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Schedule for Finishes section 090600 or comparable product acceptable to the Architect.
2. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
   a. Base Cove.
   b. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose.
   c. External Corners for Thin-Set Mortar Installations: Surface bullnose.
   d. Internal Corners: Field-butted square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.

2.3 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, in maximum lengths available to minimize end-to-end butt joints.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. C-Cure; C-Cure Board 990.
      b. Custom Building Products; Wonderboard.
      c. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
      d. USG Corporation; DUROCK Cement Board.

   2. Thickness: 1/2 inch.

2.4 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANES FOR THIN-SET TILE INSTALLATIONS

A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Polyethylene-Sheet Product: Polyethylene faced on both sides with fleece webbing for adhering to latex-portland cement mortar; 39 inches wide by 0.008-inch nominal thickness.
   1. Product: Schluter Systems L.P.; KERDI.

C. Corrugated-Polyethylene Product: Corrugated polyethylene with dovetail-shaped corrugations for adhering to latex-portland cement mortar and with anchoring webbing on the underside; 39 inches wide by 3/16-inch nominal thickness.
   1. Product: Schluter Systems L.P.; DITRA.

2.5 SETTING AND GROUTING MATERIALS

A. Manufacturers:
   1. Atlas Minerals & Chemicals, Inc.
   2. Boiardi Products Corporation.
   3. Bostik.
   4. C-Cure.
   5. Custom Building Products.
   6. DAP, Inc.
   7. Jamo Inc.
   8. LATICRETE International Inc.
   9. MAPEI Corporation.
   10. Pro Spec.
   11. Southern Grouts & Mortars, Inc.
   12. Summitville Tiles, Inc.

13. TEC Specialty Products Inc.

B. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4 "Specifications for Latex-Portland Cement Mortar," consisting of the following:
   1. Prepackaged dry-mortar mix containing dry, redispersible, ethylene vinyl acetate additive to which only water must be added at Project site.

C. Chemical-Resistant, Water-Cleanable, Tile-Grouting Epoxy: ANSI A118.3 "Specifications for Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive."
   1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F and 212 deg F, respectively, and certified by manufacturer for intended use.

D. Polymer-Modified Tile Grout: ANSI A118.7 "Specifications for Polymer Modified Cement Grouts for Tile Installation," color as indicated.
   1. Polymer Type: Ethylene vinyl acetate, in dry, redispersible form, prepackaged with other dry ingredients.

2.6 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 07 Section "Joint Sealants."

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: As specified in Division 07 Section "Joint Sealants."

D. One-Part, Pourable Urethane Sealant for Use T: As specified in Division 07 Section "Joint Sealants."

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Schluter Scheine, aluminum, 4 and 6 mm.

C. Grout Sealer: Manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.
   1. Products:
      a. Bostik; CeramaSeal Grout Sealer.
      b. C-Cure; Penetrating Sealer 978.
      c. Jamo Inc.; Penetrating Sealer.
      d. MAPEI Corporation; KER 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.
      e. Pro Spec; Grout Sealer.
      f. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
      g. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.
      h. TEC Specialty Products Inc.; TA-256 Penetrating Silicone Grout Sealer.

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

B. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
   1. Verify that concrete substrates for tile floors installed with thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
      a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
      b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

C. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
   1. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

B. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
   1. Tile floors composed of rib-backed tiles.

C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

F. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
   1. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
   2. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

I. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
   1. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

K. Metal Edge Strips: Install where tile abuts carpet and resilient flooring.

L. Grout Sealer: Apply grout sealer to cementitious grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 TILE BACKING PANEL INSTALLATION

A. Install cementitious backer units and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.5 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.6 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.7 FLOOR TILE INSTALLATION

A. General: Install tile to comply with TCNA installation method F-113 and ANSI A108 Series of tile installation standards.
   1. Include crack-suppression membrane.

B. Joint Widths: Install tile on floors with the following joint widths:
   1. Ceramic Mosaic Tile: 1/16 inch.

3.8 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with TCNA installation method W-244 and ANSI setting-bed standards.

B. Install metal lath and scratch coat for walls to comply with ANSI A108.1A, Section 4.1.

C. Joint Widths: Install tile on walls with the following joint widths:
   1. Ceramic Mosaic Tile: 1/16 inch.

3.9 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

B. Remove epoxy and latex-portland cement grout residue from tile as soon as possible.
   1. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
   2. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

C. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

D. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

E. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 093000

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Resilient base.
   2. Resilient molding accessories.

B. Related Sections:
   1. Division 01 Section "Sustainable Design Requirements" for additional Leadership in Energy & Environmental Design (LEED) requirements.
   2. Division 09 Section "Schedule for Finishes" for resilient base product.
   3. Division 09 Section "Linoleum Flooring" for linoleum floor coverings.
   4. Division 09 Section "Resilient Tile Flooring" for resilient floor tile.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:
   1. Credit IEQ 4.1: Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standard.
   2. Credit IEQ 4.4: Submit product data or other published information verifying that hard surface flooring meets testing and product requirements of FloorScore. Flooring products covered by FloorScore include vinyl, linoleum, laminate flooring, wood flooring, ceramic flooring, rubber flooring, and wall base.

C. Samples: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

1.04 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM International (ASTM) E 648 or National Fire Protection Association (NFPA) 253 "Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source," by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Mockups: Provide resilient products with mockups specified in other Sections.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.06 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F , in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

1.07 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.01 GENERAL

A. Adhesives and Sealants applied on site within the weather proofing exterior in this section must comply with South Coast Air Quality Management District Rule 1168 OR Green Seal Standard GS-36. Refer to LEED Specification 01 81 13 for specific VOC requirements.

2.02 RESILIENT BASE

A. Manufacturers: Subject to compliance with requirements, provide the products scheduled in Division 09 Section "Schedule for Finishes" or a comparable product by one of the following:
1. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
2. Flexco, Inc.
3. Johnsonite.

B. Resilient Base Standard: ASTM F 1861 "Standard Specification for Resilient Wall Base."
1. Material Requirement: Type TS (rubber, vulcanized thermoset).
2. Manufacturing Method: Group I (solid, homogeneous).
3. Style: Cove (base with toe.

C. Minimum Thickness: 0.125 inch.

D. Height: 4 inches.

E. Outside Corners: Job formed or preformed.

F. Inside Corners: Job formed or preformed.

G. Finish: As selected by Architect from manufacturer's full range.

H. Colors and Patterns: As selected by Architect from full range of industry colors.

2.03 RESILIENT MOLDING ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
2. Flexco, Inc.
3. Johnsonite.
4. Roppe Corporation, USA.

B. Description:
1. Carpet edge for glue-down applications.
2. Reducer strip for resilient floor covering.

3. Joiner for resilient flooring and carpet and transition strips.

C. Material: Rubber.

D. Colors and Patterns: As selected by Architect from full range of industry colors.

2.04 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710 "Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring."
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
   4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
      b. Perform relative humidity test using in situ probes, ASTM F 2170 "Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes." Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.
   1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.03 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Layout base material to provide minimum number of joints with no strip less than 24 inches in length (for wall segments longer than 24 inches).
   1. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
   2. Locate joints as remote from corners as the material lengths or wall configuration will permit.

C. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
   2. Inside Corners: Use straight pieces of maximum lengths possible.

3.04 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

3.05 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

3.06 CONSTRUCTION WASTE MANAGEMENT

A. Manage construction waste in accordance with provisions of Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 096513

SECTION 096516.13 - LINOLEUM FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Agreement and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes linoleum sheet flooring.

B. Related Sections:
   1. Division 09 Section "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with linoleum floor covering.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Submittals:
   1. Credit MR 4: Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).
   2. Credit IEQ 4.1: Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standard.
   3. Credit IEQ 4.4: Submit product data or other published information verifying that hard surface flooring meets testing and product requirements of FloorScore. Flooring products covered by FloorScore include vinyl, linoleum, laminate flooring, wood flooring, ceramic flooring, rubber flooring, and wall base.

C. Shop Drawings: For each type of floor covering. Include floor covering layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   1. Show details of special patterns.

D. Samples for Initial Selection: For each type of floor covering indicated.
   1. Include similar Samples of installation accessories involving color selection.

E. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch sections of each color and pattern of floor covering required.
   1. Heat-Welding Bead: Include manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

F. Heat-Welded Seam Samples: For each floor covering product and welding bead color and pattern combination required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to rigid backing and prepared by Installer for this Project.

G. Product Schedule: For floor covering. Use same designations indicated on Drawings.

H. Maintenance Data: For each type of floor covering to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor covering installation.
   1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.

B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store floor coverings and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 65 deg F or more than 90 deg F.
   1. Floor Tile: Store on flat surfaces.
   2. Sheet Flooring: Store rolls upright.

1.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor coverings during the following time periods:
   1. 72 hours before installation.
   2. During installation.
   3. 72 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 72 hours after floor covering installation.

E. Install floor coverings after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Sheet Flooring: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each color, pattern, and type of sheet flooring installed.

PART 2 - PRODUCTS

2.1 GENERAL

A. Building materials in this section must have post- and/or pre-consumer recycled content by weight of total product.

B. Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standards.

2.2 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated in Division 09 Section "Schedule of Finishes" or Forbo Flooring, Inc.

2.3 LINOLEUM FLOOR COVERING

A. Sheet Flooring: ASTM F 2034, Type I, linoleum sheet with backing.
   1. Roll Size: In manufacturer's standard length by not less than 78 inches wide.

B. Seaming Method: Heat welded.

C. Thickness: 0.08 inch.

D. Colors and Patterns: As indicated in Division 09 "Schedule of Finishes".

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit products and substrate conditions indicated.
   1. Use adhesives that have a VOC content of not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Heat-Welding Bead: Solid-strand product of linoleum floor covering manufacturer.
   1. As selected by Architect from manufacturer's full range to contrast with linoleum floor covering

D. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor coverings.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of floor coverings.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with floor covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
    a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor coverings until they are same temperature as space where they are to be installed.
1. Move floor coverings and installation materials into spaces where they will be installed at least 72 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.

3.3 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions for installing floor coverings.

B. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

C. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.

D. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on subfloor. Use chalk or other nonpermanent marking device.

E. Install floor coverings on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of floor covering installed on covers and adjoining floor covering. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.

F. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

G. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.

3.4 LINOLEUM SHEET FLOORING INSTALLATION

A. Unroll sheet floorings and allow them to stabilize before cutting and fitting.

B. Lay out sheet floorings as follows:

1. Maintain uniformity of floor covering direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor covering substrates.
3. Match edges of floor coverings for color shading at seams.
4. Avoid cross seams.
5. Eliminate deformations that result from hanging method used during drying process (stove bar marks).

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor coverings.

B. Perform the following operations immediately after completing floor covering installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor coverings before applying liquid floor polish.
   1. Apply two coat(s).

E. After allowing drying room film (yellow film caused by linseed oil oxidation) to disappear, cover floor coverings until Substantial Completion.

END OF SECTION 096516.13

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Solid vinyl floor tile.
   2. Rubber floor tile.
   3. Vinyl composition tile.

B. Related Sections:
   1. Division 09 Section "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.
   2. Division 09 Section "Resilient Sheet Flooring" for resilient sheet floor coverings.
   3. Division 09 Section "Linoleum Flooring" for linoleum floor coverings.
   4. Division 09 Section "Static-Control Resilient Flooring" for resilient floor coverings designed to control electrostatic discharge.
   5. Division 09 Section "Resilient Athletic Flooring" for resilient floor coverings for use in athletic-activity or support areas.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:
   1. Credit IEQ 4.1: Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standard.
   2. Credit IEQ 4.4: Submit product data or other published information verifying that hard surface flooring meets testing and product requirements of FloorScore. Flooring products covered by FloorScore include vinyl, linoleum, laminate flooring, wood flooring, ceramic flooring, rubber flooring, and wall base.

C. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   1. Show details of special patterns.

D. Samples for Initial Selection: For each type of floor tile indicated.

E. Samples for Verification: Full-size units of each color and pattern of floor tile required.
   1. For heat-welding bead, manufacturer's standard-size Samples, but not less than [9 inches] <Insert dimension> long, of each color required.

F. Seam Samples: For seamless-installation technique indicated and for each flooring product, color, and pattern required; with seam running lengthwise and in center of [**6-by-9-inch**] <**Insert size**> Sample applied to a rigid backing and prepared by Installer for this Project.

G. Product Schedule: For floor tile. Use same designations indicated on Drawings.

H. Qualification Data: For qualified Installer.

I. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
   1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.

B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.1 GENERAL

A. Adhesives and Sealants applied on site within the weather proofing exterior in this section must comply with South Coast Air Quality Management District Rule 1168 OR Green Seal Standard GS-36. Refer to LEED Specification 01 81 13 for specific VOC requirements.

2.2 SOLID VINYL FLOOR TILE (VFT1-5)

A. Products: Subject to compliance with requirements, provide the following or equivalent by Roppe, Johnsonite, or Armstrong:
   1. LSI Floors/Bolyu Solids Tile, 12 x 12

B. Tile Standard: ASTM F 1700.
   1. Class: As indicated by product designations.
   2. Type: Type A, smooth surface.

C. Thickness: 1/8".

D. Size: 12 by 12 inches.

E. Seaming Method: Standard.

F. Colors and Patterns: As selected by Architect and shown in Division 09 Section "Schedule for Finishes."

2.3 RUBBER FLOOR TILE (RR1-5)

A. Products: Subject to compliance with requirements, provide the following or equivalent by Armstrong or Johnsonite:
   1. Roppe Corporation, USA; Smooth Finish Rubber Floor tile in colors specified Division 09 Section "Schedule for Finishes." Vulcanized Homogeneous Rubber Tile.

B. Tile Standard: ASTM F 1344, Class I-A, homogeneous rubber tile, solid color.

C. Hardness: Manufacturer's standard hardness.

D. Wearing Surface: Smooth.

E. Size: 12 x 12 inches (pattern shown in 24 x 24 groupings of 4).

F. Seaming Method: Standard

G. Colors and Patterns: As selected by Architect shown in Schedule of Finishes.

2.4 VINYL COMPOSITION FLOOR TILE (BBT1)

A. Products: Subject to compliance with requirements, provide the following or equivalent by Johnsonite or Roppe:
   1. Armstrong World Industries, Inc.; MIGRATIONS™ with BioStride BioBased Tile™ Flooring

B. Wearing Surface: Smooth.

C. Thickness: 0.125 inch**.**

D. Size: 12 by 12 inches.

E. Colors and Patterns: As selected by Architect as listed Division 09 Section "Schedule for Finishes."

2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.
   1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
      a. VCT and Asphalt Tile Adhesives: Not more than 50 g/L.
      b. Rubber Floor Adhesives: Not more than 60 g/L.

C. Seamless-Installation Accessories:
   1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
      a. Color: [Match floor tile]
   2. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.
      a. Use chemical-bonding compound that has a VOC content of 350 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Extensive surface preparation is required over substrates from which existing products have been removed. Requirements vary among manufacturers. Insert requirements to suit Project.

B. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

C. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
    a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.

D. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.

E. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

F. Do not install floor tiles until they are same temperature as space where they are to be installed.
1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

G. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
1. Lay tiles in pattern indicated in drawings.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
1. Lay tiles in random pattern indicated in drawings.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

I. Seamless Installation:
   1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.
   2. Chemically Bonded Seams: Bond seams with chemical-bonding compound to permanently fuse sections into a seamless floor covering. Prepare seams and apply compound to produce tightly fitted seams without gaps, overlays, or excess bonding compound on floor covering surfaces.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.

B. Perform the following operations immediately after completing floor tile installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.
   1. Apply three coats.

E. Joint Sealant: Apply sealant to resilient terrazzo floor tile perimeter and around columns, at door frames, and at other joints and penetrations.

F. Sealers and Finish Coats: Remove soil, visible adhesive, and surface blemishes from resilient terrazzo floor tile surfaces before applying liquid cleaners, sealers, and finish products.
   1. Sealer: Apply two base coats of liquid sealer.
   2. Finish: Apply three coats of liquid floor finish.

G. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096536 - STATIC-CONTROL RESILIENT FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Conductive, solid vinyl floor tile.

B. Related Sections:
   1. Division 09 Section "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with static-control resilient floor coverings.

1.3 PERFORMANCE REQUIREMENTS

A. Conductive Properties: Provide floor coverings with static-control properties indicated as determined by testing identical products per test method indicated by an independent testing and inspecting agency.
   1. Electrical Resistance: Test per ASTM F 150 with 500-V applied voltage.
      a. Average greater than 25,000 ohms and less than 1 megohm when test specimens and installed floor coverings are tested surface to surface (point to point).
      b. Average no less than 25,000 ohms with no single measurement less than 10,000 ohms when installed floor coverings are tested surface to ground.
   2. Static Generation: Less than 100 V when tested per AATCC-134 at 20 percent relative humidity with conductive footwear.
   3. Static Decay: 5000 to 0 V in less than 0.03 seconds when tested per FED-STD-101C/4046.1.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittal:
   1. Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standards.

C. Shop Drawings: For each type of floor covering. Include floor covering layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   1. Show details of special patterns.
   2. Submit grounding diagram showing location of grounding strips and connections.

D. Samples for Initial Selection: For each type of floor covering indicated.

E. Samples for Verification: For each type of floor covering indicated and of size indicated below:
   1. Floor Tile: Full-size units.

F. Product Schedule: For floor covering. Use same designations indicated on Drawings.

G. Maintenance Data: For each type of floor covering to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor covering installation indicated.
   1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.

B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

C. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to static-control resilient floor coverings including, but not limited to, the following:
      a. Examination and preparation of substrates to receive floor covering.
      b. Installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store floor coverings and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer but not less than 50 deg F or more than 90 deg F.
   1. Floor Tile: Store on flat surfaces.

1.7 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive floor coverings during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

E. Install floor coverings after other finishing operations, including painting, have been completed.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.1 GENERAL

A. Adhesives and Sealants applied on site within the weather proofing exterior in this section must comply with South Coast Air Quality Management District Rule 1168 OR Green Seal Standard GS-36. Refer to LEED Specification 01 81 13 for specific VOC requirements.

2.2 CONDUCTIVE RESILIENT FLOOR COVERINGS

A. Conductive, Solid Vinyl Floor Tile SR1: ASTM F 1700, Class I (monolithic), Type A (smooth surface).
   1. Products: Subject to compliance with requirements, provide the following or equivalent by Johnsonite or Armstrong.
      a. Roppe Corporation, USA; Conductive Tile ESD static control vinyl flooring.
   2. Thickness: In manufacturer's standard thickness, 1/8” inch.
   3. Seaming Method: Standard.
   4. Colors and Patterns: Safety Yellow 760.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Static-Control Adhesive: Provided or approved by manufacturer; type that maintains electrical continuity of floor covering system to ground connection.

C. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR, Subpart D (EPA Method 24):
   1. VCT and Asphalt Tile Adhesives: Not more than 50 g/L.

D. Grounding Strips: Provided or approved by manufacturer; type and size that maintains electrical continuity of floor covering system to ground connection.

E. Maintenance Floor Tiles: Special floor tiles inscribed "Conductive floor. Do not wax."

F. Floor Polish: Provide protective, static-control liquid floor polish products as recommended by floor covering manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer and manufacturer's representative present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion or static-control characteristics of floor coverings.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions and with oversight by manufacturer's representative to ensure adhesion of floor coverings and electrical continuity of floor covering systems.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with floor covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
   4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
      b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.

C. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.

D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

E. Do not install floor coverings until they are same temperature as space where they are to be installed.
   1. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

F. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.

3.3 INSTALLATION, GENERAL

A. Install static-control resilient floor covering according to manufacturer's written instructions and with oversight by manufacturer's representative.

B. Embed grounding strips in static-control adhesive. Extend grounding strips beyond perimeter of static-control resilient floor covering surfaces to ground connections.

C. Scribe, cut, and fit floor coverings to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

D. Extend floor coverings into toe spaces, door reveals, closets, and similar openings. Extend floor covering to center of door openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

F. Install floor coverings on covers for telephone and electrical ducts, and similar items in installation areas. Maintain overall continuity of color and pattern with pieces of floor coverings installed on covers. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.

G. Adhere floor coverings to substrates using a full spread of static-control adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

H. Seamless Installation:
   1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.
   2. Chemically Bonded Seams: Bond seams with chemical-bonding compound to permanently fuse sections into a seamless floor covering. Prepare seams and apply compound to produce tightly fitted seams without gaps, overlays, or excess bonding compound on floor covering surfaces.

3.4 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so floor tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half floor tile at perimeter.
   1. Lay floor tiles square with room axis.

C. Match floor tiles for color and pattern by selecting floor tiles from cartons in same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed floor tiles.
   1. Lay static-dissipative, vinyl composition floor tiles with grain running in one direction.

D. In each space where conductive, solid vinyl floor tile is installed, install maintenance floor tile identifying conductive floor tile in location approved by Architect.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor coverings.

B. Perform the following operations immediately after completing floor covering installation:
   1. Remove static-control adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
   1. Do not wax static-control resilient floor coverings.
   2. If recommended in writing by manufacturer, apply protective static-control floor polish formulated to maintain or enhance floor covering's electrical properties to floor covering surfaces that are free from soil, static-control adhesive, and surface blemishes.
      a. Verify that both floor polish and its application method are approved by manufacturer and that floor polish will not leave an insulating film that reduces floor coverings' effectiveness for static control.

D. Cover floor coverings until Substantial Completion.

END OF SECTION 096536

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Agreement and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes modular, carpet tile.

B. Related Requirements:
   1. Division 09 Section "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.
   1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
      a. Review delivery, storage, and handling procedures.
      b. Review ambient conditions and ventilation procedures.
      c. Review subfloor preparation procedures.

1.4 SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
   2. Include installation recommendations for each type of substrate.

B. Sustainability Submittals:
   1. Product Data:
      a. Submit product data or other published information verifying the carpet meets the testing and product requirements of the Carpet and Rug Institute's Green Label Plus program, the carpet cushion meets the testing and product requirements of the Carpet and Rug Institute's Green Label program, and that the VOC (Volatile Organic Compound) content of carpet adhesive is less than or equal to 50 g/L.
      b. Sustainability: Provide the Statement of the Achievement Level the carpet has attained for Silver, 37 to 51 points, based on specific Sustainable Attribute Performance for all product stages according to ANSI/NSF 140.

C. Shop Drawings: Show the following:
   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
   2. Carpet tile type, color, and dye lot.
   3. Type of subfloor.
   4. Type of installation.
   5. Pattern of installation.
   6. Pattern type, location, and direction.
   7. Pile direction.
   8. Type, color, and location of insets and borders.

9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

D. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.

E. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

F. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
1. Build mockups at locations and in sizes shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.8 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.9 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, loss of face fiber, and delamination.
   3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL

A. Carpet in this section must meet the requirements of the Carpet and Rug Institute's Green Label Plus program. Carpet cushion in this section must meet the requirements of the Carpet and Rug Institute Green Label program. Refer to LEED Specification 01 81 13 for specific VOC requirements.

2.2 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated in Division 09 "Schedule of Finishes."

2.3 CARPET TILE

A. Products: Subject to compliance with requirements, provide products as indicated in Division 09 Section "Schedules for Finishes," and complies with the following:
   1. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.
   2. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.
   3. Emissions: Provide carpet tile that complies with testing and product requirements of CRI's "Green Label Plus" program.

2.4 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, non-staining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
   1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Resilient Edge/Transition Strips: Extruded aluminum as specified in Division 09 Section "Resilient Base and Accessories."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
   1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
   2. Subfloor finishes comply with requirements specified in Division 03 Section "Cast-in-Place Concrete" for slabs receiving carpet tile.
   3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel as indicated.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
   2. Remove yarns that protrude from carpet tile surface.
   3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 09 69 00 - ACCESS FLOORING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Access-flooring panels.
   2. Understructure.

B. Related Requirements:
   1. Division 01 Section "Sustainable Design Requirements" for additional Leadership in Energy & Environmental Design (LEED) requirements.
   2. Division 09 Sections for finish flooring applied over access-flooring panels.
   3. Division 26 Section "Grounding and Bonding for Electrical Systems" for connection to ground of access-flooring understructure.

1.03 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide access-flooring systems capable of complying with the following performance requirements according to testing procedures in CISCA's "Recommended Test Procedures for Access Floors":
   1. Concentrated Loads: 1250 lbf with the following deflection and permanent set:
      a. Top-Surface Deflection: 0.10 inch.
      b. Permanent Set: 0.010 inch.
   2. Rolling Loads: With local or overall deformation not to exceed 0.040 inch.
      a. CISCA Wheel 1: 10 passes at 1000 lbf.
      b. CISCA Wheel 2: 10,000 passes at 800 lbf.
   3. Pedestal Axial Load Test: 5000 lbf.
   4. Pedestal Overturning Moment Test: 1000 lbf x inches.
   5. Uniform Load Test: 400 lbf/sq. ft. with a maximum top-surface deflection not to exceed 0.040 inch and a permanent set not to exceed 0.010 inch.
   6. Drop Impact Load Test: 150 lb.

B. Fire Performance:
   1. Surface-Burning Characteristics: Comply with ASTM International (ASTM) E 84 "Standard Test Method for Surface Burning Characteristics of Building Materials;" testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 25or less.
      b. Smoke-Developed Index: 450 or less.
   2. Combustion Characteristics: ASTM E 136 "Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C."

1.04 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include layout of access-flooring system and relationship to adjoining Work based on field-verified dimensions.

1. Details and sections with descriptive notes indicating materials, finishes, fasteners, typical and special edge conditions, accessories, and understructures.

C. Samples:
1. Exposed Metal Accessories: Approximately 10 inches in length.
2. One complete full-size floor panel, pedestal, and understructure unit for each type of access-flooring system required.

D. LEED Submittals:
1. Credit MR 4: Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).
2. Credit IEQ 4.1: Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standard.

E. Preconstruction Test Reports: For preconstruction adhesive field test.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Preconstruction Adhesive Field Test: Before installing pedestals, field test their adhesion to subfloor surfaces by doing the following:
1. In areas representative of each subfloor surface, set typical pedestal assemblies in same adhesive and use methods required for the completed Work.
2. Allow test installation to cure for manufacturer's recommended cure time, with a pressure of 25 lbf applied vertically to pedestals during this period.
3. After curing, apply lateral load against a straight steel bar inserted 2 inches into pedestal stems. Measure the force needed to cause adhesive failure of pedestal base.
4. Remove and discard failed pedestals, and clean pedestals of adhered residue.
5. Proceed with installation only after tests show compliance with performance requirement specified for pedestals' capability to resist overturning moment.

C. Source Limitations: Obtain access-flooring system from single source from single manufacturer.

D. Preinstallation Conference: Conduct conference at Project site.
1. Review connection with mechanical and electrical systems.
2. Review requirements related to sealing the plenum.
3. Review procedures for keeping underfloor space clean.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not install access flooring until spaces are enclosed, subfloor has been sealed, ambient temperature is between 50 and 90 deg F, and relative humidity is not less than 20 and not more than 70 percent.

PART 2 - PRODUCTS

2.01 GENERAL

A. Building materials in this section must have post- and/or pre-consumer recycled content by weight of total product.

B. Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standards.

C. Basis-of-Design Products: The design is based on the product[**s**] named. Reference Division 01 Section "Product Requirements" for Basis-of-Design product definition and requirements for proposing products comparable to the Basis-of-Design.

2.02 FLOOR PANELS

A. Floor Panels, General: Provide modular panels interchangeable with other field panels without disturbing adjacent panels or understructure.
1. Size: Nominal [**24 by 24 inches**] <**Insert dimensions**>.
2. Attachment to Understructure: [**Bolted**] [**By gravity**].
3. One-to-One Carpet Tile: Fabricate panels to accept one-to-one carpet tile.

B. Cementitious-Core Steel Panels: Fabricated from cold-rolled steel sheet, with the die-cut flat top sheet and die-formed and stiffened bottom pan welded together, and with metal surfaces protected against corrosion by manufacturer's standard factory-applied finish. Fully grout internal spaces of completed units with manufacturer's standard cementitious fill.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Haworth, Inc.
b. Tate Access Floors, Inc.

2.03 UNDERSTRUCTURE

A. Pedestals: Assembly consisting of base, column with provisions for height adjustment, and head (cap); made of steel.
1. Provide pedestals designed for use in seismic applications.
2. Base: Square or circular base with not less than 16 sq. in. of bearing area.
3. Column: Of height required to bring finished floor to elevations indicated. Weld to base plate.
4. Provide vibration-proof leveling mechanism for making and holding fine adjustments in height over a range of not less than 2 inches and for locking at a selected height, so deliberate action is required to change height setting and prevent vibratory displacement.
5. Head: Designed to support the panel system indicated.
a. Provide sound-deadening pads or gaskets at contact points between heads and panels.
b. Bolted Assemblies: Provide head with four holes aligned with holes in floor panels for bolting of panels to pedestals.

2.04 FABRICATION

A. Fabrication Tolerances:
1. Size: Plus or minus 0.020 inch of required size.
2. Squareness: Plus or minus 0.015 inch between diagonal measurements across top of panel.
3. Flatness: Plus or minus 0.035 inch, measured on a diagonal on top of panel.

B. Panel Markings: Clearly and permanently mark floor panels on their underside with panel type and concentrated-load rating.

C. Bolted Panels: Provide panels with holes drilled in corners to align precisely with threaded holes in pedestal heads and to accept countersunk screws with heads flush with top of panel.
1. Captive Fasteners: Provide fasteners held captive to panels.

D. Cutouts: Fabricate cutouts in floor panels for cable penetrations and service outlets. Provide reinforcement or additional support, if needed, to make panels with cutouts comply with structural performance requirements.
1. Grommets: Where indicated, fit cutouts with manufacturer's standard grommets; or, if size of cutouts exceeds maximum grommet size available, trim edge of cutouts with

manufacturer's standard plastic molding with tapered top flange. Furnish removable covers for grommets.

2. Provide foam-rubber pads for sealing annular space formed in cutouts by cables.

2.05 ACCESSORIES

A. Adhesives: Manufacturer's standard VOC compliant adhesive for bonding pedestal bases to subfloor.

B. Service Outlets: Standard UL-listed and -labeled assemblies, for recessed mounting flush with top of floor panels; for power, communication, and signal services; and complying with the following requirements:

1. Structural Performance: Cover capable of supporting a 1000-lbf concentrated load.
2. Cover and Box Type: Hinged polycarbonate cover with opening for passage of cables when cover is closed and including frame and steel box or formed-steel plate for mounting electrical receptacles.
3. Location: In center of panel quadrant unless otherwise indicated.
4. Receptacles and Wiring: Electrical receptacles and wiring for service outlets are specified in Division 26 Sections.
5. Response Characteristics: Classified 94V-0 according to UL 94.

C. Panel Lifting Device: Panel manufacturer's standard portable lifting device for each type of panel required.

D. Perimeter Support: Where indicated, provide manufacturer's standard method for supporting panel edge and forming transition between access flooring and adjoining floor coverings at same level as access flooring.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer and manufacturer's representative present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, foreign deposits, and debris that might interfere with attachment of pedestals.
2. Verify that concrete floor sealer and finish have been applied and cured.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Lay out floor panel installation to keep the number of cut panels at floor perimeter to a minimum. Avoid using panels cut to less than 6 inches.

B. Locate each pedestal, complete any necessary subfloor preparation, and vacuum subfloor to remove dust, dirt, and construction debris before beginning installation.

3.03 INSTALLATION

A. Install access-flooring system and accessories under supervision of access-flooring manufacturer's authorized representative to produce a rigid, firm installation that complies with performance requirements and is free of instability, rocking, rattles, and squeaks.

B. Adhesive Attachment of Pedestals: Set pedestals in adhesive, according to access-flooring manufacturer's written instructions, to provide full bearing of pedestal base on subfloor.

C. Adjust pedestals to permit top of installed panels to be set flat, level, and to proper height.

D. Install flooring panels securely in place, properly seated with panel edges flush. Do not force panels into place.

E. Scribe perimeter panels to provide a close fit with adjoining construction with no voids greater than 1/8 inch where panels abut vertical surfaces.
   1. To prevent dusting, seal cut edges of steel-encapsulated, wood-core panels with sealer recommended in writing by panel manufacturer.

F. Cut and trim access flooring and perform other dirt-or-debris-producing activities at a remote location or as required to prevent contamination of subfloor under already-installed access flooring.

G. Grounded Flooring Access Panel Systems: Ground flooring system as recommended by manufacturer and as needed to comply with performance requirements for electrical resistance of floor coverings.
   1. Panel-to-Understructure Resistance: Not more than 10 ohms as measured without floor coverings.

H. Clean dust, dirt, and construction debris caused by floor installation, and vacuum subfloor area as installation of floor panels proceeds.

I. Install access flooring without change in elevation between adjacent panels and within the following tolerances:
   1. Plus or minus 1/16 inch in any 10-foot distance.
   2. Plus or minus 1/8 inch from a level plane over entire access-flooring area.

3.04 PROTECTION

A. Prohibit traffic on access flooring for 24 hours and removal of floor panels for 72 hours after installation to allow pedestal adhesive to set.

B. After completing installation, vacuum access flooring and cover with continuous sheets of reinforced paper or plastic. Maintain protective covering until time of Substantial Completion.

C. Replace access-flooring panels that are stained, scratched, or otherwise damaged or that do not comply with specified requirements.

3.05 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 096900

SECTION 098400 - ACOUSTICAL ROOM COMPONENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Agreement and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following:
   1. Acoustical ceiling tiles.
   2. Acoustical fabric wrapped panels.
   3. Fixed sound-absorptive panels.
   4. Acrylic panels.
   5. Suspension systems.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices.

1.3 PREINSTALLATION MEETINGS

A. Pre installation Conference: Conduct conference at Project site.

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Submittals:
   1. Product Data:
      a. For products having recycled content, documentation indicating percentages by weight of postconsumer and pre consumer recycled content. Include statement indicating costs for each product having recycled content.
      b. For sealants, documentation including printed statement of VOC content.

C. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
   1. Acoustical Ceiling Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
   2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.
   3. Panel Edge: 12-inch- long Sample(s) showing each edge profile, corner, and finish.
   4. Core Material: 12-inch-) square Sample at corner.
   5. Mounting Devices: Full-size Samples.
   6. Assembled Panels: Approximately 36 by 36 inches, including joints and mounting methods.

1.5 SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which suspension systems will be attached.
3. Size and location of initial access modules for acoustical panels.
4. Items penetrating finished ceiling including the following:
   a. Lighting fixtures.
   b. Air outlets and inlets.
   c. Speakers.
   d. Sprinklers.
   e. Access panels.
5. Perimeter moldings.

B. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Each Type of Panels: Full-size panels equal to 2 percent of quantity installed.
   2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
   3. Hold-Down Clips: Equal to 2 percent of quantity installed.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
   1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
   2. Smoke-Developed Index: 50 or less.

C. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ACOUSTICAL PANELS, GENERAL

A. Low-Emitting Materials: Acoustical panel ceilings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Source Limitations: Obtain each type from single source from single manufacturer.

C. Recycled Content: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

D. Acoustical Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance unless otherwise indicated.
   1. Mounting Method for Measuring NRC for Acoustical Ceiling Tile: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.
   2. Sound-Absorbing Ceiling Units: Provide sound-absorbing, and sound-reflecting panels that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
   1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL CEILING TILES (ACT-1)

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by USG Corporation: Eclipse ClimaPlus Panels Item Number: 788975 or equal by Armstrong.

B. Classification: Provide fire-resistance-rated panels complying with ASTM E 1264 for type, form, and pattern as follows:
   1. Type and Form: Type III, Form 1 and 2
   2. Pattern: E, I

3. Surface Burning Characteristics: Class A, Flame Spread: 25, Smoke Developed: 50
4. Color: White.
5. LR: Not less than 0.90
6. NRC: Not less than 0.95
7. AC: Not less than 180
8. Edge/Joint Detail: Tegular.
9. Thickness: 3/4 inches
10. Modular Size: As indicated in a schedule.

C. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 ACOUSTICAL FABRIC WRAPPED PANELS (ACP-1)

A. Basis-of-Design Product: Subject to compliance with requirements, provide A100 Series Acoustical Panels as manufactured by Wall Technology, Inc an Owens Corning Company.

B. Classification: Provide fire-resistance-rated panels complying the following:
1. Thickness:
   a. Wall: 1 inch.
2. Acoustical Performance: Sound absorption NRC: 0.90
3. Core: Dimensionally stable 6-7 PCF fiberglass board with chemically hardened edge protection.
4. Edge Detail: Resin hardened
5. Square Corners: Tailor corners
6. Facing Material:
   a. Knoll Textiles (FB1) Soliloquy, KT Collection, K1458/8
      1) Color: Citrus
7. Size: As indicated.

C. Accessories: Furnish all required attachments.

D. Attachment for Fabric Covered and Painted Panels (ACP- 1):
1. Mounting Devices: Concealed on back of unit, recommended by manufacturer to support weight of unit.

E. Attachment for Painted Panels (ACP- 2):
1. Mounting Devices: Concealed on back of unit, recommended by manufacturer to support weight of unit.

2.5 FIXED SOUND ABSORPTIVE PANELS (AP1-5)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc. Soundscapes Shapes Acoustical Clouds or equivalent. See Schedule for Finishes for colors and sizes.
1. Acoustical Cloud Units:
   a. Surface Texture: Smooth.
   b. Composition: Fiberglass.
   c. Surface finish: DuraBrite acoustically transparent membrane on front and edges.
   d. Color: See Schedule for Finishes.
   e. Shapes: See Schedule for Finishes.
   f. Thickness: 7/8 inch.

g. Edge Detail: Square edge.
h. Flame Spread: (ASTM E 84), Class A.
i. Light Reflectance: (LR): (ASTM E 1477), White: 0.90.
j. Acoustical Absorption: (ASTM C423), White: Minimum 1.17 Sabins/sf; Colors: Minimum 1.00 Sabins/sf.
k. Recycle Content: Minimum 35%.

2. Attachment Systems:
   a. Installation hardware kits for direct attachment to drywall:
      1) 5454 – Panel Hook Kit.
      2) 7006 – Escutcheon Kit.

2.6 ACRYLIC PANELS

A. Translucent acrylic sheet; ASTM D 4802, Category B-1 (continuously manufactured), Finish 1 (smooth or polished), Type UVF (UV filtering).
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Altuglas International, Division of Arkema Inc.; Plexiglas MC.
      b. Evonik Industries, a subsidiary of Degussa Corporation; Acrylite FF.
      c. Lucite International; Lucite CP.
      d. Plaskolite, Inc.; Optix.
   2. Nominal Thickness: 0.236 inch.
   3. Color: As selected by Architect from manufacturer's full range.
   4. Combustibility Class: CC2.
   5. Provide safety glazing labeling.

2.7 METAL SUSPENSION SYSTEMS FOR ACT-1

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by USG Corporation: "DONN® Fineline 1/8" DXFF 9/16", color Flat White #050, or equal by Armstrong.

B. Suspension System Components:
   1. Main Tees: UL Classified Intermediate Duty Classification; Double-web design; 1-25/32" high; rectangular top bulb; 5/16" deep x 9/16" wide bottom face with center recessed section nominal 1/8"; cross tee holes and hanger wire holes at 6" o.c.; mitered intersections 12" o.c. (or 48" o.c. with 4' x 4' ceiling panel); integral reversible splices.

C. Cross Tees :
   1. 1-25/32" high; roll-formed into double-web design with rectangular bulb; 5/16" deep x 9/16" wide bottom face with center recessed section nominal 1/8"; high tensile steel end clips clenched to web.
   2. Main tees and cross tees shall be positively locked, yet shall be removable without the use of tools.
      a. Accessories:
         1) Wall Molding: Angle shape; 1" mounting flange by 9/16" face flange; hemmed edges; exposed surface pre-finished to match suspension system components.
         2) Inside Corner: Field-mitered joints at wall molding.
         3) Outside Corner: Prefabricated corner cap; formed to 90° angle; hemmed edge; size and finish to match wall molding.
         4) Shadow Molding: Formed steel section; exposed surfaces to match suspension system components.
            a) MS174: 9/16" exposed flange; 3/8" x 3/8" reveal; 1" mounting flange.
            b) MS274: -1/4" exposed flange; 3/4" x 9/32" reveal; 7/8" mounting flange.

D. Miter Closure Clip: steel; 2" x 1/8" x 7/16"; for Fineline Suspension System

E. Molding Attachment Clip: 2 ½" x 1 5/8"; for Fineline Suspension System
   1. Product: MAC2.
   2. Used to attach cross tees and main tees to walls/ wall molding.

H. T-Bolt: 7/16" x 5/8" head, 1" x 1/4" -20NC bolt; for Fineline Suspension System.
   1. Product: TB1.
   2. Used to bolt-attach partitions, signage, or pendant-mounted indirect lighting.

I. Partition Attachment Clip: 3" x 5/16" x 9/16"; for Fineline Suspension System.
   1. Product: PAC1.
   2. Snap fit clip, prefinished to match suspension system components.
   3. Utilize TEK S/2 fastener, #6-20 x 3/8.

J. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

K. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
   1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
      a. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.

L. Wire Hangers, Braces, and Ties: Manufacturers standard.

M. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.

N. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

O. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place.

P. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.

Q. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
   1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
   2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
   3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.7 ACOUSTICAL SEALANT

R. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
   2. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant.
   3. Acoustical sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which panel attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION OF ACOUSTICAL CEILING TILES

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
   1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
   4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
   5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the

structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange directionally patterned acoustical panels as indicated on reflected ceiling plans.
2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
4. Install clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.
5. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 INSTALLATION OF ACOUSTICAL FABRIC WRAPPED PANELS

A. Install ceiling units in locations indicated with edges in alignment with walls and other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with ceiling unit manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

C. Align fabric pattern and grain with adjacent units.

D. Clip loose threads; remove pills and extraneous materials.

3.5 INSTALLATION OF ACRYLIC PANELS

A. Install acrylic panels as indicated on Drawings.

3.6 CLEANING

A. Clean exposed surfaces of panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 098400

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following exterior substrates:
   1. Concrete.
   2. Steel.
   3. Galvanized metal.
   4. Exterior gypsum board.

B. Related Sections include the following:
   1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
   2. Division 08 Sections for factory priming windows and doors with primers specified in this Section.
   3. Division 09 Section "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Product List: For each product indicated, include the following:
   1. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 QUALITY ASSURANCE

A. MPI Standards:
   1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
   2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on benchmark samples.
      a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
   1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Colors: As selected by Architect from manufacturer's full range.

PART 3 - PRODUCTS

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Concrete: 12 percent.
   2. Plaster: 12 percent.
   3. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

C. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

D. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

E. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

F. Wood Substrates:
   1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
   2. Sand surfaces that will be exposed to view, and dust off.
   3. Prime edges, ends, faces, undersides, and backsides of wood.
   4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:
   1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.

2. Testing agency will perform tests for compliance of paint materials with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces and Traffic Surfaces:
   1. Water-Based Clear Sealer System: MPI EXT 3.2H.
      a. Prime Coat: Interior/exterior clear sealer and concrete floor sealer (water based).
      b. Intermediate Coat: Interior/exterior clear sealer concrete floor sealer (water based).
      c. Topcoat: Interior/exterior clear sealer and concrete floor sealer (water based).

B. Steel Substrates:
   1. Alkyd System: MPI EXT 5.1D.
      a. Prime Coat: Alkyd anticorrosive metal primer.
      b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
      c. Topcoat: Exterior alkyd enamel semigloss.

C. Galvanized-Metal Substrates:
   1. Latex Over Water-Based Primer System: MPI EXT 5.3H.
      a. Prime Coat: Waterborne galvanized-metal primer.
      b. Intermediate Coat: Exterior latex matching topcoat.
      c. Topcoat: Exterior latex semigloss.

D. Exterior Gypsum Board Substrates:
   1. Latex System: MPI EXT 9.2A.
      a. Prime Coat: Exterior latex matching topcoat.
      b. Intermediate Coat: Exterior latex matching topcoat.
      c. Topcoat: Exterior latex semigloss.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following interior substrates:
   1. Steel.
      a. Hollow metal doors and frames
      b. Exposed steel beams and columns
      c. Exposed metal decking
      d. Metal stairs
   2. Wood.
   3. Gypsum board.
   4. Cotton or canvas insulation covering.
   5. ASJ insulation covering.
   6. Concrete slab below raised access floor.

B. Related Sections include the following:
   1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
   2. Division 08 Sections for factory priming windows and doors with primers specified in this Section.
   3. Division 09 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

1.3 DEFINITIONS

A. Gloss Level 1: A traditional matte finish-flat. Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 2: A high side sheen flat-a ‘velvet like’ finish. Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 3: A traditional ‘eggshell-like’ finish. 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level 4: A ‘satin-like’ finish. 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. Gloss Level 5: A traditional semi-gloss. 35 to 70 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 6: A traditional gloss. 70 to 85 units at 60 degrees, according to ASTM D 523.

G. Gloss Level 7: A high gloss. More than 85 units at 60 degrees, according to ASTM D 523.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.
1. Submit Samples on rigid backing, 8 inches square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:
1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

E. LEED Submittal:
1. Product Data for Credit EQ 4.2: For paints, including printed statement of VOC content and chemical components.

1.5 QUALITY ASSURANCE

A. MPI Standards:
1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
   a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft.
   b. Other Items: Architect will designate items or areas required.
2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
3. Final approval of color selections will be based on benchmark samples.
   a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
   1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Benjamin Moore & Co.
   2. Kwal-Howells Paint.

2.2 PAINT, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
   1. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
   2. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
   3. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
   4. Floor Coatings: VOC not more than 100 g/L.
   5. Shellacs, Clear: VOC not more than 730 g/L.
   6. Shellacs, Pigmented: VOC not more than 550 g/L.
   7. Flat Topcoat Paints: VOC content of not more than 50 g/L.
   8. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
   9. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
   10. Floor Coatings: VOC not more than 100 g/L.
   11. Shellacs, Clear: VOC not more than 730 g/L.
   12. Shellacs, Pigmented: VOC not more than 550 g/L.

13. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
14. Dry-Fog Coatings: VOC content of not more than 400 g/L.
15. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
16. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.

C. Low- Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.

D. Colors: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
2. Wood: 15 percent.
3. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

G. Wood Substrates:
1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

H. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

I. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.
1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:
1. Mechanical Work:
    a. Uninsulated metal piping.
    b. Uninsulated plastic piping.
    c. Pipe hangers and supports.
    d. Tanks that do not have factory-applied final finishes.
    e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
    f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
2. Electrical Work:
    a. Switchgear.
    b. Panelboards.
    c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

3.4 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:
   1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
   2. Testing agency will perform tests for compliance with product requirements.
   3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:
   1. Location: Concrete slabs below raised access flooring.
   2. Manufacturer: Prosco or approved equal.
   3. Product: Consolideck LS, Lithium Silicate.

B. Concrete Substrates, Traffic Surfaces:
   1. Water-Based Clear Sealer System: MPI INT 3.2G.
      a. First Coat: Interior/exterior clear concrete floor sealer MPI #99.
      b. Topcoat: Interior/exterior clear concrete floor sealer MPI #99.

C. Steel Substrates: Latex over Alkyd Primer System:
   1. includes the following:
      a. Hollow metal doors and frames.
      b. Exposed steel columns and beams.
      c. Exposed metal deck.
      d. Metal stairs.
      e. Exposed steel counter supports.
   2. Latex over Alkyd Primer System
      a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79 or primer, alkyd, quick dry, for metal, MPI #76.
      b. Prime Coat: Shop primer specified in Division 05 Section where substrate is specified.
      c. Intermediate Coat: Latex, interior, matching topcoat.

d. Topcoat: Latex, interior, (Gloss Level 4-satin), MPI #43.

D. Wood Substrates:
1. Latex Paint System:
a. Prime Coat: Primer sealer, latex, interior wood, MPI #39.
b. Intermediate Coat: Latex, interior, matching top coat.
c. Topcoat: latex, interior, (Gloss Level 4- satin), MPI #43.

E. Gypsum Board Substrates:
1. Latex System: MPI INT 9.2A.
a. Prime Coat: Primer sealer, Interior latex, MPI #50.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex (gloss Level 4-satin), MPI #43.

F. Cotton or Canvas and ASJ Insulation-Covering Substrates:
1. Latex System: MPI INT 10.1A.
a. Prime Coat: Primer sealer Interior latex, MPI #50.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex, semi- gloss, (Gloss Level 5), MPI #54.

END OF SECTION 099123

SECTION 101400 – SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following types of signs:
1. 1.00 - ADA Pictorial Room Identifier
2. 2 00 - ADA Room Identifier
3. 3.00 - ADA Emergency Elevator Sign
4. 4.00 - Plot Cut Vinyl Wayfinding
5. 5.00 - Plot Cut Vinyl Custom
6. 6.00 - Flat Cut Metal Letters
7. 7.00 - iLight LED Letters
8. 9.00 - Dry Erase Reserve Board
9. 10.01 - No Smoking Line Spray Paint Stencil
10. 10.02 - Sand Blasted Donor Names (NOT IN CONTRACT)
11. 11.00 - End Range Vinyl Section Identifier (NOT IN CONTRACT)
12. 12.00 - End Range Shelf Identifier (NOT IN CONTRACT)

B. Related Sections include the following:
1. Division 01 Section "Temporary Facilities and Controls" for temporary Project identification signs and for temporary information and directional signs.
2. Division 14 Section "Hydraulic Elevator" for code-required elevator signage.
3. Division 22 Section "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
4. Division 23 Section "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
5. Division 26 Sections for electrical service and connections for illuminated signs.
6. Division 26 Section "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.
7. Division 26 Section "Interior Lighting" for illuminated Exit signs.

1.3 DEFINITIONS

A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include details of construction relative to materials, dimensions of individual components, profiles and finishes.

B. Shop Drawings: Show fabrication and installation details for signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories and installation details.
   1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
   2. Provide message list, typestyles, and graphic elements, including tactile characters and Braille, and layout for each sign.
   3. For signs supported by or anchored to permanent construction, provide setting drawings, templates and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.

C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:
   1. Non-Glare acrylic stock (clear, opaque and frosted).
   2. Die-cut vinyl characters, copy and graphic symbols.
   3. Vinyl (printed, frosted, specified)

D. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:
   1. Acrylic stock: (6) six inches x (6) six inches for each thickness required.
   2. Vinyl: (6) six inches x (6) six inches for each color required.
   3. Accessories: Manufacturer's full-size unit.
   4. ADA: Full size mock up of each sign type including, paint, Braille, ADA.
   5. Dimensional letters

E. Sign Schedule: Use same designations indicated on Drawings.

F. Qualification Data: For installer.

G. Maintenance Data: For signs to include in maintenance manuals.

H. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

D. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines] and ICC/ANSI A117.1.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic
   1. Build mockup of typical wall area as shown on Drawings.
   2. Field testing shall be performed on mockups according to requirements in "Field Quality Control Article.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial.
   5. ADA: Full size mock up of each sign type including, paint, Braille, letters and pictorial.

6. Vinyl: Full-scale letter for each color required.
7. Inserts: Full-scale mock of for each color required

F. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.

1.7 COORDINATION

A. Coordinate placement of anchorage devices with templates for installing signs.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Deterioration of polymer finishes beyond normal weathering.
b. Deterioration of embedded graphic image colors and sign lamination.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TYPES

A. 1: ADA Pictorial Room identification plaque (interior unframed ADA room identifier signs). Tactile and Braille Sign must follow manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
- Material: .125” thick, non-glare, clear acrylic sheet.
- Raised-Copy Thickness: Not less than 1/32 inch.
- Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch above, .
- Font: Gotham, Regular, 5/8” high.
- Font color: high contrast to the back paint of panel, selected by Designer from manufacturer’s full range of options.
- Size: REFERENCE DRAWINGS
- Colors: selected by Designer from manufacturer’s full range of options.
- Mounting: Unframed.
  - Wall mounted with two-face tape.
  - Manufacturer's standard anchors for substrates encountered.
- Copy: REFERENCE SIGN SCHEDULE ON DRAWINGS.
- Art: provided by Designer, individual sign layout provided by Contractor, reviewed and approved by Designer.

B. 2: ADA Room Identification plaque (interior unframed room identifier signs). Tactile and Braille Sign must follow manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
   - Material: .125" thick, non-glare, clear acrylic sheet.
   - Raised-Copy Thickness: Not less than 1/32 inch.
   - Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch above, .
   - Font: Gotham, Regular, 5/8" high.
   - Font color: high contrast to the back paint of panel, selected by Designer from manufacturer's full range of options.
   - Size: REFERENCE DRAWINGS
   - Colors: selected by Designer from manufacturer's full range of options.
   - Mounting: Unframed.
     - Wall mounted with two-face tape.
     - Manufacturer's standard anchors for substrates encountered.
   - Copy: REFERENCE SIGN SCHEDULE ON DRAWINGS.
   - Art: provided by Designer, individual sign layout provided by Contractor, reviewed and approved by Designer.

C. 3: ADA Emergency Elevator plaque (interior unframed room identifier signs). Tactile and Braille Sign must follow manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
   - Material: .125" thick, non-glare, clear acrylic sheet.
   - Raised-Copy Thickness: Not less than 1/32 inch.
   - Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch above, .
   - Font: Gotham, Regular, 5/8" high.
   - Font color: high contrast to the back paint of panel, selected by Designer from manufacturer's full range of options.
   - Size: REFERENCE DRAWINGS
   - Colors: selected by Designer from manufacturer's full range of options.
   - Mounting: Unframed.
     - Wall mounted with two-face tape.
     - Manufacturer's standard anchors for substrates encountered.
   - Copy: REFERENCE SIGN SCHEDULE.
   - Art: provided by Designer, individual sign layout provided by Contractor, reviewed and approved by Designer.

D. 4: Plot Cut Vinyl Wayfinding.
   - Font Size: 6" letters.
   - Font: Gotham Book ALL CAPS.
   - Material: 3M IJ162 Adhesive Vinyl, matte laminated, plot cut, RTA.
   - Color: selected by Designer from manufacturer's full range of options.
   - Art: provided by Contractor, reviewed and approved by Designer.

E. 5: Plot Cut Vinyl Custom
   - Size: REFERENCE DRAWINGS.
   - Interior Application Material: 3M IJ162 Adhesive Vinyl, matte laminated, plot cut, RTA.
   - Exterior Application Material: 3M High Performing Adhesive Vinyl, matte laminated, plot cut, RTA.
   - Color: selected by Designer from manufacturer's full range of options.
   - Art: provided by Designer.

F. 6: Flat Cut Metal Letters
- Size: 18 inch high 1/8” thick.
- Font: Gotham Book ALL CAPS.
- Material: aluminum.
- Finish: powder coated natural satin.
- Art: provided by Contractor, reviewed and approved by Designer.

G. 7: iLight LED letters
- Size: REFERENCE DRAWINGS.
- Basis of Design: Plexineon Color Series by iLight Technologies 118 South Clinton, Suite 370 • Chicago, IL 60661 • T 312.876.8630.
- Color: Up to six different colors may be used as selected by Designer from manufacturer’s full range of options.
- Art: provided by Designer.

H. 9: Dry Erase Reserve Board
- Size: REFERENCE DRAWINGS.
- Material: no frame, magnetic dry erase board with custom graphic.
- Graphic: REFERENCE DRAWINGS.
- Art: provided by Designer.

I. 10.01: No Smoking Line Spray Paint Stencil
- Size: REFERENCE DRAWINGS.
- Type: single overlay.
- Material: router cut acrylic stencil.
- Art: provided by Designer.

J. 10.02: Sand Blasted Donor Names (NOT IN CONTRACT)
- Size: REFERENCE DRAWINGS.
- Art: provided by designer.

K. 11: End Range Vinyl Section Identifier (NOT IN CONTRACT)
- Size: REFERENCE DRAWINGS.
- Material: 3M IJ162 Adhesive Vinyl, matte laminated, plot cut, RTA.
- Copy: REFERENCE DRAWINGS.
- Art: REFERENCE DRAWINGS.

L. 12: End Range Shelf Identifier (NOT IN CONTRACT)
- Size: REFERENCE DRAWINGS.
- Material: basic matte paper with full color coverage solvent ink print.
- Color: REFERENCE DRAWINGS.
- Art: REFERENCE DRAWINGS.

2.2 SCHEDULE - REFERENCE DRAWINGS

2.3 MATERIALS

A. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing), non-glare surface exposed to view. Varying thicknesses, see drawings.
1. Transparent sheet: where indicated as “clear” provide colorless sheet with light transmittance of 93%, ASTM D1003, in matte finish, unless otherwise indicated.
2. White translucent sheet: where indicated as “white” provide white translucent sheet of density required to produce uniform brightness and minimum halation effects.

3. Opaque sheet: where indicated as “opaque” provide colored opaque acrylic sheet in colors and finishes indicated, or if not indicated, as selected from manufacture’s standards.

B. Laminated, Etched Photopolymer: Tactile Characters and Grade 2 Braille raised 1/32 inch above.

C. Vinyl film: 3M IJ162 and 3M High Performing, Adhesive Vinyl, matte laminated, plot cut, RTA, nominal thickness of 3 mils with pressure-sensitive adhesive backing. Apply vinyl to exposed face of panel sign, glass, doors and wall surfaces depending upon application.

D. Flat Cut Aluminum Letters: Powder Coated Natural Satin finish.

2.4 ACCESSORIES

A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.5 FABRICATION

A. General: Provide manufacturer's standard signs of configurations indicated.
1. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
2. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
3. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items, including anchor inserts, are sized and located to accommodate signs.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Locate signs and accessories where shown or scheduled, using mounting methods of types described and complying with manufacturer's written instructions.
   1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
   2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
   1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
   2. Shim or Cleat Mounting: Concealed aluminum plates with countersunk holes.
   3. Signs Mounted on Glass: Provide matching opaque plate on opposite side of glass to conceal mounting materials.

C. Metal Letters: Mount metal letters and numbers using standard fastening methods recommended by manufacturer for letter form, type of mounting and condition of exposure indicated. Isolate aluminum surfaces from steel surfaces to prevent electrolytic action as recommended by the manufacture for conditions indicated. Provide heavy weight paper templates to establish letter spacing and to locate holes for fasteners.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 101400

SECTION 102113 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Solid-polymer toilet compartments configured as toilet enclosures and urinal screens.

B. Related Sections:
   1. Division 10 Section "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:
   1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating costs for each product having recycled content.
   2. Product Data for Credit EQ 4.4: For particleboard, documentation indicating that product contains no urea formaldehyde.

C. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.

D. Samples for Initial Selection: For each type of unit indicated. Include Samples of hardware and accessories involving material and color selection.

E. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
   1. Each type of material, color, and finish required for units, prepared on 6-inch- square Samples of same thickness and material indicated for Work.
   2. Each type of hardware and accessory.

F. Product Certificates.

G. Maintenance Data.

1.4 QUALITY ASSURANCE

A. Comply with requirements in GSA's CID-A-A-60003, "Partitions, Toilets, Complete."

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

C. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for toilet compartments designated as accessible.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 COMPOSITE WOOD & AGRIFIBER PRODUCTS. (EQc4.4):

A. Composite wood, agrifiber products, and laminating adhesives must contain no added urea-formaldehyde resins.

2.2 MATERIALS

A. Zamac: ASTM B 86, commercial zinc-alloy die castings.

2.3 SOLID-POLYMER UNITS

Keynotes: 10.20, 10.21, 20.22, 10.23; layouts as indicated on Drawings.

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Yemm & Hart LTD
2. Or Approved Equal.

B. Toilet-Enclosure Style: Floor mounted, overhead braced.

C. Urinal-Screen Style: Wall hung.

D. Door, Panel**,** Screen, and Pilaster Construction: Solid,high-density polyethylene (HDPE**)** panel material, not less than 1 inchthick, seamless, with eased edges, no-sightline system, and with homogenous color and pattern throughout thickness of material.
1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
2. Polymer Panel Finish: One color and pattern in each room
3. Color and Pattern: As selected by architect from manufacturer’s full range.

E. Pilaster Shoes: Manufacturer's standard design; stainless steel.

F. Brackets (Fittings):
1. Full-Height (Continuous) Type: Manufacturer's standard design; extruded brite-anodized type 6463T5 aluminum.

2.4 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
   1. Material: Chrome-plated zamac
   2. Hinges: Manufacturer's standard continuous, cam type that swings to a closed or partially open position
   3. Latch and Keeper: Manufacturer's standard recessed latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
   4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
   5. Door Bumper: Manufacturer's standard heavy chrome=plated Zamac.
   6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

2.5 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Door Size and Swings: Unless otherwise indicated, provide 24-inchwide, in-swinging doors for standard toilet compartments and 36-inch wide, in-swinging doors with a minimum 32-inchwide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
   1. Maximum Clearances:
      a. Pilasters and Panels: 1/2 inch
      b. Panels and Walls: 3/4 inch
   2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.
      a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
      b. Align brackets at pilasters with brackets at walls.

B. Secure to raised floor and walls with tamper-resistant Torx screws and conical plastic anchors. Provide 2x6 wood blocking for fastening partitions to drywall and raised floor construction.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113

SECTION 102226 - OPERABLE PARTITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Manually operated, acoustical panel partitions.

B. Related Sections:
   1. Division 08 Section "Door Hardware" for hardware to the extent not specified in this Section.
   2. Division 09 Section "Gypsum Board" for fire-rated assemblies and sound barrier construction above the ceiling at track.

1.3 DEFINITIONS

A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

B. Glass and Glazing Definitions: See Division 08 Section "Glazing."

C. NIC: Noise Isolation Class.

D. NRC: Noise Reduction Coefficient.

E. STC: Sound Transmission Class.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design operable panel partitions, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Seismic Performance: Operable panel partitions shall withstand the effects of earthquake motions determined according to SEI/ASCE 7

C. The term "withstand" means "the panels will remain in place without separation of any parts from the system when subjected to the seismic forces specified."

D. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:

E. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E 90, determined by ASTM E 413, and rated for not less than the STC indicated.

1. Noise-Reduction Requirements: Operable panel partition assembly, identical to partition tested for STC, tested for sound-absorption performance according to ASTM C 423, and rated for not less than the NRC indicated.
2. Acoustical Performance Requirements: Installed operable panel partition assembly, identical to partition tested for STC, tested for NIC according to ASTM E 336, determined by ASTM E 413, and rated for 52 STC

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:
1. Credit MR 4: Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).
2. Credit IEQ 4.4 - Low Emitting Materials - Composite Wood and Agrifiber Products: For each type of product indicated, including associated laminating adhesive if applicable, submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standard.
3. Certificates for Credit MR 7: Chain-of-custody certificates certifying that operable panel partitions comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
4. Product Data for Credit EQ 4.4: For each composite wood product used in operable panel partitions, documentation indicating that product contains no urea formaldehyde.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Indicate storage and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.

D. Samples for Verification: For each type of exposed material, finish, covering, or facing indicated.

E. Delegated-Design Submittal: For operable panel partitions indicated to comply with performance requirements, including analysis data and calculations signed and sealed by the qualified professional engineer responsible for their preparation.

F. Design Calculations: Calculate requirements for seismic restraints.

G. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

H. Setting Drawings: For embedded items and cutouts required in other work, including support-beam, mounting-hole template.

I. Qualification Data: For qualified Installer and testing agency.

J. Seismic Qualification Certificates: For operable panel partitions**,** accessories, and components, from manufacturer.

K. Product Certificates: For each type of operable panel partition, from manufacturer.

L. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each operable panel partition.

M. Field quality-control reports.

N. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

O. Warranty: Sample of special warranty.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified according to Division 01 Section "Quality Requirements" for testing indicated.

C. Fire-Test-Response Characteristics: Provide panels with finishes meeting one of the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

D. Surface-Burning Characteristics: As determined by testing per ASTM E 84.
   1. Flame-Spread Index: 25 or less
   2. Smoke-Developed Index: 450 or less.

E. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265.

F. Preinstallation Conference: Conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of operable panel partition openings by field measurements before fabrication.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.

B. Failures include, but are not limited to, the following:
   a. Faulty operation of operable panel partitions.
   b. Deterioration of metals, metal finishes, and other materials beyond normal wear.

C. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL

A. Building materials in this section must have post- and/or pre-consumer recycled content by weight of total product.

B. Building materials in this section must be FSC certified.

C. Composite wood, agrifiber products, and laminating adhesives must contain no added urea-formaldehyde resins.

2.2 MATERIALS

A. Steel Frame: Steel sheet, manufacturer's standard thickness for uncoated steel.

B. Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard nominal minimum thickness for uncoated steel.

C. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use, corrosion resistance, and finish indicated; ASTM B 221 for extrusions; manufacturer's standard strengths and thicknesses for type of use.

D. Frame Reinforcement: Manufacturer's standard steel or aluminum.

E. Gypsum Board: ASTM C 36/C 36M.

F. Plywood: DOC PS 1.

2.3 OPERABLE ACOUSTICAL PANELS

A. Operable Acoustical Panels: Operable acoustical panel partition system, including panels, seals, finish facing, suspension system, operators, and accessories.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Acousti-Seal #932 Series as manufactured by Modernfold Inc, a Dorma Group Company or comparable product by one of the following:
      a. Hufcor.
      b. Panelfold Inc.

B. Panel Operation: Manually operated, paired.

C. Panel Construction: Provide top reinforcement as required to support panel from suspension components and provide reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.

D. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.

E. Panel Width: Equal widths.

F. STC: Not less than 52

G. Panel Weight: 11 lb/sq. ft. maximum.

H. Panel Thickness: Not less than 3 inches

I. Panel Closure: Manufacturer's standard.

J. Initial Closure: Flexible, resilient, bulb-shaped acoustical seal
   1. Final Closure: Constant-force, lever-operated mechanical closure expanding from panel edge to create a constant-pressure acoustical seal

K. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.

2.4 SEALS

A. General: Provide types of seals indicated that produce operable panel partitions complying with acoustical performance requirements and the following:

B. Manufacturer's standard seals.
   1. Seals made from materials and in profiles that minimize sound leakage.
   2. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.

A. Vertical Interlocking Sound Seals between panels: Roll-formed astragals, with reversible tongue and groove configuration in each panel edge, for universal panel operation. Rigid plastic astragals or astragals in only one panel edge are not acceptable.

A. Horizontal Top Seals: Continuous contact extruded vinyl bulb shape with pairs of non-contacting vinyl fingers to prevent distortion without the need for mechanically operated parts.

B. Horizontal Bottom Seals: PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.
   1. Automatically Operated for Acoustical Panels: Extension and retraction of bottom seal automatically operated by movement of partition, with operating range not less than 2 inches between retracted seal and floor finish.

2.5 FINISH FACING

A. General: Provide finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.
   1. Color/Pattern: selected by Architect from manufacturer's full range.

B. Fabric Wall Covering: Manufacturer’s standard fabric, from same dye lot, treated to resist stains.

C. Trimless Edges: Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel- to- panel joints.

2.6 SUSPENSION SYSTEMS

A. Suspension Tracks: Steel or aluminum with adjustable steel hanger rods for overhead support, designed for type of operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.

B. Basis of Design: #17 suspension system.

C. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.

D. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.

E. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

2.7 ACCESSORIES

A. Work Surfaces: Quantities, placement, and size indicated.

B. Surface: Steel marker/projection surface
1. Surface Color: As selected by Architect from manufacturer's full range
2. Size: Full width and height of panel
3. Trim: Aluminum slip-on or snap-on trim with no visible screws or exposed joints and with corners mitered to a neat, hairline joint, no vertical trim

C. Chalk Tray and Eraser Pocket: Manufacturer's standard.

D. Aluminum with color to match hinge or trim as selected.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with ASTM E 557 except as otherwise required by operable panel partition manufacturer's written installation instructions.

B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed.

C. Install panels from marked packages in numbered sequence indicated on Shop Drawings.

D. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

E. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.

3.3 ADJUSTING

A. Adjust operable panel partitions to operate smoothly, without warping or binding. Lubricate hardware and other moving parts.

3.4 FIELD QUALITY CONTROL

A. Light-Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids; adjust partitions for acceptable fit.

B. NIC Testing: Owner will engage a qualified testing agency to perform tests and inspections.

C. Testing Methodology: Perform testing of installed operable panel partition for noise isolation according to ASTM E 336, determined by ASTM E 413, and rated for not less than NIC indicated. Adjust and fit partitions to comply with NIC test method requirements.

D. Testing Extent: Testing agency shall randomly select one operable panel partition installation(s) for testing.

E. Repair or replace operable panel partitions that do not comply with requirements.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of repaired, replaced, or additional work with specified requirements.

G. Prepare test and inspection reports.

3.5 CLEANING

A. Clean soiled surfaces of operable panel partitions to remove dust, loose fibers, fingerprints, adhesives, and other foreign materials according to manufacturer's written instructions.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

END OF SECTION 102226

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Corner guards.

B. Related Sections:
   1. Division 08 Section "Door Hardware" for metal armor, kick, mop, and push plates.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide handrails capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Uniform load of 50 lbf/ft. applied in any direction.
   2. Concentrated load of 200 lbf applied in any direction.
   3. Uniform and concentrated loads need not be assumed to act concurrently.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.

B. LEED Submittals:
   1. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood rails comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
      a. Include statement indicating costs for each certified wood product.
   2. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
   3. Product Data for Credit EQ 4.4: For particleboard, documentation indicating that products contain no urea formaldehyde.

C. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.
   1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Samples for Initial Selection: For each type of impact-resistant wall protection unit indicated.
   1. Include similar Samples of accent strips and accessories involving color selection.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below. Include Samples of accent strips to verify color selected.
   1. Corner Guards: 12 inches long. Include examples of joinery, corners, and field splices.

F. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.
   1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

G. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Division 01 Section "Quality Requirements."
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.

E. Regulatory Requirements: Comply with applicable provisions inthe U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines andICC/ANSI A117.1

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
   1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
   2. Keep plastic sheet material out of direct sunlight.
   3. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
      a. Store corner-guard per manufacturers recommendation.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.

b. Deterioration of plastic and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2percent of each type, color, and texture of units installed, but no fewer than two, 4-foot- long units.

B. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.

PART 2 - PRODUCTS

2.1 MATERIALS

A. PVC Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; extruded andsheet material, thickness as indicated.
   1. Impact Resistance: Minimum 25.4 ft-lbf/in. of notch when tested according to ASTM D 256, Test Method A.
   2. Chemical and Stain Resistance: Tested according to ASTM D 543.
   3. Self-extinguishing when tested according to ASTM D 635.
   4. Flame-Spread Index: 25 or less.
   5. Smoke-Developed Index: 450 or less.

B. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than strength and durability properties specified in ASTM B 221 for Alloy 6063-T5.

C. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

D. Adhesive: As recommended by impact-resistant plastic wall protection manufacturer and with a VOC content of 70g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Transparent-Plastic Chair Rail: Consisting of clear polycarbonate plastic sheet.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. American Floor Products Co., Inc.
      b. IPC Door and Wall Protection Systems; Division of InPro Corporation.
      c. wallProtex.
   2. Height: 3 inches nominal
   3. Mounting: Surface mounted using flat-head countersunk screws through factory-drilled mounting holes.

2.2 CORNER GUARDS

A. Surface-Mounted, Resilient, Plastic Corner Guards: Assembly consisting of snap-on plastic cover installed over continuous retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. American Floor Products Co., Inc.
   b. Arden Architectural Specialties, Inc.
   c. Balco, Inc.
   d. Construction Specialties, Inc.
   e. IPC Door and Wall Protection Systems; Division of InPro Corporation.
   f. Korogard Wall Protection Systems; a division of RJF International Corporation.
   g. Musson Rubber Company.
   h. Pawling Corporation.
   i. Tepromark International, Inc.
   j. WallGuard.com.
2. Cover: Extruded rigid plastic, minimum 0.078-inch wall thickness; [as follows:] [in dimensions and profiles indicated on Drawings.]
   a. Profile: Nominal 2-inch- long leg and 1/4-inch corner radius.
   b. Height: 4 feet.
   c. Color and Texture: As selected by Architect from manufacturer's full range.
3. Retainer: Minimum 0.060-inch- thick, one-piece, extruded aluminum.
4. Retainer Clips: Manufacturer's standard impact-absorbing clips.
5. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

B. Surface-Mounted, Transparent-Plastic Corner Guards: Fabricated from clear polycarbonate plastic sheet; with formed edges; fabricated with 90- or 135-degree turn to match wall condition.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. American Floor Products Co., Inc.
   b. Arden Architectural Specialties, Inc.
   c. Balco, Inc.
   d. Construction Specialties, Inc.
   e. IPC Door and Wall Protection Systems; Division of InPro Corporation.
   f. Korogard Wall Protection Systems; a division of RJF International Corporation.
   g. Musson Rubber Company.
   h. Pawling Corporation.
   i. Tepromark International, Inc.
   j. WallGuard.com.
   k. wallProtex.
2. Wing Size: Nominal 1-1/8 by 1-1/8 inches.
3. Thickness: Minimum 0.100 inch.
4. Mounting: Countersunk screws through factory-drilled mounting holes.

C. Surface-Mounted, Metal Corner Guards: Fabricated from one-piece, formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. American Floor Products Co., Inc.
   b. Arden Architectural Specialties, Inc.
   c. Balco, Inc.
   d. Boston Retail Products.
   e. Construction Specialties, Inc.
   f. IPC Door and Wall Protection Systems; Division of InPro Corporation.
   g. Korogard Wall Protection Systems; a division of RJF International Corporation.
   h. Pawling Corporation.
   i. Tepromark International, Inc.
   j. WallGuard.com.

2. Material: Stainless steel, Type 304.
   a. Thickness: Minimum 0.0625 inch.
   b. Finish: Directional satin, No. 4.
3. Wing Size: Nominal 2-1/2 by 2-1/2 inches.
4. Corner Radius: 1/8 inch.
5. Mounting: Flat-head, countersunk screws through factory-drilled mounting holes.

2.3 FABRICATION

A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.4 METAL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Remove tool and die marks and stretch lines, or blend into finish.
   2. Grind and polish surfaces to produce uniform finish, free of cross scratches.
   3. Run grain of directional finishes with long dimension of each piece.
   4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

B. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
   1. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
   1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings or, if not indicated, at heights indicated below:
      a. Corner Guards: <Insert dimension> above finished floor.
   2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
      a. Provide anchoring devices to withstand imposed loads.
      b. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches.
      c. Adjust as required to ensure tight seams.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Warm-air dryers.
4. Childcare accessories.
5. Under lavatory guards.
6. Custodial accessories.
7. Shower Compartments

B. Related Sections:
1. Division 08 Section "Mirrors" for frameless mirrors.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule:
1. Identify locations using room designations indicated on Drawings.
2. Identify products using designations indicated on Drawings.

C. Recycled Content (MRc4):
1. Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).
2. Include information on Material Tracking Worksheets.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 - PRODUCTS

2.1 PUBLIC-USE WASHROOM ACCESSORIES

A. Toilet Tissue (Roll) Dispenser: TP1:
1. Basis-of-Design Product: Georgia-Pacific Professional, Compact Vertical Double Roll Bathroom Tissue Dispenser.
2. Mounting: Surface mounted.
3. MFG Item #: 56782.
4. Color: Stainless Steel.

B. Paper Towel (Roll) Dispenser: PTD1:
1. Basis-of-Design Product: Georgia-Pacific Professional, enMotion Recessed Automated Touchless Towel Dispenser.
2. Mounting: per manufacturer recommendations.
3. MFG Item #: 59466.
4. Color: Stainless Steel.

C. Waste Receptacle: TR1:
1. Basis-of-Design Product: Bobrick, Contura Series Recessed Waste Receptacle B-43644.
2. Mounting: Semirecessed
3. Minimum Capacity: 12.8 gal
4. Material and Finish: Stainless steel, No. 4 finish (satin)
5. Liner: Liner Mate Trash Liner Holder

D. Liquid-Soap Dispenser: SD1:
1. Basis-of-Design Product: Georgia-Pacific Professional, enMotion Recessed Automated Touchless Towel Dispenser.
2. Mounting: per manufacturer recommendations.
3. MFG Item #: 59466.
4. Material / Finish: Stainless Steel

E. Grab Bar: GB1, GB2, GB3:
1. Basis-of-Design Product: Bobrick B-5806 x 18, B-50806 x36 and B-5806 x42.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
   a. Finish: Smooth, No. 4 satin finish on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/4 inches
5. Configuration and Length: Straight, 18 inches, 36 inches, 42 inches long.

F. Sanitary-Napkin Disposal Unit: SND1:
1. Basis-of-Design Product: Bobrick B-4354, Contura series.
2. Mounting: Partition mounted
3. Door or Cover: Self-closing, disposal-opening cover
4. Receptacle: Removable, leak proof, plastic
5. Material and Finish: Stainless steel, No. 4 finish (satin).

G. Robe Hook: RH1
1. Basis-of-Design Product: Bobrick B-76827.

2. Description: Double-prong unit.
3. Material and Finish: Stainless steel, No. 4 finish (satin).

2.2 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
6. Tubular Specialties Manufacturing, Inc.

B. Shower Pan: SP:
1. Basis-of-Design Product: Freedom Showers Model: APFQ3698BF625
2. Description: Freedom ADA transfers Shower 39” x 39.5”, one piece, 5/8” barrier free threshold pre-leveled and reinforced shower base.
3. Mounting: Brackets, welded to shelf, shall be 16-gauge stainless steel. Secure Shelf to wall at points indicated on Technical Data sheet. Provide fiber plugs or expansion shields for use with sheet-metal screws or provide 1/8” toggle bolts.
4. Material and Finish: gel-coat fiberglass.
5. Accessories: Provide:
   a. Folding Shower Seat.
   b. Caulkless Drain.
   c. Grab Bars.
   d. Shower Rod and Curtain.
   e. Pressure Balance Valve with Hand-held Shower and Slide Bar.

2.3 WARM-AIR DRYERS

A. Warm-Air Dryer: HD1:
1. Basis-of-Design Product: Bobrick B-750
2. Mounting: Recessed
3. Operation: Electronic-sensor activated with timed power cut-off switch.
   a. Operation Time: 90 seconds.
4. Cover Material and Finish: Cast iron, with enamel finish in color selected by Architect
5. Electrical Requirements: As indicated on electrical drawings

2.4 CHILDCARE ACCESSORIES

A. Diaper-Changing Station: CS1:
1. Basis-of-Design Product: Bobrick KB 110-SSWM.
2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
   a. Engineered to support a minimum of 250-lbstatic load when opened.
3. Mounting: Surface mounted, with unit projecting not more than 4 inchesfrom wall when closed.
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: Exterior; 18 Gauge, type 304 stainless steel finish satin. Interior; HDPE with antimicrobial additive interior in manufacturer's standard color.

B. Child-Protection Seat: JS1.
1. Basis-of-Design Product: Bobrick KB 102-00:

2. Description: Unit that opens by folding down from stored position and with child-protection strap.
   a. Engineered to support a minimum of 50 lbs static load when opened.
3. Mounting: Surface mounted, with unit projecting not more than 5.65 inches from wall when closed. Refer to manufacturers technical data sheet for detailed mounding information.
4. Material and Finish: HDPE in manufacturer's standard color.

2.5 UNDERLAVATORY GUARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Plumberex Specialty Products, Inc.
   2. Truebro by IPS Corporation.

B. Underlavatory Guard:
   1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
   2. Material and Finish: Antimicrobial, molded plastic, white.

2.6 CUSTODIAL ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. A & J Washroom Accessories, Inc.
   2. American Specialties, Inc.
   3. Bobrick Washroom Equipment, Inc.
   4. Bradley Corporation.

C. Mop and Broom Holder
   1. Basis-of-Design Product: Bobrick B-224
   2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf
   3. Length: 36 inches
   4. Hooks: Three
   5. Mop/Broom Holders: Four spring-loaded, rubber hat, cam type.
   6. Material and Finish: Stainless steel, No. 4 finish (satin).
      a. Shelf: Not less than nominal 0.05-inch thick stainless steel.
      b. Rod: Approximately 1/4-inchdiameter stainless steel.

D. Industrial Hose Reel
   1. Basis-of-Design Product: Reelcraft, RT650-OLPSM (Model with Hose)
   2. Description: Industrial Hose & Reel, Medium Duty Spring Retractable
      a. Pressure: 300 psi
      b. Hose Inside Diameter: 3/8”
      c. Hose Length: 50’
      d. Mounting: Side Mount

2.7 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbfwhen tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Fire protection cabinets for the following:
      a. Portable fire extinguishers.
   2. Portable fire extinguishers.

B. Related Sections:
   1. Division 10 Section "Fire Extinguishers."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification: For each type of exposed product and for each color and texture specificed.

D. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Requirement in first paragraph below applies only to recessed and semirecessed cabinets.

B. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM International (ASTM) E 814 "Standard Test Method for Fire Tests of Penetration Firestop Systems," for fire-resistance rating of walls where they are installed.

C. National Fire Protection Association (NFPA) Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

D. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1.5 COORDINATION

A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire protection cabinets with wall depths.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure of hydrostatic test according to NFPA 10.
      b. Faulty operation of valves or release levers.

   2. Warranty Period: 6 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
   1. Sheet: ASTM B 209.
   2. Extruded Shapes: ASTM B 221.

2.2 FIRE PROTECTION CABINET: FEC on Code Plans and keynote: 10.50 & 10.51.

A. Cabinet Type: Suitable for fire extinguisher
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. J. L. Industries, Inc., a division of Activar Construction Products Group;
      b. Kidde Residential and Commercial Division, Subsidiary of Kidde plc; Larsen's Manufacturing Company;
      c. Potter Roemer LLC;
      d. Watrous Division, American Specialties, Inc.

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Steel sheet.

D. Recessed Cabinet: Keynote 10.50.
   1. Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
   2. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

E. Semirecessed Cabinet: Keynote 10.51.
   1. Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of

insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.

2. Rolled-Edge Trim: 2-1/2-inch64-mm) backbend depth.

F. Cabinet Trim Material: Same material and finish as door.

G. Door Material: Aluminum sheet.

H. Door Style: Solid opaque panel with frame

I. Door Glazing: No glazing.

J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide concealed hinge permitting door to open 180 degrees.

K. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
3. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle
4. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate show in submittal for approval..
   a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER
      1) Location: Applied to cabinet door.
      2) Application Process: Silk-screened
      3) Lettering Color: Red
      4) Orientation: Vertical

L. Finishes:

1. Manufacturer's standard baked-enamel paint for the following:
   a. Interior of cabinet.

2. Aluminum: Clear anodic.

2.3 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Amerex Corporation.
   b. Ansul Incorporated; Tyco International Ltd.
   c. Badger Fire Protection; a Kidde company.
   d. Buckeye Fire Equipment Company.
   e. Fire End & Croker Corporation.
   f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
   g. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
   h. Larsen's Manufacturing Company.
   i. Moon-American.
   j. Pem All Fire Extinguisher Corp.; a division of PEM Systems, Inc.

k. Potter Roemer LLC.
l. Pyro-Chem; Tyco Safety Products.

2. Valves: Manufacturer's standard.
3. Handles and Levers: Manufacturer's standard.
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.4 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.

2. Prepare doors and frames to receive locks or Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 INSTALLATION

3.2 EXAMINATION

A. Examine roughing-in for hose valves, racks and cabinets to verify actual locations of piping connections before cabinet installation.

B. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets will be installed.

C. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Prepare recesses for recessed and semirecessed fire protection cabinets as required by type and size of cabinet and trim style.

3.4 INSTALLATION

A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below:
   1. Fire Protection Cabinets: 54 inches above finished floor to top of cabinet.

B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
   1. Unless otherwise indicated, provide recessed fire protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire protection cabinets.
   2. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.

C. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
   1. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

3.5 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.

E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.6 CONSTRUCTION WASTE MANAGEMENT

A. Manage construction waste in accordance with provisions of Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 104413

SECTION 113100 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Microwave Ovens
   2. Refrigerator / Freezers
   3. Dishwashers

B. Related Sections:
   1. Division 11 Section "Unit Kitchens" for small, compact kitchen units that include residential appliances.
   2. Division 22 Section "Plumbing Fixtures" for kitchen sinks, waste disposers, and instant hot-water dispensers.
   3. SUBMITTALS

C. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, dimensions, furnished accessories, and finishes for each appliance.

D. LEED Submittals:
   1. Product Data for LEED-CI Credit EA 1.4: For appliances indicated, documentation that products are ENERGY STAR rated.

E. Samples: For each exposed finish.

F. Appliance Schedule: Use same designations indicated on Drawings.

G. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

H. Warranties: Sample of special warranties.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain residential appliances from single manufacturer for Staff Lounge.

B. Regulatory Requirements: Comply with the following:
   1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Accessibility: Appliances are required to comply with accessibility requirements in jurisdiction of the project, including but not limited to the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.4 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.

B. Microwave Oven: Full warranty including parts and labor.
   1. Warranty Period: Two years from date of Substantial Completion.

C. Refrigerator/Freezer, Sealed System: Full warranty including parts and labor for on-site service on the product.
   1. Warranty Period for Sealed Refrigeration System: Two years from date of Substantial Completion.
   2. Warranty Period for Other Components: Two years from date of Substantial Completion.

D. Dishwasher: Full warranty including parts and labor for on-site service on the product.
   1. Warranty Period for Deterioration of Tub and Metal Door Liner: Three years from date of Substantial Completion.
   2. Warranty Period for Other Components: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 COOKING APPLIANCES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
   1. Amana; a division of Whirlpool Corporation.
   2. Electrolux.
   3. General Electric Company.
   4. KitchenAid.
   5. Maytag.
   6. Whirlpool Corporation.

B. Microwave Oven MO-01.
   1. Basis-of-Design Product: Whirlpool Corporation: MT4155SPB.
      a. Color/Finish: Black.

2.2 REFRIGERATOR/FREEZERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following: Whirlpool Gold Resource Saver. Model Number GB9FHDXWB.
   1. Amana; a division of Whirlpool Corporation.
   2. Electrolux Home Products (Frigidaire).
   3. General Electric Company
   4. Jenn-Air
   5. KitchenAid
   6. Maytag
   7. Sub-Zero, Inc.
   8. Viking Range Corporation.
   9. Whirlpool Corporation.

B. Refrigerator/Freezer RF- 01**:**

1. Type: Freestanding.
2. Dimensions:
   a. Width: 30".
   b. Depth: 34".
   c. Height: 66".
3. Storage Capacity:
   a. Refrigeration Compartment Volume: 12.9 Cu. Ft.
   b. Freezer Volume: 5.6 Cu. Ft.
4. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
5. Appliance Color/Finish: Black.

C. Refrigerator RF- 02.
1. Basis-of-Design Product: Maytag: MURM24FWBS, frost free.
2. Type: Undercounter.
3. Dimensions:
   a. Width: 24.
   b. Depth: 27.
   c. Height: 27.
4. Storage Capacity:
   a. Refrigeration Compartment Volume: 5.6 Cu. Ft
5. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
6. Appliance Color/Finish: Stainless steel.

2.3 DISHWASHERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
1. Amana; a division of Whirlpool Corporation.
2. BOSCH Home Appliances.
3. Electrolux Home Products (Frigidaire).
4. General Electric Company.
5. KitchenAid
6. Maytag
7. Viking Range Corporation.
8. Whirlpool Corporation.

B. Dishwasher DW 01
1. Basis-of-Design Product: Whirlpool Gold: GU3100XTVB.
2. Type: Built-in undercounter
3. Dimensions:
   a. Width: 24”
   b. Depth: 25”
   c. Height: 32 1/2” to 34 1/2”
4. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
5. Appliance Color/Finish: Black

2.4 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written instructions.

B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

D. Utilities: See Divisions 22 and 26 for plumbing and electrical requirements.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

END OF SECTION 113100

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes roller shades.

B. Related Sections include the following:
   1. Division 06 Section "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.
   1. Motorized Shade Operators: Include operating instructions.
   2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

B. Shop Drawings: Show location and extent of roller shades. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other work, operational clearances, and relationship to adjoining work.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Ceiling suspension system members and attachment to building structure.
   2. Ceiling-mounted or penetrating items including light fixtures, air outlets and inlets, speakers, sprinklers, recessed shades, and special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.
   3. Shade mounting assembly and attachment.
   4. Size and location of access to shade operator and adjustable components.
   5. Minimum Drawing Scale: 1/4 inch = 1 foot.
   6. Minimum Drawing Scale: 1/8 inch = 1 foot.
   7. Minimum Drawing Scale: 1:50.
   8. Minimum Drawing Scale: 1:100.

D. Samples for Initial Selection: For each colored component of each type of shade indicated.
   1. Include similar Samples of accessories involving color selection.

E. Samples for Verification:
   1. Complete, full-size operating unit not less than 16 inches wide for each type of roller shade indicated.
   2. For the following products:
      a. Shade Material: Not less than 3 inches square, with specified treatments applied. Mark face of material.

b. Shade Material: Not less than 12-inch- square section of fabric, from dye lot used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of material.
c. Valance: Full-size unit, not less than 12 inches long.

F. Window Treatment Schedule: For roller shades. Use same designations indicated on Drawings.

G. Maintenance Data: For roller shades to include in maintenance manuals. Include the following:
1. Methods for maintaining roller shades and finishes.
2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
3. Operating hardware.
4. Motorized shade operator.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Source Limitations: Obtain roller shades through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide roller shade band materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
1. Flame-Resistance Ratings: Passes NFPA 701.

D. Product Standard: Provide roller shades complying with WCMA A 100.1.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory packages, marked with manufacturer and product name, and location of installation using same designations indicated on Drawings and in a window treatment schedule.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Rollers Shades: Before installation begins, for each size, color, texture, and pattern indicated, full-size units equal to 5 percent of amount installed[, but not fewer than <Insert number> units].

PART 2 - PRODUCTS

2.1 ROLLER SHADES

A. Basis-of-Design Product: Subject to compliance with requirements, provide MechoShade Systems, Inc., ThermoVeil, Series 1300, as indicated in the drawings or a comparable product acceptable to Architect.

B. Shade Band Material: Construction of the shade band includes the fabric, the (Hem) bar and the (hem) pocket, and the attachment of the shade band to the roller tube:
   1. Black-out Shade: Passed fr tests CCC-C-521E, ASTM E-84-81, ASTM E-162 and NFPA 701 Large-Small scale.
      a. Material: Fiberglass coated fabric.
      b. Thickness: 12 mils.
      c. Weight: 62 threads per sq. in (per 25 mm) minimum. 0.750 lbs/sq in minimum washable colorfast.
      d. Color: As selected by Architect from manufacturer's full range
   2. Audiovisual light-Blocking Shade: Designed for eliminating all visible light gaps when shades are fully closed; fabricated from blackout shadeband material with pocket and bottom bar extended and formed for light-tight joints among shade components and between shade components and adjacent construction.
      a. Material: Fiberglass coated fabric.
      b. Thickness: 12 mils.
      c. Weight: 62 threads per sq. in (per 25 mm) minimum. 0.750 lbs/sq in minimum washable colorfast.
      d. Color: As selected by Architect from manufacturer's full range
   3. Translucent Shade:
      a. Material: Visually transparent single fabric shadecloth. Single thickness non-raveling 0.030 inch thick vinyl fabric, woven from 0.018 inch diameter extruded vinyl yarn comprising of 21% polyester and 79% reinforced vinyl.
      b. Texture/Pattern: 2x2 dense basket-weave pattern.
      c. Openness: To be selected by Architect
      d. Color: As selected by Architect from manufacturer's full range

C. Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets; with manufacturer's standard method for attaching shade material. Provide capacity for two roller shade band(s) per roller, unless otherwise indicated.

D. Direction of Roll: Regular, from back of roller.

E. Mounting Brackets: Fascia end caps, fabricated from steel finished to match fascia or headbox.

F. Fascia: L-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; continuous panel concealing front and bottom of shade roller, brackets, and operating hardware and operators; length as indicated on Drawings; removable design for access.

G. Audiovisual Light-Blocking Shades: Designed for eliminating all visible light gaps when shades are fully closed; fabricated from blackout shade band material with fascia and bottom bar extended and formed for light-tight joints among shade components and between shade components and adjacent construction.
   1. Side Channels, Sill Channel or Angle, and Perimeter Seals: Manufacturer's standard design, including sill light seal attached to bottom bar, for eliminating light gaps when shades are closed.

2. Shade Band Retention System: Manufacturer's standard design for guiding shade band material through range of travel and holding shade band flat with edges of material within side channels.

H. Skylight Shades: Manufacturer's complete system for operable skylight shades, including operator, operating hardware, and accessories for smooth operation, designed for installation in horizontal position.
1. Side Channels and Bottom Channel or Angle: Manufacturer's standard design for concealing rollers, operator take-up operating hardware, and accessories.
2. Shade Band Retention System: Manufacturer's standard design for guiding shade band material through range of travel and holding shade band flat and taut with edges of material within side channels and firmly attached to cables or wires; including concealed battens or rods connected to fabric guides or exposed idler rollers for stiffening shade band material across glazed opening.

I. Mounting: Ceiling mounting permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.

J. Shade Operation: Manual; with continuous-loop bead-chain, clutch, and cord tensioner and bracket lift operator.
1. Position of ClutchOperator: Right side of roller, as determined by hand of user facing shade from inside, unless otherwise indicated.
2. Clutch: Capacity to lift size and weight of shade; sized to fit roller or provide adaptor.
3. Lift-Assist Mechanism: Manufacturer's standard spring assist for balancing roller shade weight and lifting heavy roller shades.
4. Loop Length: Full length of roller.
5. Bead Chain: Nickel-plated metal.
6. Cord Tensioner Mounting: Wall.
7. Operating Function: Stop and hold shade at any position in ascending or descending travel.

2.2 ROLLER SHADE FABRICATION

A. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F:
1. Shade Units Installed between (Inside) Jambs: Edge of shade not more than 1/4 inchfrom face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.

B. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting fascia roller, and operating hardware and for hardware position and shade mounting method indicated.

C. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.

D. Color-Coated Finish: For metal components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

E. Colors of Metal and Plastic Components Exposed to View: As selected by Architect from manufacturer's full range, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions, and located so shade band is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

B. Connections: Connect motorized operators to building electrical system.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain roller shades. Refer to Division 01 Section Demonstration and Training."

END OF SECTION 122413

SECTION 124813 - ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Entrance mats in recessed frames.

B. Related Sections include the following:
   1. Division 03 Section "Cast-in-Place Concrete" for slab depression grouting and filling for recessed mats and frames.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show the following:
   1. Perimeter floor moldings.

C. Samples: For each type of product indicated.
   1. Floor Mat: 12-inch- square, assembled sections of floor mat.
   2. Tread Rail: Frame Members: 12-inch- long Sample of each type and color.

D. Maintenance Data: For floor mats and frames to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain floor mats and frames through one source from a single manufacturer.

B. Accessibility Requirements: Provide installed floor mats that comply with Section 4.5 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

1.5 PROJECT CONDITIONS

A. Field Measurements: Indicate measurements on Shop Drawings.

1.6 COORDINATION

A. Coordinate size and location of recesses in concrete with installation of finish floors to receive floor mats and frames.

PART 2 - PRODUCTS

2.1 ENTRANCE MATS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Floor Products Company, Inc.
   2. ARDEN Architectural Specialties, Inc.
   3. Balco, Inc.
   4. Cactus Mat Mfg. Co.
   5. Consolidated Plastics Company, Inc.
   6. C/S Group.
   7. Durable Corporation.
   8. Flexco.
   9. Matco International.
   10. Mats, Inc.
   11. Musson, R. C. Rubber Co.
   12. Pawling Corporation; Architectural Products Division.
   13. Sbemco International Inc.
   14. Tennessee Mat Company, Inc.
   15. Tepromark International, Inc.
   16. U.S. Mat & Rubber Corporation.

B. Nuway Mats: As scheduled in Division 09 Section "Schedule of Finishes."

C. Recessed Frames:
   1. Extruded Aluminum: ASTM B 221, Alloy 6061-T6 or Alloy 6063-T5, T6, or T52.
   2. Color: Mill-finish.

2.2 CONCRETE FILL AND GROUT MATERIALS

A. Provide concrete grout and fill equivalent in strength to cast-in-place concrete slabs for recessed mats and frames. Use aggregate no larger than one-third fill thickness.

2.3 FABRICATION

A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

B. Recessed Frames: As indicated, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.
   1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

C. Coat surfaces of aluminum frames that will contact cementitious material with manufacturer's standard protective coating.

2.4 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and floor conditions for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats and frames.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install recessed mat frames to comply with manufacturer's written instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate top of mat surfaces with bottom of doors that swing across mats to provide clearance between door and mat.
   1. For installation in terrazzo flooring areas, provide allowance for grinding and polishing of terrazzo without grinding surface of recessed frames. Coordinate with other trades as required.
   2. Install necessary shims, spacers, and anchorages for proper location and secure attachment of frames.
   3. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.

3.3 PROTECTION

A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION 124813

SECTION 142400 - HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes hydraulic passenger elevators.

B. Related Sections:
   1. Division 05 Section "Metal Fabrications" for the following:
      a. Hoist beams.
      b. Pit ladders.
   2. Division 09 Section "Resilient Tile Flooring" for finish flooring in elevator cars.
   3. Division 26 Sections for electrical service for elevators to and including disconnect switches at machine room door.

1.03 DEFINITIONS

A. Definitions in American Society of Mechanical Engineers (ASME) A17.1 "Safety Code for Elevators and Escalators," apply to work of this Section.

B. Defective Elevator Work: Operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

1.04 SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for the following:
   1. Car enclosures and hoistway entrances.
   2. Operation, control, and signal systems.

B. Shop Drawings: Show plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment and signals. Include large-scale layout of car control station. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples: For exposed finishes of cars, hoistway doors and frames, and signal equipment; 3-inch-square Samples of sheet materials; and 4-inch lengths of running trim members.

D. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

E. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.
   1. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain elevators through one source from a single manufacturer.
   1. Provide major elevator components, including pump-and-tank units, controllers, signal fixtures, door operators, car frames, cabs, and entrances, manufactured by a single manufacturer.

C. Regulatory Requirements: Comply with ASME A17.1.
   1. Elevator importance factor is 1.0.

D. Accessibility Requirements: Comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and 407 in ICC A117.1.

E. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies complying with National Fire Protection Association (NFPA 80 "Standard for Fire Doors and Other Opening Protectives," that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 "Standard Methods of Fire Tests of Door Assemblies," or Underwriters Laboratory (UL) 10B "Fire Tests of Door Assemblies."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging.

B. Store materials, components, and equipment off of ground, under cover, and in a dry location. Handle according to manufacturer's written recommendations to prevent damage, deterioration, or soiling.

1.07 COORDINATION

A. Coordinate sequence of elevator installation with other work to avoid delaying the Work.

B. Coordinate locations and dimensions of other work relating to hydraulic elevators including pit ladders, sumps, and floor drains in pits; entrance subsills; and electrical service, electrical outlets, lights, and switches in pits and machine rooms.

1.08 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective elevator work within specified warranty period.
   1. Warranty Period: 1 year from date of Substantial Completion.

1.09 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide one year's full maintenance service by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
   1. Perform maintenance, including emergency callback service, during normal working hours.
   2. Include 24-hour-per-day, 7-day-per-week emergency callback service.
      a. Response Time: Two hours or less.

PART 2 - PRODUCTS

2.01 GENERAL

2.02 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide AMEE 2100, HLS by products by ThyssenKrupp Elevator or a comparable product by one of the following:
   1. KONE Inc.
   2. Otis Elevator Co.
   3. Schindler Elevator Corp.

2.03 SYSTEMS AND COMPONENTS

A. General: Provide manufacturer's standard elevator systems. Where components are not otherwise indicated, provide standard components published by manufacturer as included in standard preengineered elevator systems and as required for complete system.

B. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations. Provide either of the following:
   1. Pump, with fan-cooled squirrel-cage induction motor, mounted on oil tank with vibration isolation mounts. Enclose pump in prime-painted steel enclosure lined with 1-inch-thick, glass-fiber insulation board.
   2. Submersible pump, with submersible squirrel-cage induction motor, suspended inside oil tank from vibration isolation mounts.
   3. Provide motor with solid-state starting.

C. Hydraulic Silencers: Provide hydraulic silencer containing pulsation-absorbing material in a blowout-proof housing at pump unit.

D. Piping: Provide size, type, and weight piping recommended by manufacturer, and provide flexible connectors to minimize sound and vibration transmissions from power unit.
   1. Provide dielectric couplings at cylinder units.

E. Hydraulic Fluid: Nontoxic, readily biodegradable, fire-resistant fluid made from vegetable oil with antioxidant, anticorrosive, antifoaming, and metal-passivating additives. Hydraulic fluid is approved by elevator manufacturer for use with elevator equipment.
   1. Product: Subject to compliance with requirements, provide "Hydro Safe" by Hydro Safe Oil Division, Inc.

F. Car Frame and Platform: Welded steel units.

G. Guides: Provide either roller guides or sliding guides at top and bottom of car and counterweight frames. If sliding guides are used, provide guide-rail lubricators or polymer-coated, nonlubricated guides.

2.04 OPERATION SYSTEMS

A. General: Provide manufacturer's standard microprocessor operation system for each elevator as required to provide type of operation system indicated.

B. Single-Car Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:
   1. Battery-Powered Lowering: If power fails and car is at a floor, it remains at that floor, opens its doors, and shuts down. If car is between floors, it is lowered to a preselected floor, opens its doors, and shuts down. If car is below the preselected floor, it is lowered to the next lower floor, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.

2. Battery-Powered Lowering: When power fails, car is lowered to the lowest floor, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.
3. Automatic Dispatching of Loaded Car: When car load exceeds 80 percent of rated capacity, doors will begin closing.
4. Nuisance Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight can be adjusted.

C. Security Features: Provide the following security features, where indicated. Security features shall not affect emergency firefighters' service.
1. Card-Reader Operation: System uses card readers at car control stations to authorize calls. Security system determines which landings and at what times calls require authorization by card reader. Provide required conductors in traveling cable and panel in machine room for interconnecting card readers, other security access system equipment, and elevator controllers. Allow space for card reader in car. Provide stripe-swipe card reader integral with each car control station.
2. Keyswitch Operation: Push buttons are activated and deactivated by security keyswitches at car control stations. Key is removable only in activated position.

2.05 DOOR REOPENING DEVICES

A. Infrared Array: Provide door reopening devices with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more of the light beams shall cause doors to stop and reopen.

B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.06 FINISH MATERIALS

A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.

B. Cold-Rolled Steel Sheet: ASTM A 1008 "Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable," commercial steel, Type B, exposed, matte finish.

C. Hot-Rolled Steel Sheet: ASTM A 1011 "Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength," commercial steel, Type B, pickled.

D. Stainless-Steel Sheet: ASTM A 240 "Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications," Type 304.

E. Stainless-Steel Tubing: ASTM A 554 "Standard Specification for Welded Stainless Steel Mechanical Tubing," Grade MT 304.

F. Aluminum Extrusions: ASTM B 221 "Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes," Alloy 6063.

2.07 CAR ENCLOSURES

A. General: Provide enameled-steel car enclosures to receive removable wall panels, with car roof, access doors, power door operators, and ventilation.
1. Provide standard railings complying with ASME A17.1 on car tops where required by ASME A17.1.

2. Provide finished car including materials and finishes specified below.

B. Materials and Finishes: Provide manufacturer's standards, but not less than the following:
1. Subfloor: Underlayment grade, exterior plywood, 5/8-inch nominal thickness.
2. Floor Finish: Specified in Division 09 Section "Resilient Tile Flooring."
3. Stainless-Steel Wall Panels: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
   a. Provide textured stainless steel cladding by Rigidized Metals Corporation or comparable products acceptable to Architect.
      1) Pattern: As selected by Architect from manufacturer's full range.
4. Fabricate car with recesses and cutouts for signal equipment.
5. Fabricate car door frame integrally with front wall of car.
6. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
   a. Provide textured stainless steel cladding by Rigidized Metals Corporation or comparable products acceptable to Architect.
      1) Pattern: As selected by Architect from manufacturer's full range.
7. Sight Guards: Provide sight guards on car doors.
8. Sills: Extruded aluminum, with grooved surface, 1/4 inch thick.
9. Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.
10. Handrails: Manufacturer's standard tubular stainless steel handrails.

2.08 HOISTWAY ENTRANCES

A. General: Provide manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Provide frame size and profile to coordinate with hoistway wall construction.
1. Where gypsum board wall construction is indicated, provide self-supporting frames with reinforced head sections.

B. Materials and Fabrication: Provide manufacturer's standards, but not less than the following:
1. Stainless-Steel Frames: Formed from stainless-steel sheet.
2. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet or by laminating stainless-steel sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
3. Sight Guards: Provide sight guards on doors matching door edges.
4. Sills: Extruded aluminum, with grooved surface, 1/4 inch thick.
   a. Provide manufacturer's standard sub-sill when additional support is required for sill.
5. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107 "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)."

2.09 SIGNAL EQUIPMENT

A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with long-life incandescent lamps and acrylic or other permanent, nonyellowing translucent plastic diffusers or LEDs.

B. Car Control Stations: Provide manufacturer's standard recessed car control stations. Mount in return panel adjacent to car door, unless otherwise indicated.
1. Mark buttons and switches with standard identification for required use or function that complies with ASME A17.1. Use both tactile symbols and Braille.

2. Provide "No Smoking" sign matching car control station, either integral with car control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

C. Emergency Communication System: Provide system that complies with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

D. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet in each car and required conductors in traveling cable for firefighters' two-way telephone communication service.

E. Car Position Indicator: Provide digital-type car position indicator, located above car door or above car control station. Also provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served.
1. Include travel direction arrows if not provided in car control station.

F. Hall Push-Button Stations: Provide one hall push-button station at each landing for each single elevator or group of elevators, but not less than one station for each four elevators in a group.

G. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide the following:
1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.

H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.

I. Corridor Call Station Pictograph Signs: Provide signs matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station, unless otherwise indicated.

2.10 ELEVATORS

A. Elevator Description:
1. Type: Holeless, beside-the-car, single-acting, [**single**] [**dual**] cylinder.
2. Type: Holeless, telescoping, single cylinder.
3. Rated Load: 2100 lb.
4. Rated Speed: 150 fpm.
5. Operation System: Single automatic.
6. Auxiliary Operations:
   a. Battery-powered lowering.
   b. Automatic dispatching of loaded car.
   c. Nuisance call cancel.
7. Security Features: Card-reader and keyswitch operation.
8. Hoistway Entrances:
   a. Width: 42 inches.
   b. Height: 84 inches.
   c. Type: Single-speed side sliding.
   d. Fire-Protection Rating: 1 hour.
   e. Frames: Satin stainless steel, No. 4 finish.
   f. Doors: Satin stainless steel, No. 4 finish.
9. Additional Requirements:

a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish .
b. Provide blanket hooks and two complete sets of full-height protective blankets.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.

B. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to effectively prevent transmission of vibrations to structure and thereby eliminate sources of structure-borne noise from elevator system.

C. Install piping above the floor, where possible. Where not possible, install underground piping in Schedule 40 PVC pipe casing assembled with solvent-cemented fittings.

D. Lubricate operating parts of systems as recommended by manufacturers.

E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

F. Leveling Tolerance: 1/4 inch, up or down, regardless of load and direction of travel.

G. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

H. Locate hall signal equipment for elevators as follows, unless otherwise indicated:
1. Place hall lanterns either beside hoistway entrances, centered 72 inches above finished

3.03 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting use (either temporary or permanent) of elevators, perform acceptance tests as required and recommended by ASME A17.1 and by governing regulations and agencies.

B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times tests are to be performed on elevators.

3.04 PROTECTION

A. Temporary Use: Comply with the following requirements for elevator used for construction purposes:
1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
2. Provide strippable protective film on entrance and car doors and frames.
3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.

5. Do not load elevators beyond their rated weight capacity.
6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator. Refer to Division 01 Section "Demonstration and Training."

B. Check operation of elevator with Owner's personnel present and before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

C. Check operation of elevator with Owner's personnel present not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.06 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

A. Manage construction waste in accordance with provisions of Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 142400

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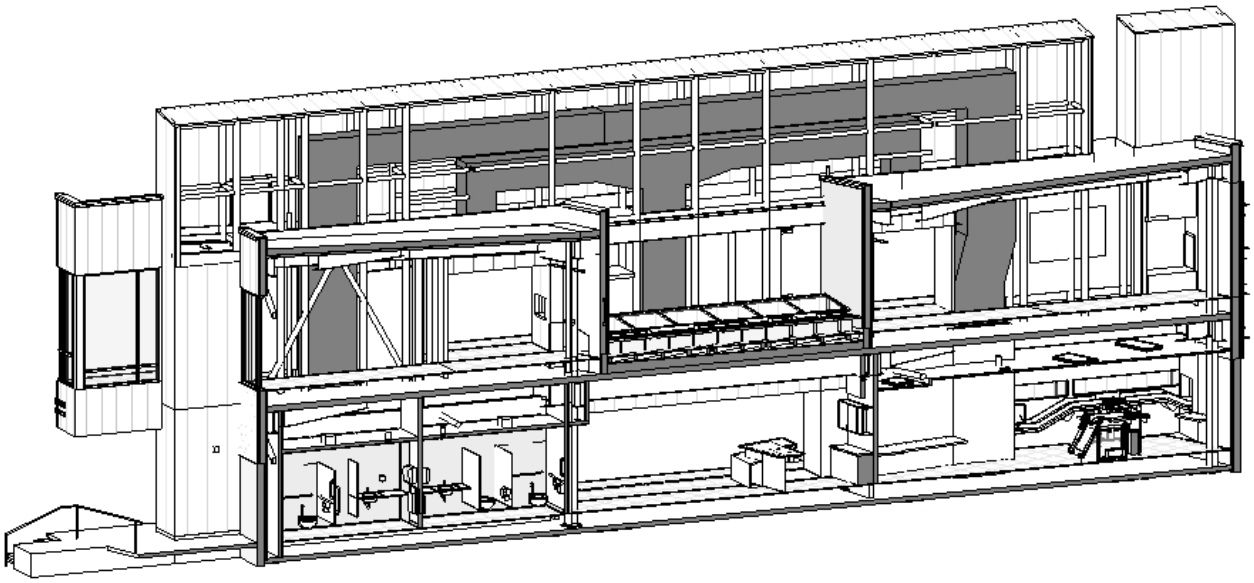

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To Be Provided by City and County of Denver, Department of Public Works.

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054000 COLD-FORMED METAL FRAMING
055000 METAL FABRICATIONS
055100 METAL STAIRS
055219 ARCHITECTURAL RAILINGS

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SECTION 210500 - FIRE PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. This Section and the Drawings outline the general, but not specific, scope of the project's Fire Protection System. The successful Contractor will be the Engineer of Record for the design of the system. The Design and Engineering of the Fire Protection System shall be by the Fire Protection Contractor. It is the Contractor's responsibility that the system meet all the requirements of NFPA (FM if applicable) and the Authority Having Jurisdiction.

B. This Section specifies Automatic Sprinkler Systems for buildings and structures. Materials and equipment specified in this Section include:
   1. Pipe, Fittings, Valves and Specialties
   2. Sprinklers and Accessories

C. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 2 Section "Fire Service Piping" for fire protection piping from fire service mains to a point 5-feet outside the building.
   2. Division 7 Section "Joint Sealers" for materials and methods for sealing pipe penetrations through basement walls and fire/smoke barriers.
   3. Division 10 Section "Fire Extinguishers, Cabinets and Accessories" for fire extinguishers and extinguisher cabinets.
   4. Division 23 Section "Mechanical Identification" for labeling and identification of fire protection piping system and components.
   5. Division 23 sections inclusive.

D. Attention is called to the fact that this is a LEED project. Project requirements include compliance with a Division 1 LEED criteria, including, but not limited to:
   1. Construction Indoor Air Quality (IAQ) Management Plan, and construction waste management and disposal requirements.
   2. Product Data for temporary MERV 8 filtration if systems will be used during construction.
   3. Six photographs at three difference occasions (18 total) during construction of the different SMACNA requirements, along with a brief description of the SMACNA approach employed, documenting implementation of the IAQ management measures, such as protection of ducts, floor mopping/sweeping, cleaning of air handling units, installation of filters, and on-site stored or install absorptive materials.
   4. Low-Emitting Adhesives and Sealants requirements.
   5. Low-Emitting Paints and Coatings requirements.
   6. Coordination with commissioning agent and commissioning requirements.

1.3 DEFINITIONS

A. Pipe sizes used in this Specification are Nominal Pipe Size (NPS).

B. Other definitions for Fire Protection Systems are listed in NFPA Standards 13, 14, 20 and 24.

C. Working Plans as used in this Section means those documents (including drawings and calculations) prepared pursuant to the requirements contained in NFPA-13 for obtaining approval of the Authority Having Jurisdiction.

1.4 SYSTEM DESCRIPTION

A. Provide a complete Fire Sprinkler System for the entire building (including, but not limited to, electrical rooms, mechanical rooms and the remainder of the building), except designated areas as shown on the drawings, which will not require fire sprinkler coverage, will be specifically noted with "No A/S".

B. Fire Protection System is a "Wet-Pipe" system employing automatic sprinklers attached to a piping system containing water and connected to a water supply so that water discharges immediately from sprinklers opened by fire.

1.5 SUBMITTALS

A. Product data for each type sprinkler head, valve, piping and piping specialty, fire protection specialty, fire department connection and any equipment installed in accordance with the Contract Documents. Index per specification chapter and item number.

B. Shop drawings prepared in accordance with NFPA-13 identified as "Working Plans", including detailed riser schematics indicating pipe sizes and lengths; and hydraulic calculations which have been approved by the Authority Having Jurisdiction. Do not proceed with the installation of the work until the Architect/Engineer review of shop drawings is received.

C. Contractor shall stamp shop drawings indicating compliance with applicable codes and contract drawings. Contractor shall stamp drawing "Approved for Construction".

D. If more than two (2) submittals (either for shop drawings or for as-built drawings) are made by the Contractor, the Owner reserves the right to charge the Contractor for subsequent reviews by their consultants. Such extra fees shall be deducted from payments by the Owner to the Contractor.

E. Maintenance data for each type sprinkler head, valve, piping specialty, fire protection specialty, fire department connection and hose valve specified, for inclusion in operating and maintenance manual specified in Division 1.

F. Welder's Qualification Certificate.

G. Test Reports and Certificates, including "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Materials and Test Certificate for Underground Piping" as described in NFPA-13.

H. Hydraulic calculations and drawings created by the Contractor and submitted to the Engineer shall have the signed stamp of a professional engineer registered in the State of Colorado and familiar with this type of installation and with previous similar experience or the signature with certification number of a Level 4 Senior Engineering Technician of the National Institute for Certification of Engineering Technology (practicing in the Fire Protection field) certifying that the Fire Sprinkler System has been hydraulically calculated in compliance with NFPA and governing codes.

I. Fire sprinkler piping design drawings shall show, and be coordinated with, all ductwork, air devices, lighting, electrical panels and structural elements of the Building.

1.6 HYDRAULIC DESIGN

A. The Fire Sprinkler System shall be hydraulically calculated by the Contractor.

B. The Wet Pipe Fire Sprinkler System for the building shall be hydraulically calculated to comply with NFPA-13:

C. The final fire protection system demand shall be a minimum of 10 PSI below the water supply curve.

D. Velocities in pipes shall be shown on hydraulic calculations. Velocities in overhead piping shall not exceed 32-feet per second. Velocities in underground piping shall not exceed 16-feet per second.

E. Allow 10-feet of loss for electric water flow switches and note on hydraulic calculations.

F. The Fire Protection Contractor shall provide as many sets of hydraulic calculations as necessary, performed and submitted to prove that the most remote and demanding areas are calculated.

G. Design information shall be permanently affixed to the main riser as described in NFPA Pamphlet 13.

H. Before hydraulically calculating fire sprinkler system, the Fire Protection Contractor shall verify exact water flow data with Local Water and/or Fire Department. A copy of the water flow test data from the Local Water and/or Fire Department shall accompany the hydraulic calculations.

I. The pipe and valve sizes indicated on the drawings and details are minimum sizes to be used regardless of sizes allowed by hydraulic calculations.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Installation and alterations of fire protection piping, equipment, specialties, and accessories, and repair and servicing of equipment shall be performed only by qualified installer. The term "qualified" means experienced in such work (experienced shall mean having a minimum of five (5) previous projects similar in size and scope to this project), familiar with all precautions required, and has complied with all the requirements of the Authority Having Jurisdiction. The Contractor shall be licensed for the design and installation

for the specific type of system in the jurisdiction where the work is to be performed and the State of Colorado. Upon request, submit evidence of such qualifications to the Engineer. Refer to Division 1 Section "Definitions and Standards" for definitions for "Installers".

B. Qualifications for Welding Processes and Operators: Comply with the requirements of AWS D10.9, "Specifications of Qualifications of Welding Procedures and Welders for Piping and Tubing, Level AR-3".

C. Regulatory Requirements: Comply with the requirements of the following codes:
   1. NFPA-13 - Standard for the Installation of Sprinkler System.
   2. NFPA-13R - Standard for the Installation of Sprinkler Systems in residential occupancies up to four (4) stories.
   3. NFPA-14 - Standard for the Installation of Standpipe and Hose Systems.
   4. NFPA-24 - Installation of Private Fire Service Mains and their applications.
   5. NFPA-1961 - Standard for Fire Hose.
   6. NFPA-1963 - Screw Threads and Gaskets for Fire Hose Connections.
   7. UL Compliance: Fire protection system materials and components shall be Underwriter's Laboratories listed and labeled for the application anticipated.
   8. National Electrical Code (NEC).

1.8 SEQUENCING AND SCHEDULING

A. Schedule rough-in installations with installations of other building components.

B. Minimum time frame for notice of inspections, tests and meetings is five (5) days and list the persons to be notified.

1.9 EXTRA STOCK

A. Heads: For each style and temperature range (and length for dry heads) required, furnish additional sprinkler heads per NFPA-13.
   1. Obtain receipt from Owner that extra stock has been received.

B. Wrenches: Furnish two (2) spanner wrenches for each type and size of valve connection and fire hose coupling.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in fire protection systems.

B. All equipment used on this project shall be new and UL Listed, unless noted or specified otherwise.

2.2 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide fire protection system products from one of the following:

1. Swing Check Valves:
   a. Central
   b. Mueller
   c. Kennedy Valve, Division of ITT Grinnell Valve Co., Inc.
   d. Star Sprinkler Corp.
   e. Viking
   f. Victaulic
   g. Globe
2. Butterfly and Ball Valves:
   a. Grinnell
   b. Mueller
   c. Victaulic
   d. Milwaukee
3. Grooved Mechanical Couplings:
   a. Gruvlok
   b. Victaulic Company of America
4. Double Check Valve Assembly:
   a. Febco Model 805YD
   b. Watts Model 709
   c. Hersey Model 2 or E-1
   d. Ames Model 2,000 (epoxy)
5. Fire Protection Specialty Valves:
   a. Reliable Automatic Sprinkler Co., Inc.
   b. Star Sprinkler Corporation
   c. Viking Corporation
   d. Central Grinnell/Gem
   e. Globe
6. Fire Department Connection:
   a. Croker
   b. Potter-Roemer
   c. Elkhart
   d. Grinnell/Gem
7. Sprinkler Heads:
   a. Automatic Sprinkler Corp. of America.
   b. Central Sprinkler Corp.
   c. ITT Grinnell
   d. Reliable Automatic Sprinkler Co., Inc.
   e. Star Sprinkler Corp.
   f. Viking Corp.
   g. Globe
8. Fire Protection Specialties:
   a. Croker-Standard Division; Fire-End & Croker Corp.
   b. Elkhart Brass Mfg. Co., Inc.
   c. Grinnell Fire Protection Systems Co., Inc.
   d. Grunau Sprinkler Mfgr. Co., Inc.
   e. Potter Roemer, Inc.
9. Inspector's Test and Drain Module:

a. Victaulic
b. A.G.F.
c. Grinnell/Gem

10. Flexible Stainless Steel Hose Branch Line:
    a. Flex Head Industries, Series 2000
    b. Or Equal

2.3 BASIC IDENTIFICATION

A. General: Provide identification complying with Division 23 Basic Mechanical Materials and Methods section "Mechanical Identification", in accordance with the following listing:
   1. Fire Protection Piping: Pipe markers.
   2. Fire Protection Valves: Valve tags.
   3. Fire Protection Signs: Provide the following signs:
      a. At each sprinkler valve, sign indicating what portion of system valve controls.
      b. At each outside alarm device, sign indicating what authority to call if device is activated.
      c. At door to each sprinkler control valves, sign reading **"FIRE CONTROL"**.
      d. At each drain or test, sign indicating its purpose.

B. Attach to the riser a metal sign indicating the name, address and telephone number of the Fire Protection Contractor. Also indicate the date of installation.

2.4 BASIC PIPING SPECIALTIES

A. General: Provide piping specialties complying with Division 23 Basic Mechanical Materials and Methods section "Piping Specialties", in accordance with the following listing:
   1. Pipe Escutcheons
   2. Dielectric Unions
   3. Drip Pans
   4. Pipe Sleeves
   5. Sleeve Seals
   6. Fire Barrier Penetration Seals

2.5 BASIC SUPPORTS AND ANCHORS

A. General: Provide supports and anchors complying with Division 23 Basic Mechanical Materials and Methods section "Supports and Anchors" in accordance with the following listing:
   1. Adjustable steel clevis hangers, adjustable steel band hangers, or adjustable band hangers, for horizontal-piping hangers and supports.
   2. Two-bolt riser clamps for vertical piping supports.
   3. Steel turnbuckles and malleable iron sockets for hanger-rod attachments.
   4. Concrete inserts, top-beam C-clamps, side beam or channel clamps or center beam clamps for building attachments.
   5. Concrete inserts and other type hangers penetrating into or through structural members shall be submitted (by the Fire Protection Contractor) to, and have the approval of, the Structural Engineer contracted for this project.

6. Hangers (which are acceptable for Project) and hanger spacing shall be in accordance with NFPA-13.

2.6 PIPE AND FITTINGS (UNDERGROUND)

A. Underground pipe shall be ductile iron, thickness Class 52 unless specified otherwise by local authorities or ANSI/AWWA C150/A21.50-81; 350 PSI pressure rating; tar coated outside, cement mortar lined inside in accordance with ANSI/AWWA C104/A21.4-80. Full lengths of pipe shall be utilized to the greatest extent possible.

B. Fittings for ductile iron pipe shall be 250 PSI pressure rating in accordance with ANSI/AWWA C110-77, tar coated outside and cement lined inside in accordance with ANSI/AWWA C104/A21.4-80.

C. Joints shall be push-on or mechanical type as per ANSI/AWWA C111/A21.11-80.

2.7 PIPE AND TUBING MATERIALS (INSIDE BUILDING)

A. General: Refer to Part 3 Article "Pipe Applications" for identification of systems where the below specified pipe and fitting materials are used.

B. Steel Pipe: ASTM A 53, A795 or A135, Schedule 40 or Schedule 10, U.S. manufacture, Black steel pipe, plain ends.

C. American Tube Company "Dyna-Thread-40" and "Dyna-Flow" and Allied Tube and Conduit Corporation "Super Flo" are acceptable to Schedule 40 pipe. Installation shall be per manufacturer's recommendations.

D. Schedule 5 pipe shall not be allowed.

E. The Corrosion Resistance Ratio of the pipe shall be 1.00 or greater. Documentation shall be presented with product submittal.

F. Schedule 10 pipe shall only be allowed for pipe sizes 2-1/2 inch and larger.

G. Provide galvanized, Schedule 40, piping system for preaction system.

H. Flexible Stainless Steel Hose Branch Line: Use only for connection to individual sprinkler head, shall be all welded construction, Factory Mutual Approved, U.L. Listed, 300 psig rated. Each hose shall be factory leak tested. Device shall comply with 2002 NFPA 13 Guidelines.

2.8 FITTINGS (INSIDE BUILDING)

A. Cast Iron Threaded Fittings: ANSI B16.4, Class 125 standard pattern, for threaded joints. Threads shall conform to ANSI B1.20.1.

B. Malleable Iron Threaded Fittings: ANSI B16.3, Class 300, standard pattern, for threaded joints. Threads shall conform to ANSI B1.20.1. Install steel pipe with threaded joints and fittings for 2-inch and smaller and where shown on drawings.

C. Steel Fittings: ASTM A234, seamless or welded, for welded joints.

D. Grooved Mechanical Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47 Grade 32510 malleable iron; or ASTM A53, Type F or Types E or S.

E. Grooved Mechanical Couplings: Consist of ductile or malleable iron housing, a synthetic rubber gasket of a central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure roll-grooved pipe and fittings. Grooved mechanical couplings including gaskets used on dry-pipe systems shall be listed for dry-pipe service.

F. Grooved Mechanical Fittings and Couplings for the entire fire protection system shall be of the same manufacturer as submitted in shop drawing equipment review.

G. Cast Iron Threaded Flanges: ANSI B16.1, Class 250; raised ground face, bolt spot faced.

H. Cast Bronze Flanges: ANSI B16.24, Class 300; raised ground face, bolt holes spot faced.

I. Plain end, hooker type, or push-on fittings or couplings shall not be allowed.

J. Bushings and reducing couplings shall not be allowed.

K. UL listed and Factory Mutual approved segmentally welded fittings are acceptable. Friction loss and flow data shall accompany hydraulic calculations.

2.9 JOINING MATERIALS

A. Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.

B. Gasket Materials: Thickness, materials and type suitable for fluid or gas to be handled, and design temperatures and pressures.

2.10 GENERAL DUTY VALVES

A. Butterfly valves - 2-Inch and Smaller: Body cast iron, 175 pound cold water working pressure – non-shock, threaded ends, stainless steel disk with EPDM seal. Valves shall have a hand wheel, slow opening and closing with water hammer elimination, and internal tamper switch.

B. Butterfly Valves: 2-1/2 Inch to 8-inch shall be listed to 175 PSI with optional internal tamper switch. Body shall be ductile iron with a corrosion resistant coating. Seat shall be field replaceable without the use of special tools. The valve shall be provided with stem bushings to isolate the stem from the stem journal. The valve body shall be machined with a retaining lip for positive retention of the seat to provide drip tight shutoff at full rated differential pressure with the downstream piping removed.

C. Ball Valves: 1-1/2 Inch and smaller shall be threaded, forged brass construction, with teflon seats and blow out proof stem.

D. Ball Valves: 2-Inch to 3-inch shall be listed to 300 PSI with optional internal tamper switch. Body shall be ductile iron with corrosion resistant coating. Ball shall be 316 stainless steel.

E. Swing Check Valves: MSS SP-71; Class 175, cast iron body and bolted cap conforming to ASTM A 126, Class B; horizontal swing, with a bronze disc or cast-iron disc with bronze disc ring, and flanged ends. Valve shall be capable of being refitted while the valve remains in the line.

F. Double Check Valve Assembly: Double check valve assembly shall be UL listed for fire protection service and USC-CCCF approved. Installation arrangement shall be per manufacturer's recommendations.

2.11 BASIC METERS AND GAUGES

A. General: Provide meters and gauges complying with Division 23 Basic Mechanical Materials and Methods section "Meters and Gauges", in accordance with the following listing:
   1. Pressure gauges, 0-250 PSI range.

2.12 ALARM DEVICE AND FIRE PROTECTION SPECIALTIES

A. General: Types and sizes shall mate and match piping and equipment connections. Provide fire protection specialties, UL listed, in accordance with the following listing. Provide sizes and types which mate and match piping and equipment connections.

B. Water Flow Indicators: Vane type waterflow detector, rated to 250 PSIG; designed for horizontal or vertical installation; have two (2) SPDT circuit switches to provide isolated alarm and auxiliary contacts, 7 ampere 125 volts AC and 0.25 ampere 24 volts DC; complete with factory-set field-adjustable retard element to prevent false signals, tamper-proof cover which sends a signal when cover is removed, and with activation time retarding capability set at 30 seconds. The setting shall be verified through the Inspectors Test prior to Final Inspection.

C. Supervisory Switches: Provide products recommended by manufacturer for use in service indicated. SPST, normally closed contacts, designed to signal valve in other than full open position.

2.13 AUTOMATIC SPRINKLERS

A. Sprinkler Heads: Fusible link type, and style as indicated or required by the application. Unless otherwise indicated, provide heads with nominal 1/2-inch discharge orifice, for "ordinary" temperature range with a minimum temperature of 155 degree F. Provide "intermediate" temperature heads in Electrical Rooms and where required as noted in NFPA-13.

B. Sprinkler Head Finishes: Provide heads with the following finishes:
   1. Upright, Pendent and Sidewall Styles: Chrome plated, factory brass, in finish spaces, exposed to view; rough bronze finish for heads in unfinished spaces and not exposed to view. Heads shall be stainless steel where installed exposed to acids, chemicals, or other corrosive fumes.

2. Concealed Style (ceiling): Rough brass, adjustable, with painted White cover plate. GEM Models FR946 and F946 Clean Line Sprinklers are not acceptable.
3. Concealed Style (horizontal sidewall): Rough brass, adjustable, with painted White cover plate; extended coverage. VIKING Model VK680.
4. Recessed Style: Bright chrome, with bright chrome escutcheon plate. GEM Models FR948 and F948 recessed sprinklers are not acceptable.
5. See drawings for additional sprinkler type requirements.

C. Sprinkler Head Cabinet and Wrench: Finished steel cabinet, suitable for wall mounting, with hinged cover and space for spare sprinkler heads plus sprinkler head wrench. Provide amounts of each style per NFPA-13. Locate head cabinet on shop drawing submittal.

D. Plastic fire sprinkler escutcheons are not acceptable.

2.14 FIRE DEPARTMENT CONNECTIONS

A. Wall Type Siamese Connections: Polished chrome cast brass, 2-way flush wall type, with wall escutcheon and having National Standard threads, for the connections size indicated, as specified in NFPA 1963. Each inlet shall have a clapper valve, and cap and chain. Unit shall have wall escutcheon of cast-brass, finish to match connections, with words "STANDPIPE - FIRE DEPT. CONNECTION" or "AUTO SPKR. - FIRE DEPT. CONNECTION" or "AUTO SPKR. AND STANDPIPE - FIRE DEPARTMENT CONNECTION" in raised letters. Contractor shall verify threads with Local Fire Department.

B. Fire Department connections including location shall meet the approval of the Fire Department Having Jurisdiction.

2.15 INSPECTOR'S TEST AND DRAIN ASSEMBLY

A. Provide an alarm test module of a manufacturer listed in Paragraph 2.2.

B. Comply with NFPA-14, Section 5-11, for draining and testing of wet standpipe system.

C. Test and drain piping shall be routed to exterior. Location shall meet Owner's approval.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine rough-in for fire hose valves and cabinets to verify actual locations of piping connections prior to installing cabinets.

B. Examine walls for suitable conditions where cabinets are to be installed.

C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PIPE APPLICATIONS

A. Install Schedule 40 steel pipe with threaded joints and fittings for 2-inch and smaller.

B. Install Schedule 40 steel pipe with roll-grooved ends and grooved mechanical coupling or with threaded joints and fittings.

C. Acceptable alternates to Schedule 40 pipe shall be installed per manufacturer's recommendations.

3.3 PIPING INSTALLATIONS

A. Provide a minimum 5'-0" cover for all underground pipe installations. Install in accordance with AWWA C600.

B. Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of piping systems. So far as practical, install piping as indicated. Drawings are diagrammatic in character and do not necessarily indicate every required offset, valve, fitting, etc.
   1. Deviations from approved "Working Plans" for sprinkler piping require written approval of the Authority Having Jurisdiction. Written approval shall be on file with the Engineer prior to deviating from the approved "Working Plans".

C. Install sprinkler piping to provide for system drainage in accordance with NFPA-13.

D. Use approved fittings to make all changes in direction, branch takeoffs from mains, and reductions in pipe sizes. Welded outlet branch pipe fittings are acceptable.

E. Install unions in pipe 2-inch and smaller, adjacent to each valve. Unions are not required on flanged devices or in piping installations using grooved mechanical couplings.

F. Install flanges or flange adapters on valves, apparatus, and equipment having 2-1/2 inch and larger connections.

G. For welded pipe, all cutouts (coupons) shall be removed prior to installation.

H. Hangers and Supports: Comply with the requirements of NFPA-13. Hanger and support spacing and locations for piping joined with grooved mechanical couplings shall be in accordance with the grooved mechanical coupling manufacturer's written instructions for rigid systems. Provide protection from damage where subject to earthquake in accordance with NFPA-13.

I. Make connections between underground and aboveground piping using an approved transition piece strapped or fastened to prevent separation.

J. Install mechanical sleeve seal at pipe penetrations in basement and foundation walls. Refer to Division 23 Section "Basic Piping Materials and Methods".

K. All piping penetrating walls to structure shall be sleeved and sealed per Division 23.

L. Install test connections sized and located in accordance with NFPA-13 complete with shutoff valve. Test connections may also serve as drain pipes.

M. Install pressure gauge on the riser or feed main at or near each test connection. Provide gauge with a connection not less than 1/4-inch and having a soft metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and where they will not be subject to freezing.

N. The fire line entry valves shall have monitoring electrical switches, the wiring from which shall be carried to the Fire Annunciating Panel.

O. The Fire Protection Contractor shall be responsible for the coordination of his installation with all other contractors.

P. Protect adjacent area where pipe cutting and threading takes place (e.g. floors, ceilings, walls, etc.).

Q. There shall be no fire sprinkler piping in Electrical Rooms other than piping serving sprinklers directly in that room or installed over any electrical panels.

R. Provide spring-loaded check valve at top of drain risers.

S. Install pressure gauges on city and system sides of fire entry valve assembly.

T. Install hangers straight and true and piping parallel to building lines.

3.4 PIPE JOINT CONSTRUCTION

A. Welded Joints: AWS D10.9, Level AR-3.

B. Threaded Joints: Conform to ANSI B1.20.1, tapered pipe threads for field cut threads. Join pipe, fittings, and valves as follows:
   1. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
   2. Align threads at point of assembly.
   3. Apply appropriate tape or thread compound to the external pipe threads.
   4. Assemble joint to appropriate thread depth. When using a wrench on valves, place the wrench on the valve end into which the pipe is being threaded.
   5. Damaged Threads: Do not use pipe with threads which are corroded or damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.

C. Flanged Joints: Align flange surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly to appropriate torque specified by the bolt manufacturer.

D. Mechanical Grooved Joints: Roll grooves on pipe ends dimensionally compatible with the couplings.

E. End Treatment: After cutting pipe lengths, remove burrs and fins from pipe ends.

3.5 VALVE INSTALLATIONS

A. General: Install fire protection specialty valves, fittings and specialties in accordance with the manufacturer's written instructions, NFPA-13 and the Authority Having Jurisdiction.

B. Gate Valves: Install electronically supervised-open indicating valves so located to control all sources of water supply except fire department connections. Where there is more than one (1) control valve, provide permanently marked identification signs indicating the portion of the system controlled by each valve. Refer to Division 23 Section "Mechanical Identification" for valve tags and signs.

C. Valve at water main tap shall be underground gate valve with roadway box.

D. Install approved double check valve assembly in each water supply connection.

3.6 SPRINKLER HEAD INSTALLATIONS

A. Any sprinklers with any paint on them, as a result of the painting of the sprinkler piping, shall be replaced. The sprinkler system shall then be hydrostatically tested again at the Contractor's expense.

B. Sprinkler heads shall be positioned so as to comply with NFPA-13 for any obstructions.

C. Run piping concealed above heated furred ceilings and in joists to minimize obstructions. Expose only heads.

D. Protect sprinkler heads against mechanical injury with standard guards.

E. Provide 1-inch diameter nipple and 1-inch x 1/2-inch reducing fitting for each upright head. (Excluding Mechanical Equipment Rooms.)

F. Provide heads in "pocketed" areas caused by exposed duct, piping or beams.

G. Sprinkler head deflector distance from face of finished ceiling shall not exceed 4-inch.

H. Sprinkler heads shall be located in the center of all 2-foot x 2-foot ceiling tiles, quarter points, and along the centerline lengthwise of 2-foot x 4-foot ceiling tiles.
   1. Sprinklers in I.T. closets shall be wall mounted (S. Dewall type).

I. Use proper tools to prevent damage during installations.

J. Install sprinkler piping in a manner such that mechanical equipment, ceiling tiles or lights can be accessed and easily removed.

K. Minimum fire sprinkler head temperature rating for sprinklers in electrical rooms shall be 212 degree F. Keep sprinklers as far from transformers and/or panels as spacing allows.

3.7 FIRE DEPARTMENT CONNECTION INSTALLATIONS

A. Install automatic drip valves at the check valve on the fire department connection to the mains. Route drain to exterior.

B. Install mechanical sleeve seal at pipe penetration in outside walls.

3.8 INSTALLATION OF BASIC IDENTIFICATION

A. General: Install mechanical identification in accordance with Division 23 Basic Mechanical Materials and Methods section "Mechanical Identification".

B. Install fire protection signs on piping in accordance with NFPA-13 and NFPA-14 requirements.

3.9 INSTALLATION OF METERS AND GAUGES

A. Install meters and gauges in accordance with Division 23 Basic Mechanical Materials and Methods section "Meters and Gauges".

3.10 FLEXIBLE STAINLESS STEEL HOSE BRANCH LINE

A. Install per requirements associated with the listing of U.L. and Factory Mutual for installation in suspended or sheet rock ceilings. Provide factory brackets to maintain listing of installation for applicable sprinkler head type connection.

3.11 FIELD QUALITY CONTROL

A. Flush, test and inspect Sprinkler Piping Systems in accordance with NFPA-13, Standard for Installation of Sprinkler systems, Edition 1991 - Chapter 8.

B. The Fire Sprinkler System shall not be connected to underground piping until the fire service main is tested and approved.

C. The Fire Protection Contractor shall conduct and bear the costs of all necessary tests of the Fire Protection Work, furnish all labor, power and equipment. All piping shall be tested with water as required, the tests witnessed by the Authority Having Jurisdiction.

D. The Fire Protection Piping shall be tested under a hydrostatic pressure of not less than 200 PSIG, for a duration of not less than two (2) hours.

E. Replace piping system components which do not pass the test procedures specified, and retest repaired portion of the system at Fire Protection Contractor's expense.

F. All piping tests (pneumatic and hydrostatic) shall be conducted prior to the application of any painting materials. This will prevent hidden leaks and/or repainting of repaired/altered piping.

3.12 SYSTEM CERTIFICATION

A. The Contractor shall provide the Owner with written certification prior to final inspection, that all new equipment:
   1. Has been visually inspected and functionally tested as required by the specifications.
   2. Is installed entirely in accordance with the manufacturer's recommendations within the limitations of the system's UL listings and NFPA criteria.
   3. Is in proper working order.

3.13 FINAL INSPECTION AND TESTING

A. The Contractor shall make arrangements with the Owner for final inspection and witnessing of the final acceptance tests. The Fire Protection Contractor, the Alarm System Contractor and the Owner will conduct the final inspection and witness the final acceptance test.

B. All tests and inspections required by the referenced Codes and Standards, and the Owner shall be performed by the Contractor.

C. The inspecting committee as referenced above will visit the job site to inspect the work and witness the final acceptance tests when they have been advised by the Contractor that the work is completed and ready for test. If the Work is not complete or the test is unsatisfactory, the Contractor shall be responsible for the Consultant's extra time and expenses for re-inspection and witnessing the re-testing of the work. Such extra fees shall be deducted from payments by the Owner to the Contractor.

D. After the system has been inspected and tested, a certificate, "Contractor's Material and Test Certificate Sprinkler System - Water Spray System", shall be provided by the Contractor and shall be signed by him or his representative, the Owner's representative and by a representative of the Fire Department if appropriate. Sufficient copies shall be prepared to ensure the Engineer, Owner, all Inspecting Authorities and the Contractor have a copy for their files. The Contractor shall prepare one (1) test report for each inspection performed whether successful or not.

E. The signing of the Certificate by the Owner's representative shall in no way prejudice any claim against the Contractor for faulty material, poor workmanship, or failure to comply with Inspecting Authority's requirements or Local Ordinances.

F. Contractor shall provide at least five (5) working days notice for all tests.

G. All sprinkler supervisory initiating devices shall be functionally tested to verify proper operation.

H. All supervisory functions of each initiating device shall be functionally tested.

I. Receipt of all alarm and trouble signals, initiated during the course of the testing, shall be verified at the Fire Alarm Control Panel.

3.14 OPERATION AND MAINTENANCE MANUAL

A. The Contractor shall provide the Owner with a loose-leaf manual containing:
   1. A detailed description of the systems.
   2. A detailed description of routine maintenance required or recommended or which would be provided under a maintenance contract including a maintenance schedule and detailed maintenance instructions for each type of device installed.
   3. Manufacturer's Data Sheets and Installation Manuals/Instructions for all equipment installed.
   4. A list of recommended spare parts.
   5. Service Directory.
   6. Full size mylar reproducibles of the Record Drawings (stamped and signed per Section 1.6), and AutoCad version 2000 "CD's" which are electronically stamped/signed.
   7. Hydraulic Calculations (stamped and signed per Section 1.6).

B. Within fifteen (15) days of the completion of the work, six (6) copies of the manual shall be submitted for approval.

3.15 RECORD DRAWINGS

A. The Contractor shall provide and maintain on the site an up-to-date record set of approved shop drawing prints which shall be marked to show each and every change made to the sprinkler system from the original approved Shop Drawings. This shall not be construed as authorization to deviate from or make changes to the shop drawings approved by the Owner without written instruction from the Owner in each case. This set of drawings shall be used only as a record set.

B. Upon completion of the Work, the record set of prints shall be used to prepare complete, accurate final record drawings reflecting any and all changes and deviations made to the sprinkler system.

C. The Owner, at his option and at the Contractor's expense, may require revised hydraulic calculations depending on the extent and nature of field changes.

D. The Record Drawings and Hydraulic Calculations shall have the signed stamp of a Professional Engineer registered in the State of Colorado or the signature with certification number of a Level 4 Senior Engineering Technician of the National Institute for Certification of Engineering Technology certifying the Record Drawings and the Hydraulic Calculations accurately represent the completed Fire Protection System.

E. Upon completion of the Work, two (2) sets of Black-line Record Drawings shall be submitted to the Owner for review.

F. Upon review of the Black-Line Record Drawings, one (1) set of reproducible mylar record drawings and one (1) Electronic copy of Black-Line Record Drawings shall be delivered to the Owner.

3.16 GUARANTEE PERIOD

A. Guarantee: The Contractor shall guarantee all materials and workmanship for a period of one (1) year beginning with the date of final acceptance by the Owner. The Contractor shall be responsible during the design, installation, testing and guarantee periods for any damage caused

by him (or his subcontractors) or by defects in his (or his subcontractor's) work, materials, or equipment.

B. Emergency Service: During the installation and warranty period, the Contractor shall provide emergency repair service for the sprinkler system within four (4) hours of a request by the Owner for such service. This service shall be provided on a twenty-four (24) hour per day, seven (7) days per week basis.

3.17 TRAINING

A. The Contractor shall conduct two (2) training sessions of four (4) hours each to familiarize the building personnel with the features, operation and maintenance of the sprinkler systems. Training sessions shall be scheduled by the Owner at a time mutually agreeable to the Contractor and the Owner.

3.18 WATER DAMAGE

A. The Fire Protection Contractor shall be responsible for any damage to the work of others, to building and property/materials of others caused by leaks in automatic sprinkler equipment, unplugged or disconnected pipes or fittings, and shall pay for necessary replacement or repair of work or items so damaged during the installation and testing periods of the automatic sprinkler work.

3.19 WORK BY OTHERS

A. Electrical Contractor shall wire all water flow switches and tamper switches on valves to central alarm panel, and shall also wire alarm bells or light/horn.

END OF SECTION 210500

SECTION 220000 - BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including the, General and Supplementary Conditions, Division-1 Conditions specification sections apply to the Division 22 specifications and drawings.

B. Related Sections: Refer to all sections in Division 22 Refer to Division 26 specification section and Division 26 drawings.

1.2 SUMMARY

A. This Section specifies the basic requirements for plumbing installations and includes requirements common to more than one (1) section of Division 22. It expands and supplements the requirements specified in sections of Division 1 and Division 22.

B. The Contractor shall coordinate and co-operate with Owner at all times for all new to existing connections, system shutdowns and restart-up, flushing and filling both new and existing systems.

C. The Contractor shall be responsible for the maintenance operation and servicing of all new mechanical systems which are to be used by the Owner during the time of any occupancy and use of any areas within the construction limitations before final completion or acceptance of the systems. A written record of maintenance, operation and servicing shall be turned over to the Owner prior to final acceptance.

D. Attention is called to the fact that this is a LEED project. Project requirements include compliance with Division 1 LEED criteria, including, but not limited to:
   1. Construction Indoor Air Quality (IAQ) Management Plan, and construction waste management and disposal requirements.
   2. Low-Emitting Adhesives and Sealants requirements.
   3. Low-Emitting Paints and Coatings requirements.
   4. Coordination with commissioning agent and commissioning requirements.

1.3 PROJECT CONDITIONS

A. Protect all mechanical and electrical work against theft, injury or damage from all causes until it has been tested and accepted.

B. Be responsible for all damage to the property of the Owner or to the work of other contractors during the construction and guarantee period. Repair or replace any part of the Work which may show defect during one (1) year from the final acceptance of all work. Provided such defect is, in the opinion of the Architect, due to imperfect material or workmanship and not due to the Owner’s carelessness or improper use.

1.4 INSTALLER'S QUALIFICATIONS

A. All Plumbing Work shall be performed by a State of Colorado Licensed Contractor under the supervision of a Licensed Plumber. Contractors shall verify that plumbers are currently licensed by the State of Colorado and shall supply the Project Manager with names and license numbers. Contractors shall have a minimum of three (3) years of satisfactory performance in conducting the type of work specified.

1.5 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

B. Extend all grease fittings to an accessible location.

C. Furnish hinged steel access doors with concealed latch, whether shown on drawings or not, in all walls and ceilings for access to all concealed valves, shock absorbers, air vents, motors, balancing cocks, and other operating devices requiring adjustment or servicing. Refer to Division 1 for access door specification.

D. The minimum size of any access door shall not be less than the size of the equipment to be removed or 24-inch x 24-inch if used for service only, unless size is indicated on Drawings.

E. Furnish doors to trades performing work in which they are to be built, in ample time for building-in as the work progresses. Whenever possible, group valves, cocks, etc., to permit use of minimum number of access doors within a given room or space.

F. Factory manufactured doors shall be of a type compatible with the finish in which they are to be installed.

G. Access doors in fire-rated walls and ceilings shall have equivalent UL label and fire rating.

1.6 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment shop drawings and manufacturer's requirements for actual provided equipment for rough-in requirements.

1.7 REQUIREMENTS OF REGULATORY AGENCIES

A. Refer to Division 1.

B. Execute and inspect all work in accordance with all Underwriters, local and state codes, rules and regulations applicable to the trade affected as a minimum, but if the plans and/or specifications call for requirements that exceed these rules and regulations, the greater

requirement shall be followed. Follow recommendations of NFPA, SMACNA, EPA, OSHA and ASHRAE.

C. Comply with standards in effect at the date of these Contract Documents, except where a standard or specific date or edition is indicated.

D. The handling, removal and disposal of regulated refrigerants shall be in accordance with U.S. EPA, state and local regulations.

E. After entering into contract, Contractor will be held to complete all work necessary to meet these requirements without additional expense to the Owner.

1.8 REQUIREMENTS OF LOCAL UTILITY COMPANIES

A. Comply with rules and regulations of local utility companies. Include in bid the cost of all valves, valve boxes, meter boxes, meters and such accessory equipment which will be required for the project.

1.9 PERMITS AND FEES

A. Refer to Division 1.

B. Owner shall pay all tap, development, meter, etc., fees required for connection to municipal and public utility facilities.

C. Contractor shall arrange for and pay for all inspections, licenses and certificates required in connection with the Work.

1.10 MECHANICAL INSTALLATIONS

A. Drawings are diagrammatic in character and do not necessarily indicate every required offset, valve, fitting, etc.

B. Drawings and specifications are complementary. Whatever is called for in either is binding as though called for in both.

C. Drawings shall not be scaled for rough-in measurements or used as shop drawings. Where drawings are required for these purposes or have to be made from field measurement, take the necessary measurements and prepare the drawings.

D. Before any Work is installed, determine that equipment will properly fit the space; that required piping grades can be maintained and that ductwork can be run as contemplated without interferences between systems, with structural elements or with the work of other trades.

E. Coordinate the installation of mechanical materials and equipment above and below ceilings with suspension system, light fixtures, and other building components.
   1. Coordinate ceiling cavity space carefully with all trades. In the event of conflict, install mechanical and electric systems within the cavity space allocation in the following order of priority.
      a. Plumbing waste, vent piping and roof drain mains and leaders

b. Supply, return and exhaust ductwork
c. Fire sprinkler mains and leaders
d. Electrical conduit
e. Domestic hot and cold water piping
f. Fire sprinkler branch piping and sprinkler runouts

F. Verify all dimensions by field measurements.

G. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.

H. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.

I. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

J. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials.

K. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.

L. Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

M. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

1.11 EXCAVATING AND BACKFILLING

A. General:
1. Provide all necessary excavation and backfill for installation of Mechanical Work in accordance with Division 1.
2. In general, follow all regulations of OSHA as specified in Part 1926, Subpart P, "Excavations, Trenching and Shoring". Follow specifications of Division 23 as they refer specifically to the Mechanical Work.

B. Contact Owners of all underground utilities to have them located and marked, at least two (2) business days before excavation is to begin. Also, prior to starting excavation, brief employees on marking and color codes and train employees on excavation and safety procedures for natural gas lines. When excavation approaches gas lines, expose lines by carefully probing and hand digging.

C. Provide all necessary pumping, cribbing and shoring.

D. Walls of all trenches shall be a minimum of 6-inch clearance from the side of the nearest mechanical work. Install pipes with a minimum of 6-inch clearance between them when located in same trench.

E. Pipe Trenching:
   1. Dig trenches to depth, width, configuration, and grade appropriate to the piping being installed. Dig trenches to 6-inches below the level of the bottom of the pipe to be installed. Install 6-inch bed of pea gravel or squeegee, mechanically tamp to provide a firm bed for piping, true to line and grade without irregularity. Provide depressions only at hubs, couplings, flanges, or other normal pipe protrusions.

F. Backfilling shall not be started until all work has been inspected, tested and accepted. All backfill material shall be reviewed by the Soils Engineer. In no case shall lumber, metal or other debris be buried in with backfill.

G. Trench Backfill:
   1. Backfill to 12-inches above top of piping with pea gravel or squeegee, the same as used for piping bed, compact properly.
   2. Continue backfill to finish grade, using friable material free of rock and other debris. Install in 6-inch layers, each properly moistened and mechanically compacted prior to installation of ensuing layer. Compaction by hydraulic jetting is <u>not</u> permissible.

H. After backfilling and compacting, any settling shall be refilled, tamped, and refinished at this Contractor's expense.

I. This Contractor shall repair and pay for any damage to finished surfaces.

J. Complete the backfilling near manholes using pea gravel or squeegee, installing it in 6-inch lifts and mechanically tamping to achieve 95 percent compaction.

K. Use suitable excavated material to complete the backfill, installed in 6-inch lifts and mechanically compacted to seal against water infiltration. Compact to 95 percent for the upper 30-inches below paving and slabs and 90 percent elsewhere.

1.12 TEMPORARY FACILITIES

A. Light, Heat, Power, Etc.:
   1. Responsibility for providing temporary electricity, heat and other facilities shall be as specified in Division 1.

B. Use of Permanent Building Equipment for Temporary Heating or Cooling:
   1. Permanent building equipment shall not be used without written permission from the Owner. If this equipment is used for temporary heating or cooling, it shall be adequately maintained per manufacturer's instructions and protected with filters, strainers, controls, reliefs, etc. The guarantee period shall not start until the equipment is turned over to the Owner for his use.

1.13 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Refer to the Instructions to Bidders and Division 1, "PRODUCTS, OPTIONS AND SUBSTITUTION".

1.14 SUBMITTALS

A. Refer to the Conditions of the Contract (General and Supplementary), Division 1 and AIA Document A201 (1987) Edition, "SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES".

B. The manufacturer's material or equipment listed in the schedule or identified by name on the drawings are the types to be provided for the establishment of size, capacity, grade and quality. If alternates are used in lieu of the scheduled names, the cost of any changes in construction required by their use shall be borne by Contractor.

C. All equipment shall conform to the State and/or Local Energy Conservation Standards.

D. Submittal of shop drawings, product data, and samples will be accepted only when submitted by and stamped by the Contractor. Data submitted from subcontractors and material suppliers directly to the Architect will not be processed unless prior written approval is obtained by the Contractor.

E. Before starting Work, prepare and submit to the Architect all shop drawings and descriptive equipment data required for the project. Unless each item is identified with specification section and sufficient data to identify its compliance with the specifications and drawings, the item will be returned without action or "Revise and Resubmit". Continue to submit shop drawings after each Engineer's action, until a "Reviewed" action is received. The Contractor shall submit the total number of sets as called for in Division 1 to the Architect for final distribution. Submittals shall include the following specified materials and, in addition, any materials not listed below but which are specified in the individual sections of Division 22 which follow.
   1. Pipe Markers
   2. Sanitary and storm drainage piping, fittings and joining materials
   3. Plumbing fixtures, trim, fittings and rough-in dimensions, cleanouts and drains
   4. Domestic water piping, fittings and joining materials
   5. Domestic water heaters
   6. Water hammer arresters
   7. Valves, including pressure relief and pressure regulating
   8. Pumps
   9. Tanks, including expansion storage
   10. Thermometers and pressure gauges
   11. Piping specialties
   12. Supports, anchors and seals
   13. Expansion compensators
   14. Flexible pipe connectors
   15. Water flow meters
   16. Vibration isolators
   17. Insulation, including plastic pipe fitting insulation covers and manufacturer's installation instructions

F. Wiring diagrams, control panelboards, motor test data, motors, starters and controls for electrically operated equipment furnished by mechanical trades.

G. Identify each item with specification section and sufficient data to certify its compliance with the specifications.
   1. Include compliance with LEED requirements.

1.15 PRODUCT LISTING

A. Prepare listing of major mechanical equipment and materials for the project, within two (2) weeks of signing the Contract Documents and transmit to the Mechanical Engineer.

B. Unless otherwise specified, all materials and equipment shall be of domestic (USA) manufacture and shall be of the best quality used for the purpose in commercial practice.

C. Provide all information requested.

D. Submit this listing as a part of the submittal requirement specified in Division 1, "Submittal Procedures".

E. When two (2) or more items of same material or equipment are required (plumbing fixtures, pumps, valves, air conditioning units, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in work, except as otherwise indicated.

F. Provide products which are compatible within systems and other connected items.

1.16 NAMEPLATE DATA

A. Provide permanent operational data nameplate on each item of mechanical equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

1.17 DELIVERY, STORAGE, AND HANDLING

A. Refer to Division 1.

B. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

C. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage, dirt, dust and moisture.

D. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

E. Provide factory-applied plastic end-caps on each length of pipe and tube, except for concrete, corrugated metal, hub-and-spigot, clay pipe. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

F. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.

G. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

1.18 RECORD DOCUMENTS

A. Refer to Division 1. The following paragraphs supplement the requirements of Division 1.

B. Keep a complete set of record document prints in custody during entire period of construction at the construction site.

C. Mark drawing prints to indicate revisions to piping, size and location both exterior and interior; including locations of control devices, filters, and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned to column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.); RFI's; change orders; concealed control system devices. Changes to be noted on the drawings shall include final location of any piping relocated more than 1'-0" from where shown on the drawings.

D. Mark Equipment Schedules on the drawings with changes to Manufacturer, Model Number, and data based on reviewed shop drawings.

E. At the completion of the project, turn these record drawings over to the General Contractor for his submission to the Architect. This Contract will not be considered completed until these record drawings have been received and reviewed by the Architect.

1.19 OPERATION AND MAINTENANCE DATA

A. Refer to Division 1.

B. The Testing and Balancing Report shall be submitted and received by the Engineer at least five (5) calendar days prior to the Contractor's request for final observation time frame requirements. Final Observation(s) will not proceed without T&B Report. Include in the O&M Manual after review with "Review" or "Make Corrections Noted" has been accomplished.

C. In addition to the information required by Division 1 for maintenance data, include the following information:
   1. Description of mechanical equipment, function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
   2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
   3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
   4. Servicing instructions and lubrication charts and schedules.
   5. Manufacturer's service manuals for all mechanical equipment provided under this Contract.
   6. Include the valve tag list.

7. Name, Address and Telephone Number of party to be contacted for twenty-four (24) hour service for each item of equipment.
8. Starting, stopping, lubrication, equipment identification numbers and adjustment clearly indicated for each piece of equipment.
9. Complete parts list.
10. Mechanical warranties.

D. This Contract will not be considered completed, nor will final payment be made, until all specified material, including Testing and Balancing Report, is received in this Operating and Maintenance Report and the manual is reviewed by the Architect.

1.20 LUBRICATION OF EQUIPMENT

A. Refer to Division 1. The following paragraphs supplement the requirements of Division 1.

B. Contractor shall properly lubricate all mechanical pieces of equipment which he provided before turning the building over to the Owner. He shall attach a linen tag or heavy duty shipping tag on the piece of equipment showing the date of lubrication and the type and brand of lubricant used.

C. Furnish the Engineer with a typewritten list in quadruplicate, of each item lubricated and type of lubricant used, no later than two (2) weeks before completion of the project, or at time of acceptance by the Owner of a portion of the building and the mechanical systems involved.

1.21 WARRANTIES

A. Refer to Division 1 for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements. In any case, the entire mechanical system shall be warranted no less than one (1) year from the time of acceptance by the Owner.

B. Compile and assemble the warranties specified in Division 22, into a separated set of vinyl covered, three-ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment to include date or beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.22 CLEANING

A. Refer to Division 1.

B. Refer to Division 22, "TESTING, ADJUSTING AND BALANCING" for requirements for cleaning filters, strainers, and mechanical systems prior to final acceptance.

PART 2 - NOT USED

PART 3 - NOT USED

PART 4 - EXECUTION

4.1 LEED REQUIREMENTS

A. Refer to Division 1.

B. Source Control – For Contractor information, all paints, carpet, caulks, adhesives, sealants are specified as low-VOC and non-toxic. Recover, isolate and ventilate containers housing toxic materials. Avoid exhaust fumes from idling vehicles and gasoline fueled tools.

C. Pathway Interruption – During construction, isolate areas of work to prevent contamination of clean or spaces. Ventilate using 100% outside air to exhaust contaminated air directly to the outside during installation of VOC emitting materials. Use pressure differentials or barriers between work and clean areas to prevent contaminated air from entering clean areas.

D. Housekeeping – Protect building materials from weather and store in a clean area prior to unpacking for installation. Clean all coils, air filters, and fans before performing testing and balancing procedures. Institute cleaning activities designed to control contaminants in building spaces.

E. Scheduling – Complete applications of wet and odorous materials such as VOCs in paints, sealants, and coatings before installing absorbing materials such as ceiling tiles, carpets, insulation, gypsum products, and fabric-covered furnishings. Avoid exposure of all interior materials to moisture.

F. Protect stored on-site or installed absorptive materials from moisture damage.

END OF SECTION 220000

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of Piping Specialties Work required by this section is indicated on drawings and schedules and by requirements of this section.

B. Types of Piping Specialties specified in this section include the following:
   1. Escutcheons
   2. Dielectric Fittings
   3. Mechanical Sleeve Seal
   4. Fire and Smoke Barrier Penetration Seal
   5. Drip Pan
   6. Pipe Sleeve
   7. Sleeve Seals

C. Piping Specialties furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 22 sections.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of piping specialties of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:
   1. FCI Compliance: Test and rate "Y" type strainers in accordance with FCI 73-1 "Pressure Rating Standard for "Y" Type Strainers." Test and rate other type strainers in accordance with FCI 78-1 "Pressure Rating Standard for Pipeline Strainers Other than "Y" Type."
   2. ASME B 31.9 "Building Services Piping" for materials, products, and installation.
   3. Safety valves and pressure vessels shall bear the appropriate ASME label.
   4. Fabricate and stamp air separators and compression tanks to comply with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
   5. ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualification" for qualifications for welding processes and operators.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions, and dimensioned drawings for each type of manufactured piping specialty. Include pressure drop curve or chart for each type and size of pipeline strainer. Submit schedule showing manufacturer's figure number, size, location, and features for each required piping specialty.

B. Shop Drawings: Submit for fabricated specialties, indicating details of fabrication, materials, and method of support.

1. Include compliance with LEED requierments.

C. Maintenance Data: Submit maintenance data and spare parts lists for each type of manufactured piping specialty. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. Pipe Escutcheons:
      a. Chicago Specialty Mfg. Co.
      b. Producers Specialty & Mfg. Corp.
      c. Sanitary-Dash Mfg. Co.
   2. Dielectric Fittings:
      a. B & K Industries, Inc.
      b. Capital Mfg. Co.; Division of Harsco Corp.
      c. Eclipse, Inc.
      d. Epco Sales, Inc.
      e. Perfection Corp.
      f. Rockford-Eclipse Division
   3. Mechanical Sleeve Seal:
      a. Thunderline Corp.
      b. "Metraseal" by Metraflex Co.
   4. Fire and Smoke Barrier Penetration Seal:
      a. Electrical Products Division/3M
      b. Dow Corning
      c. Flame Stop, Inc.
      d. MetaCaulk

2.2 PIPE ESCUTCHEONS

A. General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.

B. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.

C. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.

2.3 DIELECTRIC FITTINGS

A. General: Provide standard products recommended by manufacturer for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and stop corrosion.

B. Dielectric Unions: Not allowed**.**

C. Dielectric Waterway Fittings:
1. ASTM-A53 Xinc electroplated steel pipe casing with inert, non-corrosive thermoplastic lining (NSF/FDA listed).
2. Thread x thread ends 1/2-inch x 3-inch through 4-inch x 6-inch.
3. Groove x thread ends 1/2-inch x 4-inch through 4-inch x 6-inch.
4. Listed by IAPMO/UPC and SBCC PST and ESI.
5. Dielectric unions are not an acceptable substitute for dielectric waterway fittings.

D. Dielectric Flange Insulation Kits:
1. Field-assembled, companion flange assembly, full face or ring type.
2. Neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
3. Provide separate companion flanges and steel bolts and nuts.
4. Rated at 175 psi conforming to ANSI B16.42 (iron) B16.24 (bronze).
5. Factory certified to withstand minimum of 600 volts on a dry line without flashover.
6. Meets federal specifications for tensile strength and thread end connections.

2.4 MECHANICAL SLEEVE SEALS

A. General: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.5 FIRE AND SMOKE BARRIER PENETRATION SEALS

A. General: Provide UL listed products for sealing all openings through fire or fire/smoke rated walls, floors, or ceilings used as passage for mechanical piping.

2.6 FABRICATED PIPING SPECIALTIES

A. Drip Pans: Provide drip pans fabricated from corrosion-resistant sheet metal with watertight joints, and with edges turned up 2-1/2 inch, and with double sloped to drain bottom. Reinforce top, either by structural angles or by rolling top over 1/4-inch steel rod. Provide hole, gasket, and flange at low point for watertight joint and 1-inch drain line connection.

B. Pipe Sleeves: Provide pipe sleeves of one (1) of the following:
1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gauges: 3-inch and smaller, 20 gauge; 4-inch to 6-inch, 16 gauge; over 6-inch, 14 gauge.

2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
3. Iron Pipe: Fabricate from cast iron or ductile iron pipe; remove burrs.

C. Sleeve Seals: Provide sleeve seals for sleeves located in foundation walls below grade, or in exterior walls, of one (1) of the following:
1. Mechanical Sleeve Seals: Installed between sleeve and pipe.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.

B. Mechanical Sleeve Seals: Loosely assemble rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form watertight seal.

C. Fire or Fire/Smoke Barrier Penetration Seals: Where pipe penetration occurs in fire or fire/smoke rated walls, provide the following:
1. Fill the entire length of the opening with sealing compound. Adhere to manufacturer's installation instructions.
2. Cracks, Voids, or Holes Up to 4-Inch Diameter: Use putty or caulking, one-piece intumescent elastomer, non-corrosive to metal, compatible with synthetic cable jackets, and capable of expanding ten (10) times when exposed to flame or heat, UL-listed.
3. Openings 4-Inch or Greater: Use sealing system capable of passing three (3) hour fire test in accordance with ASTM E-814, consisting of wall wrap or liner, partitions, and end caps capable of expanding when exposed to temperatures of 250 to 350 degree F (121 to 177 degree C), UL-listed.

D. Where pipe penetrations occur in non-fire rated floors, roof slabs, or walls, the space between pipe insert and the sleeve shall be packed on each end with mineral wool or other non-combustible material, positively fastened in place.

E. Provide dielectric waterways or insulating flanges, as required by pipe size, on all connections of dissimilar metals.

3.2 INSTALLATION OF FABRICATED PIPING SPECIALTIES

A. Drip Pans: Locate drip pans under piping as indicated. Hang from structure with rods and building attachments, weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1-inch drain line to drain connection, and run to nearest plumbing drain or elsewhere as indicated.

B. Pipe Sleeves: Install pipe sleeves of types indicated where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members of work, except as

detailed on drawings, or as reviewed by Architect/Engineer. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insert will have free movement in sleeve, including allowance for thermal expansion; but not less than two (2) pipe sizes larger than piping run. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Extend floor sleeves 4-inch above finished floor in all Mechanical Equipment Rooms and pipe chases. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.

1. Install sheet metal sleeves at interior partitions and ceilings other than suspended ceilings.
2. Install iron pipe sleeves at exterior penetrations; both above and below grade.
3. Install steel pipe sleeves except as otherwise indicated.

C. Sleeve Seals: Install in accordance with the following:
   1. Fire and Smoke Penetration Seal: Fill and pack annular space between sleeve and pipe with an approved fire and smoke penetration seal material on both sides.

END OF SECTION 22050

SECTION 220519 - METERS AND GAUGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of Meters and Gauges required by this section is indicated on drawings and/or specified in other Division 22 sections.

B. Types of Meters and Gauges specified in this section include the following:
   1. Temperature Gauges and Fittings:
      a. Glass Thermometers
      b. Thermometer Wells
      c. Temperature Gauge Connector Plugs
   2. Pressure Gauges and Fittings:
      a. Pressure Gauges
      b. Pressure Gauge Cocks
      c. Pressure Gauge Connector Plugs

C. Meters and gauges furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 22 sections.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of meters and gauges, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:
   1. UL Compliance: Comply with applicable UL Standards pertaining to meters and gauges.
   2. ANSI and ISA Compliance: Comply with applicable portions of ANSI and Instrument Society of America (ISA) Standards pertaining to construction and installation of meters and gauges.

C. Certification: Provide meters and gauges whose accuracies, under specified operating conditions, are certified by manufacturer.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of meter and gauge. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit meter and gauge schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gauge.

B. All flow measuring devices to be provided shall be reviewed and approved by the Test and Balance Contractor for proper scale, rangeability and function prior to submitting shop

drawings. The Test and Balance Contractor shall provide a typed letter stating this review has been completed and included with shop drawing submittals.

C. Maintenance Data: Submit maintenance data and spare parts lists for each type of meter and gauge. Include this data and product data in Maintenance Manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. Glass Thermometers:
      a. Ernst Gauge Co.
      b. Marshalltown Instruments, Inc.
      c. Miljoco Corp.
      d. Weiss Instruments, Inc.
      e. Dwyer
   2. Temperature Gauge Connector Plugs:
      a. Fairfax Company
      b. Peterson Equipment Co.
      c. Universal Lancaster
      d. Sisco
      e. MG Piping Products Co.
   3. Pressure Gauges and Pressure Gauge Cocks:
      a. Ametek/U.S. Gauge
      b. Marsh Instrument Co.; Unit of General Signal
      c. Marshalltown Instruments, Inc.
      d. Miljoco Corp.
      e. Weiss Instruments, Inc.
      f. MG Piping Products Co.
      g. Dwyer
   4. Pressure Gauge Connector Plugs:
      a. Fairfax Company
      b. Peterson Equipment Co.
      c. Universal Lancaster
      d. Sisco
      e. MG Piping Products Co.
      f. Miljoco Corp.

2.2 GLASS THERMOMETERS

A. General: Provide glass thermometers of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.

B. Case: Die cast aluminum finished in baked epoxy enamel, glass front, spring secured, 9-inch long.

C. Adjustable Joint: Die cast aluminum, finished to match case, 180 degree adjustment in vertical plane, 360 degree adjustment in horizontal plane, with locking device.

D. Tube and Capillary: Non-Toxic spirit filled, 1 percent scale range accuracy, shock mounted.

E. Scale: Satin faced, non-reflective aluminum, permanently etched markings.

F. Stem: Copper-plated steel, or brass, for separable socket, length to suit installation.

G. Range: Conform to the following:
   1. Hot Water: 30 Degree - 240 degree F with 2 degree F scale divisions (0 degree - 160 degree C with 2 degree C scale divisions).
   2. Chilled Water: 30 - 180 Degree F with 2 degree F scale divisions (0 degree - 100 degree C with 1 degree C scale divisions).

2.3 THERMOMETER WELLS

A. General: Provide thermometer wells constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2-inch extension for insulated piping. Provide cap nut with chain fastened permanently to thermometer well.

2.4 TEMPERATURE GAUGE CONNECTOR PLUGS

A. General: Provide temperature gauge connector plugs pressure rated for 500 PSI and 200 degree F (93 degree C). Construct of brass and finish in nickel-plate, equip with 1/2-inch NPS fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8-inch O.D. probe assembly from dial type insertion thermometer. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.

2.5 PRESSURE GAUGES

A. General: Provide pressure gauges of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.

B. Type: General Use, 1 percent accuracy, ANSI B40.1 Grade A, phospher bronze bourdon type, bottom connection.

C. Case: Stainless steel, drawn steel, or brass, glass lens, 4-1/2 inch diameter.

D. Connector: Brass with 1/4-inch male NPT. Provide protective syphon when used for steam service.

E. Scale: White coated aluminum, with permanently etched markings.

F. Range: Conform to the following:
   1. Vacuum: 30-Inch Hg - 15 PSI.
   2. Water: 0 - 100 PSI.
   3. Steam: 0 - 200 PSI.

2.6 PRESSURE GAUGE COCKS

A. General: Provide pressure gauge cocks between pressure gauges and gauge tees on piping systems. Construct gauge cock of brass with 1/4-inch female NPT on each end, and "T" handle brass plug.

B. Syphon: 1/4-Inch straight coil constructed of brass tubing with 1/4-inch male NPT on each end.

C. Snubber: 1/4-Inch brass bushing with corrosion resistant porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.

2.7 PRESSURE GAUGE CONNECTOR PLUGS

A. General: Provide pressure gauge connector plugs pressure rated for 500 PSI and 200 degree F (93 degree C). Construct of brass and finish in nickel-plate equip with 1/2-inch NPS fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8-inch O.D. probe assembly from dial type insertion pressure gauge. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which meters and gauges are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF TEMPERATURE GAUGES

A. General: Install temperature gauges in vertical upright position, and tilted so as to be easily read by observer standing on floor.

B. Thermometer Wells: Install in piping tee where indicated, in vertical upright position. Fill well with oil or graphite, secure cap.

C. Temperature Gauge Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap. Provide portable temperature gauge for each plug connection.

3.3 INSTALLATION OF PRESSURE GAUGES

A. General: Install pressure gauges in piping tee with pressure gauge cock, located on pipe at most readable position.

B. Locations: Install in the following locations, and elsewhere as indicated:
   1. At suction and discharge of each pump.
   2. At discharge of each pressure reducing valve.

3. At water service outlet.

C. Pressure Gauge Cocks: Install in piping tee with snubber. Install syphon for steam pressure gauges.

D. Pressure Gauge Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap. Provide portable pressure gauge for each plug connection.

E. All pressure gauges shall have coil syphon and isolation gauge cock, "snubber" valve, to service the gauge and isolate it from the pipe system service without having to drain the piping system.

F. For 6-Inch and Larger Piping Service, use ball valve for gauge isolation valve which shall be not less than 1/4-inch diameter for full gauge pipe correction diameter.

3.4 ADJUSTING AND CLEANING

A. Adjusting: Adjust faces of meters and gauges to proper angle for best visibility.

B. Cleaning: Clean windows of meters and gauges and factory-finished surfaces. Replace cracked or broken windows, repair any scratched or marred surfaces with manufacturer's touch-up paint.

END OF SECTION 220519

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes potable cold, hot, and recirculated hot water valves within the building to a point 5-feet outside the building. This section includes the following:
   1. Valves

1.2 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the provisions of the following:
   1. Comply with ASME B16.10 and ASME B16.34 for Dimension and Design Criteria.
   2. NSF Compliance: NSF 61 for Valve Materials for Potable-Water Service.
   3. Local Plumbing Code and Utility Department requirements.
   4. Colorado Cross Connection Control Manual.

1.3 SUBMITTALS

A. Submit under provisions of Division 1.

1.4 CLOSEOUT SUBMITTALS

A. Submit under provisions of Division 1.

B. Test Reports.

PART 2 - PRODUCTS

2.1 VALVES

A. General:
   1. Comply with MSS-92 1980 "Valve Users Manual".
   2. Sizes: Provide valves of same size as upstream pipe size.
   3. Extended Stems: Where insulation is indicated or specified, provide extended stems to allow full operation of the valve without interference by the insulation.
   4. Bypass and Drain Connections: Comply with MSS SP-45.

B. Gate Valves:
   1. 3-Inch and Larger: MSS-SP 70, 200 PSI CWP, non-rising stem, bolted bonnet, resilient wedge, epoxy coated ASTM A126 Class B cast iron body, handwheel operator, meets AWWA-C509. Provide right hand open valves at water meter per Denver Water Requirements.

a. Acceptable Manufacturers:
   1) Watts 405-NRS-RW
   2) Febco

C. Ball Valves:
1. 3-Inch and Smaller: MSS-SP-110, 150 PSI SWP, 600 PSI WOG, two-piece ASTM B-584 cast bronze body, full port, chrome plated brass/bronze ball, TFE seats, anti-blowout stem, separate packnut with adjustable stem packing, extended stem, and vinyl covered steel handle. Threaded or soldered end connections.
   a. Acceptable Manufacturers:
      1) Nibco T/S 585-70
      2) Milwaukee
      3) Apollo (Conbraco)
      4) Watts
      5) Grinnell

D. Globe Valves:
1. 2-1/2 Inch and Smaller: MSS SP-80, Class 150, ASTM B-62 bronze body and bonnet, TFE seat disc and malleable iron or ductile iron hand wheel, union bonnet, non-asbestos packing, silicon bronze ASTM B-371 or low-zinc alloy B-99 stem. Threaded or soldered end connections.
   a. Acceptable Manufacturers:
      1) Nibco T/S 235-4
      2) Milwaukee
      3) Hammond
      4) Stockham
      5) Grinnell
2. 3-Inch and Larger: MSS SP-85, Class 125, ASTM A-126, Class B cast iron body and bolted bonnet, cast bronze or cast iron disc and cast iron or malleable iron hand wheel, non-asbestos packing, bronze trimmed, OS&Y. Flanged end connection.
   a. Acceptable Manufacturers:
      1) Nibco F718-B
      2) Milwaukee
      3) Hammond
      4) Stockham
      5) Grinnell

E. Butterfly Valves:
1. 3-Inch and Larger: MSS-SP-67, ASTM A126, Class B fully lugged cast iron body, ASTM B 148 aluminum bronze disc, ASTM A582 416 stainless steel stem, EPDM liner, bronze bearings, non-metallic bushing and NBR stem seals. Rated for 250 PSI bi-directional shutoff and 250 PSI dead-end service with downstream piping removed. Provide extended neck for insulation. Sizes 3-inch – 6-inch shall be lever operated with 10-position throttling plate; sizes 8-inch and larger shall have weatherproof gear operators.
   a. Acceptable Manufacturers:
      1) Keystone Figure 222
      2) Nibco
      3) Milwaukee
      4) Watts
      5) Grinnell

F. Check Valves:
   1. Swing Check Valve:
      a. 2-1/2 Inch and Smaller: MSS SP-80; Class 150 SWP, ASTM B-62 bronze body and bonnet, horizontal swing design, Y-pattern, with TFE seat disc. Threaded or soldered end connections.
         1) Acceptable Manufacturers:
            a) Nibco T/S433-Y
            b) Milwaukee
            c) Grinnell
      b. 3-Inch and Larger: MSS SP-71; Class 125, ASTM A126 Class B cast iron body with bronze trim, non-asbestos gasket, horizontal swing, and flanged ends. Valve shall be capable of being refitted without removing from pipe.
         1) Acceptable Manufacturers:
            a) Nibco F918-B
            b) Milwaukee
            c) Stockham
            d) Hammond
            e) Grinnell

G. Drain Valve: Ball valve with threaded hose end and cap with chain. Valve upstream of backflow preventer shall have vacuum breaker and cap.
   1. Acceptable Manufacturers:
      a. Apollo 78-100/78-200
      b. Nibco
      c. Milwaukee
      d. Watts

PART 3 - EXECUTION

3.1 VALVES

A. Installation:
   1. Use gate valves only on domestic water service entrances as specified by the Authority Having Jurisdiction.
   2. Use ball or butterfly valves for isolation valves unless noted otherwise.
   3. Use globe valves for throttling or water meter bypass.
   4. Use calibrated balancing valves or globe valves for balancing valves.
   5. Sectional Valves: Install sectional valves on each branch and riser, close to main, where branch or riser serves two (2) or more plumbing fixtures or equipment connections, and elsewhere as indicated.
   6. Shutoff Valves: Install shutoff valves on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.
   7. Drain Valves: Install drain valves at the base of each riser, at low points of horizontal runs, and elsewhere as required to completely drain distribution piping system.
   8. Check Valves: Install swing check valves on discharge side of each pump, and elsewhere as indicated.
   9. Chain Wheel Operators: For valves 2-1/2 inch and larger installed 96-inches or higher above finished floor elevation in mechanical rooms. Extend chains to an elevation of 6'-0" above finished floor elevation.

10. Where soldered end connections are used, use solder having a melting point below 840 degree F for gate, globe, and check valves and below 421 degree F for ball valves.
11. Provide unions with valves having threaded ends.

3.2 ADJUSTING AND CLEANING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistant leaking occurs.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLBG PIPING AND EQUIP

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of Supports and Anchors required by this section is indicated on drawings and/or specified in other Division 22 sections.

B. Types of Supports and Anchors specified in this section include the following:
   1. Horizontal-Piping Hangers and Supports
   2. Vertical-Piping Clamps
   3. Hanger-Rod Attachments
   4. Building Attachments
   5. Saddles and Shields
   6. Spring Hangers and Supports
   7. Miscellaneous Materials
   8. Anchors
   9. Equipment Supports

C. Supports and anchors furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 22 sections.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:
   1. Regulatory Requirements: Comply with applicable Plumbing Codes pertaining to product materials and installation of supports and anchors.
   2. Nationally Recognized Testing Laboratory and NEMA Compliance (NRTL): Hangers, supports, and components shall be listed and labeled by a NRTL where used for fire protection piping systems. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.
   3. Duct Hangers: SMACNA Duct Manuals.
   4. MSS Standard Compliance:
      a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor. Submit pipe hanger and support schedule showing

manufacturer's figure number, size, location, and features for each required pipe hanger and support.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of assembly of components.

C. Product certificates signed by the manufacturer of hangers and supports certifying that their products meet the specified requirements.

D. Maintenance Data: Submit maintenance data and parts list for each type of support and anchor. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. Pipe Hangers and Supports:
      a. B-Line Systems Inc.
      b. Carpenter and Patterson, Inc.
      c. Fee & Mason Mfg. Co.; Division Figgie International
      d. Grinnell Corp.
      e. PHD Manufacturing, Inc.
      f. Elcen Metal Products Company
      g. Michigan Hanger Company
      h. ITT Grinnell Corp.
      i. Unistrut Metal Framing Systems
      j. Hubbard Enterprises (Supports for domestic water piping)
      k. Specialty Products Co. (Supports for domestic water piping)
      l. Hilti Construction Chemicals, Inc.
   2. Saddles and Shields:
      a. Grinnell Corp.
      b. Pipe Shields, Inc.
      c. Insulation Pipe Supports Manufacturing
      d. Insulated Saddle Shield Insert Product Inc.
      e. Joy Dot Marketing
      f. Future Market Industries, Inc.
      g. Michigan Hanger Company
      h. Component Products Co.
      i. Value Engineered Products, Inc.
   3. Roof Pipe Supports:
      a. MAPA
      b. B-Line
   4. Concrete Inserts and Anchors:
      a. Phillips Drill Company
      b. Michigan Hanger Company

c. Unistrut Metal Framing Systems
d. Elcen Metal Products Company
e. ITW Ramset/Red Head
f. Hilti Construction Chemicals, Inc.

2.2 PIPE HANGERS AND SUPPORTS

A. Hangers and support components shall be factory fabricated of materials, design, and manufacturer complying with MSS SP-58.
1. Components shall have galvanized coatings where installed for piping and equipment that will not have field-applied finish.
2. Pipe attachments shall have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.

B. Adjustable Clevis Hanger: MSS Type 1
1. Steel Pipe, size 3/8-inch thru 12-inch, Grinnell Fig. 260
2. Copper Pipe, size 1/2-inch thru 4-inch, Grinnell Fig. CT-65
3. Cast Iron Pipe, size 4-inch thru 24-inch, Grinnell Fig. 590

C. Adjustable Swivel Ring: MSS Type 10
1. Steel Pipe, size 1/2-inch thru 2-inch, Grinnell Fig. 69; size 2-1/2 inch thru 8-inch, Grinnell Figs. 69 or 70
2. Copper Pipe, size 1/2-inch thru 4-inch, Grinnell Fig. CT-69

D. Pipe Clamps: MSS Type 8
1. Steel Pipe, size 3/4-inch thru 20-inch, Grinnell Fig. 261
2. Copper Pipe, size 1/2-inch thru 4-inch, Grinnell Fig. CT-121

E. U Bolts: MSS Type 24
1. Steel Pipe, size 1/2-inch thru 36-inch, Grinnell Fig. 137
2. Copper Pipe, size 1/2-inch thru 8-inch, Grinnell Fig. 137C

F. Straps: MSS Type 26
1. Steel Pipe, size 1/2-inch thru 4-inch, Grinnell Fig. 262

G. Pipe Stanchion Saddle: MSS Type 37
1. Steel Pipe, size 4-inch thru 12-inch, Grinnell Fig. 259

H. Yoke and Roller Hanger: MSS Type 43
1. 2-1/2 inch thru 20-inch, Grinnell Fig. 181

I. Hanger Rods: Continuous threaded steel, sizes as specified.

J. Hangers:
1. Hot Pipes:
a. 1/2-Inch thru 1-1/2 Inch: Adjustable wrought steel ring.
b. 2-Inch thru 5-Inch: Adjustable wrought steel clevis.
c. 6-Inch and Over: Adjustable steel yoke and cast iron roller.
2. Cold Pipes:
a. 1/2-Inch thru 1-1/2 Inch: Adjustable wrought steel ring.

b. 2-Inch and Over: Adjustable wrought steel clevis.

3. Multiple or Trapeze: Structural steel channel (with web vertical), with welded spacers and hanger rods. Provide cast iron roller and stand for hot pipe sizes 6-inch and over. Provide hanger rods one (1) size larger than for largest pipe in trapeze. If the deflection at center of trapeze exceeds 1/360 of the distance between the end hangers, install an additional hanger at mid-span or use a larger channel.

K. Wall Supports for Horizontal Pipe:
1. 1/2-Inch thru 3-1/2 Inch: Steel offset hook.
2. 4-Inch and Over: Welded steel bracket and wrought steel clamp. Provide adjustable steel yoke and cast iron roll for hot pipe 200 degree F and over and sizes 6-inch and over.

L. Supports for Vertical Pipe: Steel riser clamp.

M. Upper Attachments:
1. For attaching hanger rods to structural steel I-beams:
a. Provide adjustable beam clamp, Elcen No. 95 with No. 235 rod socket or equal. Attach to bottom flange of beam.
2. For attaching hanger rods to bar joists:
a. When bottom chord is constructed of structural steel angles, provide Elcen No. 84H square washer or equal with nut. Place hanger rod between backs of the two (2) angles and support with the washer on top of the angles. Spot weld washer to angles.
b. When bottom chord is constructed of round bars, provide Elcen No. 137 bar joint washer or equal.

2.3 CONCRETE INSERTS AND ANCHORS

A. Inserts: Case shall be of galvanized carbon steel with square threaded concrete insert nut for hanger rod connection; 3/4-inch lateral adjustment; top lugs for reinforcing rods, nail holes for attaching to forms. Michigan Hanger Models 355 and 355N or equal Unistrut or Elcen. This type of upper attachment is to be used for all areas having poured in place concrete construction.
1. Size inserts to suit threaded hanger rods.

B. Provide fasteners attached to concrete ceilings that are vibration and shock resistant. Provide hangers for piping and cuts attached to concrete construction with one (1) of the following types.
1. Concrete insert per MSS SP 58, Type 18.
2. Powder driven fasteners subject to approval of Structural Engineer. Each fastener shall be capable of holding a test load of 1,000 pounds whereas the actual load shall not exceed 50 pounds.
3. Self-drilling expansion shields. The load applied shall not exceed one-fourth the proof test load required.
4. Machine bolt expansion anchor. The load applied shall not exceed one-fourth the proof test load required.

C. Anchors: Carbon steel, zinc plated. Installation shall be in holes drilled with carbide-tipped drill bits or by use of self-drilling anchors.

1. Provide anchors suitable for the location of installation and designed to withstand all forces and movements acting in the anchor. Manufacture pipe anchors in accordance with MSS SP 58. Provide a safety factor of four (4) for the anchor installation.

2.4 SADDLES AND THERMAL SHIELD INSERTS

A. General: Provide thermal shield inserts under all insulated piping hangers and thermal shield inserts on all piping through floors, wall and roof construction penetrations. Size saddles and shields for exact fit to mate with pipe insulation or a minimum of 1-inch thick for uninsulated pipe thermal shield inserts.

B. Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.
   1. B-Line: B3160 to B3165

C. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.
   1. Grinnell Fig. 167

D. Thermal Shield Inserts: Provide 100-psi average compressive strength, waterproof, asbestos free calcium silicate, encased with a sheet metal enclosure. Insert and shield shall cover the entire circumference on vertical pipes, or the bottom half circumference of the pipe on horizontal mounting supports, and shall be of length recommended by the manufacturer for pipe size and thickness of insulation or the thickness of the wall, roof or floor construction.

2.5 MISCELLANEOUS MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36.

B. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix ratio shall be 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

C. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS Standards.

D. Pipe Guides: Provide factory-fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

2.6 ROOF PIPE SUPPORTS

A. Factory fabricated roof support system for piping application. Base shall be compatible with roofing membrane. For support materials other than metal, such materials shall be UV resistant. All metal components shall be corrosion resistant by either galvanization or zinc plating.

B. Supports shall be designed to support the piping system and installed in accordance to manufacturer's requirements.

C. Install with supplemental pad under support base as required by roofing system design.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 PREPARATION

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments. **Review Structural Drawings to obtain structural support limitations.**

B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at Project Site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified. **Provide Shop Drawing showing method and support locations from structure.**

3.3 INSTALLATION OF BUILDING ATTACHMENTS

A. Install building attachments within concrete or on structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert to forms. Where concrete with compressive strength less than 2,500 psi is indicated, install reinforcing bars through openings at top of inserts.

B. New Construction:
   1. Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.
   2. Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying pipe over 4-inch or ducts over 60-inch wide.
   3. Where concrete slabs form finished ceiling, finish inserts flush with slab surface.
   4. Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square steel plate and nut above slab, if construction above permits.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

A. Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69 and SP-89. Arrange for grouping of parallel runs of

horizontal piping to be supported together on field fabricated, heavy-duty trapeze hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.

C. Support fire-water piping independently from other piping systems.

D. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

E. Install hangers and supports to allow controlled movement of piping systems, to permit freedom of movement between pipe anchors, to facilitate action of expansion joints, expansion loops, expansion bends and similar units and within 1'-0" of each horizontal elbow.

F. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31.9 Building Services Piping Code is not exceeded.

H. Insulated Piping: Comply with the following installation requirements:
1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
2. Saddles: Install Protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.
3. Thermal Shield Inserts: Install thermal shield inserts MSS Type 40 on cold and chilled water piping that has vapor barrier. Thermal shield inserts shall span an arc of 180 degrees and shall have dimensions in inches not less than the following:

NPS	Length	Thickness
1/4 thru 3-1/2	12	0.048
4	12	0.060
5 and 6	18	0.060
8 thru 14	24	0.075
16 thru 24	24	0.105

4. Pipes 8-inches and larger shall have wood inserts.
5. Insert material shall be at least as long as the protective shield.
6. Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

I. Support vertical runs at each floor.

J. Install steel natural gas piping with the following minimum rod size and maximum spacing:

Size (NPS)	Maximum Span in Feet	Minimum Rod Size - Inches
1/2	6	3/8
3/4 to 1	8	3/8
1-1/4 or larger (horizontal)	10	1/2
Vertical, all sizes	Every floor level	

K. Install horizontal water distribution piping with the following maximum spacing and minimum rod sizes:

Nom. Pipe Size - Inches	Steel Pipe Max. Span - Feet	Copper Tube Max. Span - Feet	Min. Rod Diameter - Inches
Up to 1/2	6	6	3/8
3/4 & 1	8	6	3/8
1-1/4	10	6	3/8
1-1/2	10	6	3/8
2	10	10	3/8
2-1/2	10	10	1/2
3	10	10	1/2
4	10	10	5/8 (1/2 for copper)
5	10	10	5/8 (1/2 for copper)
6	10	10	3/4 (5/8 for copper)
8	10	10	7/8 (3/4 for copper)
10	10	10	7/8 (3/4 for copper)
12	10	10	7/8 (3/4 for copper)

L. Install sanitary drainage and vent systems with the following maximum spacing and minimum rod sizes:

Pipe Material	Max Horizontal Spacing in Ft.	Max Vertical Spacing in Ft.
Cast Iron, No Hub	4	--
Cast Iron Pipe, Lead & Oakum	5	15
Cast Iron Pipe, Compression Gasket	4	15
	(at every other joint, unless pipe length over 4', then each joint)	
Copper Tubing - 1-1/2" and Smaller	6	10
Copper Tubing - 2" and Larger	10	10

M. Support horizontal cast iron pipe as follows:
1. Hub and Spigot: All sizes - One (1) hanger to each joint.
2. No-Hub: All sizes.
    a. With Clamp-All and Anaheim Series 4,000 stainless steel couplings and MG cast iron couplings: One (1) hanger to each joint.

b. With all other stainless steel band type couplings: One (1) hanger to each side of joint.
c. Support all horizontal cast iron pipe within 18-inches of each joint and with 5-feet maximum spacing between hangers, except that pipe exceeding 5-feet in length shall be supported at intervals no greater than 10-feet.
d. Use hanger rods same size as for steel.
e. Support vertical cast iron pipe at each story height and at its base. Secure vertical hub and spigot pipe immediately below the hub. Support vertical no-hub pipe so that the weight is carried from the pipe to the support and not from the joint to the support.

N. Provide copper or copper plated hangers and supports for copper piping or provide sheet lead packing between hanger or support and piping.

O. Place a hanger within 1-foot (0.305 m) of each horizontal elbow.

P. Use hangers which are vertically adjustable 1-1/2 inch (38.1 mm) minimum after piping is erected.

Q. Support vertical steel and copper piping at every story height but at not more than 15-foot intervals for steel and 10-feet for copper.

R. Where several pipes can be installed in parallel and at same elevation, provide trapeze hangers.

S. Where practical, support riser piping independently of connected horizontal piping.

T. All insulated pipes (≥ 2"d) shall have thermal shield insert 6 at all support points. All piping shall have thermal shield inserts at each penetration through wall, floor and roof.

U. Each pipe drop to equipment shall be adequately supported. All supporting lugs or guides shall be securely anchored to the building structure.

V. Install all couplings with torque wrench, torqued to inch-pounds as specified by the manufacturer.

W. Securely anchor and support plumbing domestic water piping in chases or walls. Use factory manufactured clamps and brackets connected to fixture carriers, waste/vent piping or brackets connected to studs. Wires or straps will not be permitted.
1. When copper supplies are connected to flush valves, support the tubing by the studs or by a fixture carrier, not by clamping to waste/vent piping.
2. Prevent copper tubes from making contact with steel brackets using duct tape, fire retardant polyethylene inserts or other dielectric insulating material.
3. Place supports every 10-feet on vertical pipe and every 5-feet on horizontal pipe.

X. Hang all insulated pipe at the point of support in the following manner:
1. Hanger: See Paragraph 2.03 B.
2. Thermal Shield Insert: Provide thermal shield insert of the same thickness as adjoining insulation for insulated pipe. The entire 360 degrees shall be waterproof, asbestos free, calcium silicate.
a. If the pipe hanger spacing exceeds 10-feet or if there are to be pipe rollers, utilize a double thick shield on bearing surface.

b. On refrigerant, domestic cold water, chilled water and horizontal roof drain pipe the thermal shield insert shall extend 2-inches beyond the construction material and the sheet metal shield shall span an arc of 360 degrees. All hangers shall be properly sized to accommodate the thermal shield insert and no hanger shall penetrate or crush any of the insulating material.

Y. Install anchors and fasteners in accordance with manufacturer's recommendations and the following:

1. In the event a self-drilling expansion shield or machine bolt expansion shield is considered to have been installed improperly, the Contractor shall make an acceptable replacement or demonstrate the stability of the anchor by performing an on-site test under which the anchor will be subjected to a load equal to twice the actual load.
2. Powder-driven fasteners may be used only where they will be concealed after the construction is complete. Where an occasional fastener appears to be improperly installed, additional fastener(s) shall be driven nearby (not closer than six (6) inches) in undisturbed concrete. Where it is considered that many fasteners are improperly installed, the Contractor shall test load any fifty (50) successively driven fasteners. If 10 percent or more of these fasteners fail, the Contractor shall utilize other fastening means as approved and at no additional cost to the Owner.
3. Hangers for piping and ducts shall be attached to cellular steel floor decks with steel plates and bolted rod conforming to the steel deck manufacturer's requirements. Where the individual hanger load exceeds the capacity of a single floor deck attachment, steel angles, beams or channels shall be provided to span the number of floor deck attachments required.
4. Welding may be used for securing hangers to steel structural members. Welded attachments shall be designed so that the fiber stress at any point of the weld or attachment will not exceed the fiber stress in the hanger rod.

3.5 INSTALLATION OF ANCHORS

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31.9, and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31.9 and with AWS Standards D1.1.

C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to control movement to compensators.

D. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.6 EQUIPMENT SUPPORTS

A. Fabricate structural steel stands to suspend equipment from structure above or support equipment above floor.

B. Grouting: Place grout under supports for piping and equipment.

C. Concrete based for the mechanical equipment indoors or outdoors will be provided by the General Contractor only if shown on the Architectural or Structural Drawings. Otherwise, all bases shall be provided by this Contractor.

D. Housekeeping bases shall be 4-inch thick minimum, extended 4-inch beyond machinery bedplates.

E. This Contractor shall be responsible for the proper size and location of all bases and shall furnish all required anchor bolts and sleeves. If bases are provided by the General Contractor, furnish him with templates showing the bolt locations.

F. Equipment shall be secured to the bases with anchor bolts of ample size. Bolts shall have bottom plates and pipe sleeves and shall be securely imbedded in the concrete. All machinery shall be grouted under the entire bearing surface. After grout has set, all wedges, shims and jack bolts shall be removed and the space filled with non-shrinking grout. This Contractor shall provide lead washers at all equipment anchor bolts.

G. Construct equipment supports above floor of structural steel members or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

H. Provide rigid anchors for ducts and pipes immediately after vibration connections to equipment. See also Section 230548.

3.7 FLASHING AND SAFING

A. Flash and counterflash where mechanical equipment passes through weather or water-proofed walls, floors, and roofs.

B. Provide lead flashing around ducts and pipes passing from equipment rooms, installed according to manufacturer's data for sound control.

3.8 SLEEVES AND SEALS

A. General:
   1. Encase all insulated pipes penetrating fire rated walls and floors in 360 degree metal-shielded insulation inserts as manufactured by Pipe Shields, Inc. or equal. Extend insulation insert on all domestic cold water, chilled water and refrigerant lines 1-inch beyond sheet metal shield.

B. Pipes:
   1. Pipes:
      a. New Construction: Pipes penetrating fire rated concrete or masonry construction, whether insulated or not, shall be provided with sheet metal or pipe sleeves fitted into place at time of construction. In poured concrete, the sleeves shall be steel pipe with a full circle, continuously welded water stop plate to also act as a sleeve anchor. When installing Link-Seal (see Paragraph f.) the sleeve and Link-Seal shall be of matched sizes. Otherwise, sleeves shall be of such size to provide all around clearance of 1/4-inch to 1-inch. Seal entire space between pipe and sleeve with fire stopping as specified in Paragraph A.

b. Existing Construction: For existing construction or masonry construction, prepare pipe opening by carefully cutting or core drilling, install sheet metal sleeve, and fill any open space with fire stopping material. Cutting of concrete or masonry shall be done after approval of Structural Engineer.

c. Sleeves in non-fire rated or non-bearing walls, floors or ceilings, new or existing construction, shall be steel pipe or galvanized sheet metal with lock-type longitudinal seam. Pack all open spaces on each end with mineral wood or other non-combustible material, positively fastened in place. Asbestos is not acceptable.

d. Where a pipe of any description passes through a concrete floor, the sleeve shall extend at least 2-inch above the finished floor, except when using the ProSet Systems.

e. At Contractor's option, where uninsulated pipes penetrate cast-in-place concrete floors, the "ProSet Systems," Atlanta, Georgia, sleeving may be employed.

f. For pipes penetrating foundation walls, water-proofing membrane floors or other places where water leakage could be encountered, install Link-Seal wall sleeves by Thunderline Corporation in manner recommended by the manufacturer.

C. Seals:

1. General:

a. Seal all holes or voids where mechanical systems penetrate fire rated floors and walls with a fire stopping sealant having a fire rating equal to or greater than that of the construction being penetrated, but not less than two (2) hours. The sealant shall meet the requirements of ASTM E-814, ASTM E-119 and UL-1479. It shall be installed with strict adherence to the manufacturer's instructions and according to the product's UL Laboratory listing. The use of asbestos in any form is not permitted.

2. Types of Seals:

a. Intumescent (3M Company CP25 Caulk and 303 Putty)

b. Expanding Foam (Dow Corning 3-6548 Silicone RTV Foam)

c. Refractory Putty (SOHIO Carborundum Fire Putty)

3. Method of Use:

a. Intumescent Type: For insulated pipe, install insulation through the sleeve with a continuous vapor seal if required. Install intumescent seal in the annular space between the pipe insulation and the pipe sleeve. Refer to manufacturer's data sheets for maximum annular space allowable and thickness of material required to maintain the rating of the construction being penetrated in conformance with applicable UL Fire Stop Classification for the product.

b. Expanding Foam: For insulated pipe, terminate the insulation on both sides of the wall or floor being penetrated and fill the space between the construction and the bare pipe with the foam. For uninsulated pipe, continue pipe through the penetration and proceed as with insulated pipe.

c. Refractory Putty: For insulated pipe, provide a 360 degree metal-shielded calcium silicate insulation insert as specified in Paragraph A. Pack and seal the entire space between shield and sleeve with refractory putty. When sealing bare pipe, omit the metal-shielded insert.

D. Escutcheons:

1. In finished parts of the building, after painting is completed, install chromium plated escutcheons on all pipes passing through walls and floors.

3.9 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for pipe anchors and equipment supports. Install and align fabricated anchors in indicated locations.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so that no roughness shows after finishing.

3.10 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Touch-Up Painting: Immediately after erection of anchors and supports, clean field welds and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA-1 requirements for touch-up of field-painted surfaces.
   1. Touch-Up Painting: Cleaning and touch-up painting of field welds, bolted connections, and abraded areas of the shop paint on miscellaneous metal is specified in Division 9 section "PAINTING" of these specifications.

C. For galvanized surfaces, clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 220529

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of Mechanical Identification Work required by this section is indicated on drawings and/or specified in other Division 22 sections.

B. Types of Identification Devices specified in this section include the following:
   1. Painted Identification Materials
   2. Plastic Pipe Markers
   3. Plastic Tape
   4. Underground-Type Plastic Line Marker
   5. Engraved Plastic-Laminate Signs
   6. Plasticized Tags
   7. Lettering and Graphics

C. Refer to Division 26 sections for Identification Requirements of Electrical Work; not work of this section.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:
   1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.
   1. Include compliance with LEED requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. Allen Systems, Inc.
   2. Brady (W.H.) Co.; Signmark Division

3. Brimar Industries, Inc.
4. Industrial Safety Supply Co., Inc.
5. Seton Name Plate Corp.

2.2 MECHANICAL IDENTIFICATION MATERIALS

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 22 sections. Where more than single type is specified for application, selection is Installer's option, but provide single selection for each product category.

2.3 PAINTED IDENTIFICATION MATERIALS

A. Stencils: Standard fiberboard stencils, prepared for required applications with letter sizes generally complying with recommendations of ANSI A13.1 for piping or to match existing size in existing building, but not less than 3/4-inch high letters for access door signs and similar operational instructions.

B. Stencil Paint: Standard exterior type stenciling enamel; Black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.

C. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated, comply with ANSI A13.1 for colors or to match existing building standard identification.

2.4 PLASTIC PIPE MARKERS

A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.

B. Insulation: Furnish 1-inch thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125 degree F (52 degree C) or greater. Cut length to extend 2-inch beyond each end of plastic pipe marker.

C. Small Pipes: For external diameters less than 6-inch (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one (1) of the following methods:
   1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
   2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4-inch wide; full circle at both ends of pipe marker, tape lapped 1-1/2 inch.

D. Large Pipes: For external diameters of 6-inch and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than three (3) times letter height (and of required length), fastened by one (1) of the following methods:
   1. Steel spring or non-metallic fasteners.
   2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2 inch wide; full circle at both ends of pipe marker, tape lapped 3-inches.

3. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.

E. Lettering: Comply with piping system nomenclature as specified, scheduled, shown, or to match existing building lettering nomenclature system and abbreviate only as necessary for each application length.

F. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

2.5 PLASTIC TAPE

A. General: Provide manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

B. Width: Provide 1-1/2 inch wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6-inch, 2-1/2 inch wide tape for larger pipes.

C. Color: Comply with ANSI A13.1, except where another color selection is indicated.

2.6 UNDERGROUND-TYPE PLASTIC LINE MARKERS

A. General: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6-inch wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried pipe.

B. Provide multi-ply tape consisting of solid aluminum foil core between 2-layers of plastic tape.

2.7 ENGRAVED PLASTIC-LAMINATE SIGNS

A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, Black with White core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. Thickness: 1/8-Inch, except as otherwise indicated.

C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.8 PLASTICIZED TAGS

A. General: Manufacturer's standard pre-printed or partially pre-printed accident-prevention tags, of plasticized card stock with matt finish suitable for writing, approximately 3-1/4 inch x 5-5/8 inch, with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary wording (As examples; DANGER, CAUTION, DO NOT OPERATE).

2.9 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified, scheduled and approved by the Owner/Engineer. Provide numbers, lettering and wording as indicated and approved by the Owner/Engineer for proper identification and operation/maintenance of mechanical systems and equipment.

B. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as designated on the drawings or schedule as well as service.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 PIPING SYSTEM IDENTIFICATION

A. General: Install pipe markers of the following type on each system indicated to receive identification, and include arrows to show normal direction of flow. Existing building identification shall match the existing method which exists in the building.

B. Plastic pipe markers, with application system as indicated under "MATERIALS" in this section. Install on pipe insulation segment where required for hot non-insulated pipes.

C. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.

D. Near each valve and control device.

E. Near each branch, excluding short take-offs for fixtures; mark each pipe at branch, where there could be question of flow pattern.

F. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.

G. At access doors, manholes and similar access points which permit view of concealed piping.

H. Near major equipment items and other points of origination and termination.

I. Spaced intermediately at maximum spacing of 25-foot along each piping run, except reduce spacing to 15-foot in congested areas of piping and equipment.

J. On piping above removable acoustical ceilings.

3.3 UNDERGROUND PIPING IDENTIFICATION

A. General: During back-filling/top-soiling of each exterior underground piping systems, install continuous underground-type plastic line marker, located directly over buried line at 6-inch to 8-inch below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16-inch, install single line marker. For tile fields and similar installations, mark only edge pipelines of field.

3.4 MECHANICAL EQUIPMENT IDENTIFICATION

A. General: Install minimum 2-inch x 4-inch engraved plastic laminate equipment marker on each individual items of mechanical equipment. Provide signs for the following general categories of equipment.
   1. Main building systems control and operating valves, including safety devices and hazardous units such as gas outlets.
   2. Fuel-burning units including boilers, water heaters, medical gas equipment.
   3. Pumps, and similar motor-driven units.
   4. Heat exchangers, and similar equipment.
   5. Tanks and pressure vessels.
   6. Water treatment systems and similar equipment.

B. Lettering Size: Minimum 1/4-inch high lettering for name of unit.

C. Text of Signs: In addition to the identified unit, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

3.5 ADJUSTING AND CLEANING

A. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

END OF SECTION 220553

SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes:
   1. Piping Insulation, Jackets and Accessories

B. Refer to other Division 22 sections for Shields, Inserts, and Mechanical Identification.

C. Insulation thickness based on 1999 ASHRAE 90.1 recommendations. Ductwork insulation thickness is based on Table 6.2.4.2B, Envelope Criteria Table 5-16 through 5-19 for Exterior, Unvented Attic With Roof Insulation, Unconditioned Space and Indirectly Conditioned Spaces. Piping insulation thickness is based on Table 6.2.4.5.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than three (3) years.

B. Installer's Qualifications: Firm with at least five (5) years successful installation experience on projects with mechanical insulations similar to that required for this project.

C. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics and insulating cements.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's installation instructions and schedule listing materials, thickness, K-value, density, and furnished accessories for each service or equipment specified.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard ratings of the products, name of manufacturer, and brand.

B. Protect insulation against dirt, water, chemical, and mechanical damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide product by one of the following:
   1. Insulation:
      a. Armstrong World Industries, Inc. (flexible elastomeric)
      b. Johns-Manville Products Corp. (fiberglass, calcium silicate)
      c. Knauf Fiber Glass (fiberglass)
      d. Manson Insulation Co. (fiberglass, calcium silicate)
      e. Owens-Corning Fiberglas Corp. (fiberglass)
      f. Rubatex Corp. (flexible elastomeric)
   2. Jacketing and Covering Products:
      a. Childers
      b. Ceel-Co.
      c. Johns-Manville Products Corp.
      d. Knauf Fiber Glass

2.2 PIPING INSULATION

A. Glass Fiber: ASTM C 547, Type 1, rigid molded, noncombustible (NFPA 259), 0.23 "K" value at 75 degree F mean temperature, maximum service temperature 850 degree F, moisture sorption less than 0.2% by volume. Composite 25/50-flame spread/smoke developed rating (ASTM E 84, UL 723, and NFPA 255).

B. Vapor Retarder Jacket: ASTM C 1136, 45lbs/in tensile strength (ASTM D 828), beach puncture 50 oz in/in tear minimum (ASTM D 781). White Kraft paper reinforced with glass fiber yarn and bonded to aluminum foil, secured with self-sealing longitudinal laps and butt strips.

C. Connections: Tacks, pressure sensitive color matching vinyl tape, Perma-Weld adhesive.

D. Calcium Silicate: ASTM C 533, Type I, rigid molded, noncombustible (ASTME E 136), 0.42 "K" value at 300 degree F mean temperature, maximum service temperature 1200 degree F, 160 psi compressive strength for 5 percent compression (ASTM C 165), flexural strength 70 psi (ASTM C 203). 0/0 flame spread/smoke developed rating (ASTM E 84).

E. Tie Wire: 16-Gauge stainless steel with twisted ends on maximum 12-inch centers.

F. Field Applied Fittings and Jackets:
   1. Aluminum: 0.016-Inch thick sheet with factory applied moisture barrier, embossed finish with longitudinal slip joints and 2-inch laps, die shaped fitting covers.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions where mechanical insulation is to be installed. Do not proceed until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 PLUMBING PIPING INSULATION

A. Cold Piping:
   1. Applications:
      a. Potable and non-potable cold water.
      b. Potable chilled water.
      c. Interior aboveground storm water (excluding overflow system).
      d. Plumbing vents within six (6) lineal feet of roof outlet.
      e. Roof drain bowls.
   2. Insulation:
      a. Fiberglass: 1/2-Inch thickness up to 1-1/4 inch pipe size, 1-inch thickness for 1-1/2 inch pipe size and larger.

B. Hot Piping:
   1. Applications:
      a. Potable hot water.
      b. Potable hot water and hot water circulation.
      c. Hot equipment drain.
   2. Insulation:
      a. Hot water and circulating water; Fiberglass: ½-inch thickness for non-circulating runouts up to 8 feet in length for pipe sizes less than 1-inch. All other piping insulation shall be 1-inch thickness and have a conductivity not exceeding 0.27 BTU per inch/h x FT^2 x °F.

3.3 INSTALLATION OF PIPING INSULATION

A. Install insulation after piping system tests have been completed.

B. Clean piping to remove foreign substances and moisture prior to applying insulation.

C. Install insulation products according to manufacturer's written instructions, building codes, and recognized industry standards.

D. Omit insulation on exposed chrome-plated piping (except for handicapped fixtures), air chambers, unions, balance cocks, flow regulators, drain lines from water coolers, drainage piping located in crawl spaces or tunnels, buried piping, fire protection piping, and pre-insulated equipment.

E. Secure longitudinal jacket laps and butt strips according to manufacturer's recommendations.

F. Firmly rub lap and butt strips to pressurize seam and ensure positive closure.

G. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use scraps.

H. Apply insulation to piping with all joints tightly fitted to eliminate voids.

I. Apply insulation on cold surfaces with a continuous, unbroken vapor seal. Hangers, supports, and anchors that are secured directly to cold surfaces must be adequately insulated and vapor sealed to prevent condensation.

J. Extend surface finishes to protect all surfaces, end, and raw edges of insulation.

K. Protect vapor-barrier jackets on pipe insulation from puncture or other damage. Avoid the use of staples on vapor barrier jackets. Seal vapor barrier penetrations with vapor barrier finish recommended by the manufacturer.

L. Cover valves, fittings and similar items with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded or job fabricated covers (at Installer's option).

M. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where fire-stopping materials are required.

N. Provide thermal shield inserts on all pipe. For piping below ambient temperature, apply vapor barrier lap cement on butt joints and seal with 3-inch wide vapor barrier tape.
   1. Minimum insulation insert lengths:
      a. 1-1/2 – 2-1/2 Inch Pipe: 10-Inches
      b. 3 – 6-Inch Pipe: 12-Inches
      c. 8 – 10-Inch Pipe: 16-Inches
      d. 12-Inch and Larger Pipe: 22-Inches

O. Apply galvanized metal shields between hangers or supports and pipe insulation. Form shields to fit the insulation and extend up to the centerline of the pipe. The shield length shall be 4-inches less than the associated insulation hanger insert to allow for vapor retarding butt joints on each side of the shields.

P. Apply adhesives, mastics and coatings at manufacturer's recommended minimum coverage per gallon.

Q. Replace all damaged insulation in whole; Repair of damaged insulation will not be accepted.

R. Insulate fittings and valves with PVC insulated fitting covers and insulation inserts per manufacturer's recommendations.

S. Install aluminum jacket on exterior piping.
   1. Install metal jackets by overlapping seams 2-inches and securing with metal bands on 24-inch centers. Caulk all seams with clear silicone. Locate longitudinal seams at the bottom of piping. Finish elbows and tees with matching metal fitting covers. Finish other fittings with conventional weather insulation materials with aluminum finish.
   2. Install flexible elastomeric pipe insulation with longitudinal joints directed downward and apply two (2) coats of manufacturer's approved U.V. resistant finish for pipe sizes that are too small for aluminum jacket.

3.4 EXISTING INSULATION REPAIR

A. Repair damaged sections of existing mechanical insulation, both previously damaged or damaged during this construction period.

END OF SECTION 220700

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes potable cold, hot, and recirculated hot water piping, fittings, and specialties within the building to a point 5-feet outside the building. This section includes the following:
   1. Pipe and Tube Materials:
      a. Above Grade, inside buildings.
      b. Below Grade, inside buildings.
   2. Water Meters Inside the Building

1.2 DEFINITIONS

A. Water Distribution Piping: A pipe within the building or on the premises, which conveys water from the water service pipe or meter to the points of usage.

B. Water Service Piping: The pipe from the water main or other source of potable water supply to the water distributing system of the building served.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the provisions of the following:
   1. ASME B 31.9 "Building Services Piping" for materials, products and installation. Safety valves and pressure vessels shall bear the appropriate ASME label.
   2. ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualification" for Qualifications for Welding Processes and Operators.
   3. Comply with ANSI B31 Code for Pressure Piping.
   4. Local Plumbing Code and Utility Department requirements.
   5. Comply with NSF 61: Drinking Water System Components - Health Effects; Sections 1 through 9," For Potable Domestic Water Piping and Components.
   6. Colorado Cross Connection Control Manual.

B. All piping systems shall be installed to manufacturer's standards and in accordance with the pipe manufacturer's instructions. Contractor shall demonstrate prior to installation of any piping that joining methods and procedures are acceptable to the Engineer and/or Owner with the Factory Representative present. During the installation of the piping system, the Contractor shall be required to provide joint coupons as requested by the Owner or Engineer and repair and/or replace system if joints are deemed unsatisfactory.

1.4 INSTALLER'S QUALIFICATIONS

A. All Plumbing Work shall be performed by a State of Colorado Licensed Contractor under the supervision of a Licensed Plumber. Contractors shall verify that plumbers are currently

licensed by the State of Colorado and shall supply the Project Manager with names and license numbers. Contractors shall have a minimum of three (3) years of satisfactory performance in conducting the type of work specified.

1.5 SUBMITTALS

A. Submit under provisions of Division 1.

1.6 CLOSEOUT SUBMITTALS

A. Submit under provisions of Division 1.

B. Test Reports.

PART 2 - PRODUCTS

2.1 PIPE AND TUBE MATERIALS

A. Above Grade Inside Buildings:
   1. Pipe 4-Inch and Smaller: ASTM B 88; Type L hard drawn copper tube.
      a. Contractor's Option for 2-inch and smaller: Pro-press system comply with ASME B16.22, Performance criteria of IAPMO PS117. Sealing element shall be EPDM
      b. Fittings:
         1) Wrought Copper Solder-Joint Fittings: ASME B16.22.
         2) Cast Copper Solder-Joint Fittings: ASME B16.18.
         3) Cast Copper Alloy Flanges Class 150 and 300, Flat-Face Type: ASME B16.24.
      c. Joining Material:
         1) Lead-Free Solder: ASTM B32-Sb5, Sn 95; Tin (Sn) approximately 95 percent and Antimony approximately 5 percent; minimum tensile strength of 5,900 psi.
      d. Fluxes:
         1) ASTM B813, Water Soluble, Liquid or Paste Type. Fluxes having greater than 0.20 percent lead content shall not be used.
   2. 6-Inch and Larger: ASTM B88, Type L hard drawn copper tube.
      a. Fittings:
         1) Copper fittings with grooves designed to accept grooved end couplings. Standard fittings shall be copper per ASTM B75 alloy C12200; bronze sand castings per ASTM B584 copper alloy CDA 844 (81-3-7-9) per ASME B16.18.
         2) Cast Copper Alloy Flanges Class 150 and 300, Flat-Face Type: ASME B16.24.
         3) Use dielectric waterways, gaskets, and flange kits when connecting dissimilar metals.
      b. Flange Adapters:

1) Ductile Iron ASTM A-536, engaging directly into roll grooved copper tube and fittings and bolting directly to ANSI Class 125 cast iron and Class 150 steel flanged components.

c. Mechanical Couplings:

1) Rigid couplings for copper consisting of a ductile iron cast housing, ASTM A-536, Grade "E" EPDM gasket, ASTM D-2000, pressure responsive design, with plated nuts and bolts to secure unit together.

B. Below Grade Inside Buildings:

1. Pipe 2-1/2 Inch and Smaller: ASTM B 88; Type K soft copper or Type K annealed copper tube.
   a. Fittings:
      1) Wrought Copper Solder-Joint Fittings: ANSI B16.22.
      2) Cast Copper Solder-Joint Fittings: ASME B16.18.
   b. Joining Material:
      1) Brazing: ANSI/AWS 5.8.
      2) Copper to copper connections: BCuP series filler metals.
      3) Copper to brass or copper to steal connections: BAg-5.
      4) Brazing rods containing cadmium shall not be used.
   c. Fluxes:
      1) ANSI/AWS A5.31, Type FB3-A or FB3-C.
2. Pipe 3-Inch and Larger:
   a. Ductile Iron Pipe: Class 52, ANSI A21.51; AWWA C151; 350 PSI pressure rating.
      1) Cement Mortar Lining for Ductile Iron and Gray Iron Pipe and Fittings for Water: ANSI A21.4; AWWA C104.
      2) Polyethylene Encasement for Gray and Ductile Cast Iron Piping: ANSI A21.5; AWWA C105.
      3) Fittings:
         a) Gray Iron Fittings: ANSI/AWWA C110/A21.10.
         b) Ductile Iron Fittings: ANSI/AWWA C110/A21.10.
      4) Joint Materials: Rubber gasket joints. ANSI/AWWA C111/A21.11.

2.2 WATER METERS

A. 2-Inch and Smaller: Disc type conforming to AWWA C700. Registration in gallons. Utility company remote registration system.

1. Acceptable Manufacturers:
   a. Badger
   b. Hersey
   c. Neptune
   d. Rockwell Intl.

B. Water Meters: Comply with Denver Water Requirements.

C. Submeters: Provide contacting head type submeter with remote readout interface with the BAS System. Coordinate with Section 23 09 00, Direct Digital Control System.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Install pipes and pipe fittings in accordance with recognized industry practices to achieve permanently leak proof piping systems, capable of performing service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance/ replacement of valves and equipment. Reduce sizes by use of reducing fittings. Align piping accurately at connections, within 1/16-inch misalignment tolerance.

B. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures. Only piping serving this type of equipment space shall be allowed.

C. Use fittings for all changes in direction and all branch connections.

D. Install piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

E. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.

F. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Install piping free of sags or bends and allow sufficient space above removable ceiling panels to allow for panel removal.

G. Locate groups of pipes parallel to each other, spaced to permit application of insulation and servicing of valves.

H. Install drains at all low points in mains, risers, and branch lines consisting of a tee fitting, 3/4-inch ball valve, and short 3/4-inch threaded nipple and cap.

I. Fire and Smoke Wall Penetrations: Maintain the fire and smoke rated integrity where pipes pass through fire and smoke rated walls, partitions, ceilings, and floors.

J. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Use steel pipe for sleeves 6-inch and smaller. Use sheet metal for pipe sleeves 6-inch and larger.

K. Coordinate foundation and all other structural penetrations with Structural Engineer.

L. Install pipe ends clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket seating.

M. Install mechanical couplings and grooved piping systems per the manufacturer’s installation instructions.

3.2 UNDERGROUND PIPE INSTALLATION

A. Clean fittings, nipples and other field joints thoroughly before coating.

B. Cast Iron Pipe:
   1. Protect gray and ductile cast iron pipe installed below grade with polyethylene encasement applied in accordance with ANSI/AWWA C105/A21.5.
   2. Install ductile iron pipe below grade as prescribed by AWWA C600.

C. Provide and install concrete thrust block and 3/4-inch steel threaded tie bar at each direction change on underground pressure pipe. Embed tie bar in thrust block and connect to upstream fitting. Paint tie bar with two (2) coats of Bitumastic #50 paint.

D. Bury all outside water piping minimum 5'-0" below grade to top of pipe.

3.3 SERVICE ENTRANCE

A. Extend water distribution piping 5'-0" outside of building.

B. Install sleeve and mechanical sleeve seal at penetrations through foundation wall for watertight installation.

C. Install shutoff valve at service entrance inside building; complete with strainer, pressure gauge, and test tee with valve.

3.4 INSTALLATION OF WATER METER

A. Install water meter in accordance with manufacturers installation instructions and requirements.

3.5 EQUIPMENT CONNECTIONS

A. Piping Runouts to Fixtures: Provide hot and cold water piping run outs to fixtures of sizes indicated, but in no case smaller than required by Plumbing Code.

B. Mechanical Equipment Connections: Provide shutoff valve and union for each connection, provide drain valve on drain connection. For connections 2-1/2 inch and larger, use flanges instead of unions.

3.6 FIELD QUALITY CONTROL

A. Inspections: Inspect water distribution piping as follows:
   1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the Authority Having Jurisdiction.
   2. During the progress of the installation, notify the Plumbing Official Having Jurisdiction, at least forty-eight (48) hours prior to the time such inspection must be made. Perform tests specified below in the presence of the Plumbing Official.
      a. Rough-In Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.

b. Final Inspection: Arrange for a final inspection by the Plumbing Official to observe the tests specified below and to insure compliance with the requirements of the Plumbing Code.

3. Reinspections: Whenever the Plumbing Official finds that the piping system will not pass the test or inspection, make the required corrections and arrange for reinspection by the Plumbing Official.
4. Reports: Prepare inspection reports, signed by the Plumbing Official.

B. Piping Tests:
1. General: Provide temporary equipment for testing, including pump and gauges. Test piping system before insulation is installed wherever feasible. Test each natural section of each piping system independently but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.
2. Test piping that is to be concealed before being permanently enclosed.
3. As soon as work has been completed, conduct preliminary tests to ascertain compliance with specified requirements. Make repairs or replacements as required.
4. Give a minimum of twenty-four (24) hours notice to Engineer of dates when acceptance test will be conducted. Conduct tests as specified for each system in presence of representative of Agency Having Jurisdiction or his representative. Submit three (3) copies of successful tests to the Engineer for his review. Report shall state system tested and date of successful test.
5. Obtain certificates of approval, acceptance and compliance with regulations of Agencies Having Jurisdiction. Work shall not be considered complete until such certificates have been delivered.
6. All costs involved in these tests shall be borne by Contractor.
7. System Tests:
a. Hydrostatic Test: Pressurize the system to 100psig or 150 percent of system pressure, whichever is greater. Maintain pressure until the entire system has been inspected for leaks, but in no case for a time period of less than four (4) hours.
b. Repair failed piping sections by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.
c. Drain test water from piping systems after testing and repair work has been completed.

3.7 ADJUSTING AND CLEANING

A. Clean and disinfect water distribution piping as follows:
1. Purge all new water distribution piping systems and parts of existing systems, which have been altered, extended, or repaired prior to use. Clean and replace strainers.
2. Use the purging and disinfecting procedure prescribed by the Authority Having Jurisdiction, or in case a method is not prescribed by that authority, the procedure described in either AWWA C651, or AWWA C652, or as described below:
a. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlet.
b. Fill the system or part thereof, with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) the system, or part thereof, and allow to stand for twenty-four (24) hours.

c. Drain the system, or part thereof, of the previous solution, and refill with a water/chlorine solution containing at least 200 parts per million of chlorine and isolate and allow to stand for three (3) hours.
d. Following the allowed standing time, flush the system with clean potable water until chlorine does not remain in the water coming from the system.
e. Submit water samples in sterile bottles to the Authority Having Jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.

B. Prepare reports for all purging and disinfecting activities.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes potable cold, hot, and recirculated hot water specialties within the building to a point 5-feet outside the building. This section includes the following:
   1. Piping Specialties:
      a. Water Hammer Arrestors
      b. Strainers
      c. Hose Bibbs
      d. Wall and Roof Hydrants
      e. Backflow Preventers
      f. Pressure Reducing Valves
      g. Thermostatic Mixing Valves
      h. Pressure/Temperature Relief Valves

1.2 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the provisions of the following:
   1. Local Plumbing Code and Utility Department requirements.
   2. NSF Compliance: Drinking Water System Components – Health Effects; Sections 1 through 9.
   3. Colorado Cross Connection Control Manual.

B. All piping systems shall be installed to manufacturer's standards and in accordance with the pipe manufacturer's instructions. Contractor shall demonstrate prior to installation of any piping that joining methods and procedures are acceptable to the Engineer and/or Owner with the Factory Representative present. During the installation of the piping system, the Contractor shall be required to provide joint coupons as requested by the Owner or Engineer and repair and/or replace system if joints are deemed unsatisfactory.

1.3 INSTALLER'S QUALIFICATIONS

A. All Plumbing Work shall be performed by a State of Colorado Licensed Contractor under the supervision of a Licensed Plumber. Contractors shall verify that plumbers are currently licensed by the State of Colorado and shall supply the Project Manager Engineer with names and license numbers. Contractors shall have a minimum of three (3) years of satisfactory performance in conducting the type of work specified.

1.4 SUBMITTALS

A. Submit under provisions of Division 1.

1.5 CLOSEOUT SUBMITTALS

A. Submit under provisions of Division 1.

B. Test Reports.

C. Backflow Preventer State Certification Test.

PART 2 - PRODUCTS

2.1 PIPING SPECIALTIES

A. Drain Valve: Ball valve with threaded hose end and cap with chain. Valve upstream of backflow preventer shall have vacuum breaker and cap.
   1. Acceptable Manufacturers:
      a. Apollo 78-100/78-200
      b. Nibco
      c. Milwaukee
      d. Watts

B. Water Hammer Arresters:
   1. Piston type, with copper/brass casing and piston, pressure rated for 250 PSI, tested and certified in accordance with PDI Standard WH-201. Size according to the following schedule.

Drawing Designation	Fixture Unit Rating	P.D.I. Size	Arrestor Throat Size
SA-1	1-11	A	1/2"
SA-2	12-32	B	3/4"
SA-3	33-60	C	1"
SA-4	61-113	D	1-1/4"
SA-5	114-154	E	1-1/2"
SA-6	155-330	F	2"

   2. Acceptable Manufacturers:
      a. Precision Plumbing Products
      b. Sioux Chief
      c. Watts Regulator Co.

C. Strainers:
   1. Wye Pattern Strainers: 125 PSIG working pressure, cast iron or bronze construction, complete with bottom drain connection and removable Type 304 stainless steel screens with 3/64-inch perforations at 233 per square inch. Cast iron to be epoxy coated for domestic water service.
      a. Acceptable Manufacturers:

1) Febco 650/758
2) Watts
3) Nibco

D. Hose Bibbs:
1. HB-1 Equipment Rooms: Rough chrome plated bronze body, renewable composition disc, tee handle, 3/4-inch NPT inlet, vacuum breaker, 3/4-inch hose outlet.
a. Acceptable Manufacturers:
1) Chicago Faucet
2) Woodford
3) T&S Brass

E. Wall and Roof Hydrants:
1. WH-1 Exposed type non-freeze wall hydrant; all brass with chrome plated face plate, "T" handle loose key, two (2) check valves, self-draining body and shank, exposed 3/4-inch male hose thread outlet, 3/4-inch male or female thread inlet, renewable seat; shank length to extend through primary exterior wall sufficient distance to prevent freezing.
a. Acceptable Manufacturers:
1) Woodford
2) Josam
3) Wade

F. Backflow Preventers:
1. Reduced Pressure Type: All bronze (3/4-inch - 2-inch)/ductile iron (2-1/2 inch - 10-inch) body with two (2) independently operating, spring loaded check valves and one (1) differential relief valve with automatic intermediate atmospheric vent. Pressure in intermediate zone to activate relief valve when there is a 2 PSIG. differential between the zone and the upstream side of the first check valve. The relief valve shall remain open until a positive pressure differential is re-established. Assembly to be furnished with full port, positive shutoff isolation valves, in-line strainer, union connections, funnel, and all test cocks. Assembly to have approval of National Sanitary Foundation, U.S.C. Foundation for Cross Connection Control, A.S.S.E. State and or Local Authorities.
a. Acceptable Manufacturers:
1) Febco
2) Watts

G. Pressure Reducing Valves - Air/Water (Direct Acting):
1. Low and Medium Capacity (15 to 120 GPM): All bronze pressure reducing valves, sensitive spring and diaphragm for accurate pressure control; manual adjustment for outlet pressure integral strainer, female thread connections. See detail on Mechanical Plans for size, capacity and piping arrangement.
a. Acceptable Manufacturers:
1) Watts No. 223

H. Thermostatic Mixing Valves:
1. TMV-1: Exposed type, all bronze thermostatically controlled mixing valve with stainless steel piston, fail safe automatic shut-down if either hot or cold water pressure fails; union connection, rough chrome finish. 1 ¼ in. hot and cold water inlet pipe sizes, 1 ¼ in. tempered water outlet pipe size.

a. Acceptable Manufacturers:
   1) Powers
   2) Leonard
   3) Symmons

I. Pressure/Temperature Relief Valves (PTRV):
   1. Fully automatic, all bronze pressure/temperature relief valve with test lever and extension thermostatic element; temperature relief setting at 210 degree F and pressure setting at 150 PSIG; valve to meet ASME Standards and comply with the latest AGA ratings. Relief opening to be piped to an indirect connection at nearest floor drain.
      a. Acceptable Manufacturers:
         1) A.W. Cash Valve Mfg. Corp
         2) Watts Regulator Co.
         3) Conbraco Industries, Inc.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

A. Backflow Preventers:
   1. Install in compliance with the Plumbing Code, Colorado Cross Connection Control Department and Authority Having Jurisdiction. Locate in same room as equipment being connected. Pipe relief outlet through air gap and without valves, to nearest floor drain.
   2. Provide testing and report on all backflow prevention devices in accordance with Denver Water and the Colorado Cross Connection Control Manual (Latest Edition) requirements. Attach testing approval tag to all back flow preventers.

B. Pressure Regulating Valves: Install with inlet and outlet shutoff valves, and balance cock bypass. Install pressure gauge on valve outlet. Install pressure reducing valves to limit maximum static pressure at plumbing fixtures to 57 PSIG.

C. Water Hammer Arresters:
   1. Install water hammer arresters with isolation valve in accessible location.
   2. Provide access doors located in accordance with architectural recommendations.

D. Install Mixing Valves with integral check valves or in-line check valves, unions and isolation valves.

3.2 FIELD QUALITY CONTROL

A. Inspections: Inspect water distribution piping as follows:
   1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the Authority Having Jurisdiction.
   2. During the progress of the installation, notify the Plumbing Official Having Jurisdiction, at least forty-eight (48) hours prior to the time such inspection must be made. Perform tests specified below in the presence of the Plumbing Official.
      a. Rough-In Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.

b. Final Inspection: Arrange for a final inspection by the Plumbing Official to observe the tests specified below and to insure compliance with the requirements of the Plumbing Code.

3. Reinspections: Whenever the Plumbing Official finds that the piping system will not pass the test or inspection, make the required corrections and arrange for reinspection by the Plumbing Official.
4. Reports: Prepare inspection reports, signed by the Plumbing Official.

3.3 ADJUSTING AND CLEANING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119

SECTION 221316 - SANITARY WASTE & VENT PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section specifies the following:
   1. Pipe and Tube Materials:
      a. Sanitary Drainage, Vents
      b. Sump Pump Discharge
      c. Equipment Drains and Overflows

1.2 DEFINITIONS

A. Building Drain: That part of the lowest piping of a drainage system which receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the building sewer to a point 5'-0" outside the building wall.

B. Building Sewer: That part of the horizontal piping of a drainage system which extends from the end of the building drain and conveys its discharge to a public sewer, private sewer, individual sewage disposal system, or other point of disposal.

C. Drainage System: Includes all the piping within a public or private premises which conveys sewage, rain water or other liquid wastes to a point of disposal. It does not include the mains of public sewer systems or a private or public sewage treatment or disposal plant.

D. Vent System: Pipe or pipes installed to provide a flow of air to or from a drainage system, or to provide a circulation of air within such system to protect trap seals from siphonage and back pressure.

1.3 SUBMITTALS

A. Submit under provisions of Division 1.

1.4 CLOSEOUT SUBMITTALS

A. Submit under provisions of Division 1.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the provisions of the following:
   1. Plumbing Code Compliance: Comply with applicable portions of International Plumbing Code and Denver Amendments.
   2. ANSI Compliance: Comply with applicable ANSI standards pertaining to materials, products, and installation of soil and waste systems.

3. ASSE Compliance: Comply with applicable ASSE standards pertaining to materials, products, and installation of soil and waste systems.
4. ASTM Compliance: Comply with applicable ASTM Standards pertaining to materials, products, and installation of soil and waste systems.
5. CISPI Compliance: Comply with applicable CISPI Standards pertaining to materials, products, and installation of soil and waste systems.
6. PDI Compliance: Comply with applicable PDI standards pertaining to products and installation of soil and waste systems.
7. PVC, PP and ABS Pipe: Only Contractor's personnel which have received training in the installation of this material and meet the manufacturer's qualifications shall do the assembly of such material.

PART 2 - PRODUCTS

2.1 SANITARY DRAINAGE AND VENTS

A. Above Grade:
1. Pipe 1-1/2 Inch to 10-Inch: Service class hubless cast iron soil pipe: CISPI 301, ASTM A888.
   a. Fittings: CISPI 301, ASTM C1277, hubless cast iron, long sweep bends.
   b. Joining Material: ASTM A888, assembly of stainless steel shield and clamp, and CISPI 310, ASTM C564 elastomeric sealing sleeve.
2. Pipe 1-1/4 Inch to 4-Inch: DWV Copper Tube: ASTM B 306.
   a. Fittings:
      1) Cast Copper Solder-Joint Drainage Fittings: ASME B16.23.
      2) Wrought Copper Solder-Joint Drainage Fittings: ASME B16.29.
   b. Joining Material:
      1) Solder: ASTM B32, Sn 95 or Sn 94; Tin (Sn) approximately 95 percent and silver (Ag) approximately 5 percent having 0.10 percent maximum lead (Pb) content.
   c. Fluxes:
      1) ASTM B813 liquid or paste type. Fluxes having grater than 0.20 percent lead content shall not be used.
3. Manufacturers (Cast Iron Pipe):
   a. Tyler Pipe
   b. AB&I
   c. Charlotte Pipe & Foundry

B. Below Grade:
1. Pipe 2-Inch to 15-Inch: Service class cast iron hub-and-spigot soil pipe, ASTM A74.
   a. Fittings: ASTM A74 cast iron service class, hub and spigot compression joint, long sweep bends.
   b. Neoprene Compression Gaskets: ASTM C564.
2. Pipe 2-Inch to 16-Inch: Iron Pipe Size (IPS) Polyvinyl Chloride (PVC) Schedule 40 DWV.
   a. Manufactured from virgin Type 1, Grade 1 PVC 1120 (Cell Class 12454-B) per ASTM D-1784.
   b. Meet the dimensional, physical properties, and tolerances of ASTM D-1785 and ASTM D-2665.

c. Mark pipe with ASTM D-2665, nominal pipe size, and the symbols PVC and DWV at 5-foot intervals.
d. Fittings: ASTM D2665, PVC, solvent cement with long sweep bends. Injection molded conforming to National Sanitation Standard 14.
e. Joining Material:
1) Solvent cement suitable for type and size of pipe installed as recommended by the pipe manufacturer.
2) Make solvent cement joints from a two-step process with primer manufactured for thermoplastic piping systems and solvent cement conforming to ASTM D-2564.

3. Manufacturers (Cast Iron Pipe):
a. Tyler Pipe
b. AB&I
c. Charlotte Pipe & Foundry

2.2 SUMP PUMP DISCHARGE

A. Above Grade – Inside Buildings:
1. Pipe 4-Inch and Smaller: ASTM B 88; Type L hard drawn copper tube.
a. Fittings:
1) Wrought Copper Solder-Joint Fittings: ASME B 16.22
2) Cast Copper Solder-Joint Fittings: ASME B 16.18
3) Cast Copper Alloy Flanges, Class 150 and 300, Flat-Face Type: ASME B 16.24
b. Joining Material:
1) Solder: ASTM B32, Sn 95 or Sn 94; Tin (Sn) approximately 95 percent and silver (Ag) approximately 5 percent having 0.10 percent maximum Lead (Pb) content.
c. Fluxes:
1) ASTM B813, liquid or paste type. Fluxes having greater than 0.20 percent lead content shall not be used.

B. Swing Check Valve:
1. 2-1/2 Inch and Smaller: MSS SP-80; Class 150 SWP, ASTM B-26 bronze body and bonnet, horizontal swing design, Y-pattern, with TFE seat disk. Threaded or soldered end connections.
a. Acceptable Manufacturers
1) Nibco t/S433-Y
2) Milwaukee
3) Grinnell

2.3 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Pipe and Fittings:
1. DWV Copper Tube: ASTM B 306.
2. Fittings:
a. Cast Copper Solder-Joint Drainage Fittings: ASME B16.23.
b. Wrought Copper Solder-Joint Drainage Fittings: ASME B16.29.
3. Joining Material:

a. Solder: ASTM B32, Sn 95 or Sn 94; Tin (Sn) approximately 95 percent and silver (Ag) approximately 5 percent having 0.10 percent maximum lead (Pb) content.

4. Fluxes:
   a. ASTM B813 liquid or paste type. Fluxes having grater than 0.20 percent lead content shall not be used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General: Install piping in accordance with Authorities Having Jurisdiction, except where more stringent requirements are indicated.

B. Inspect piping before installation to detect apparent defects. Mark defective materials with white paint and promptly remove from site.

C. Verify all dimensions by field measurements. Verify that all drainage and vent piping and specialties may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

D. Verify all existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.

E. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation.

F. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed.

G. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PIPING INSTALLATION

A. Install plumbing drainage piping with 1/4-inch per foot (2 percent) downward slope in direction of drain for piping 3-inch and smaller, and 1/8-inch per foot (1 percent) for piping 4-inch and larger.

B. Install 1-inch thick extruded polystyrene over underground drainage piping above frost line and not under building. Provide width to extend minimum of 12-inch beyond each side of pipe. Install directly over pipe, centered on pipe centerline.

C. Make changes in direction for drainage and vent piping using appropriate 45 degree wyes, half-wyes, or long sweep quarter, sixth, eighth, or sixteenth bends.

D. SANITARY TEES OR SHORT QUARTER BENDS SHALL NOT BE USED IN DRAIN PIPING. Use long-turn tees where two (2) fixtures are installed back to back and have a common drain.

E. Provide thrust restraints consisting of bracing to structure and rodded joints at branches and changes in direction for cast iron pipe 5-inches and larger suspended within the building.

F. Provide sway bracing to prevent shear at joints on cast iron piping suspended in excess of 18-inches on single rod hangers.

G. Install underground drain piping to conform with the plumbing code, and in accordance with the Cast Iron Soil Pipe Institute Engineering Manual.

H. Lay piping beginning at low point of system, true to grades and alignment indicated, with unbroken continuity of invert.

I. Place bell ends or groove ends of piping facing upstream.

J. Install gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements.

K. Grade trench bottoms to provide a smooth, firm, and stable foundation, free from rock, throughout the length of the pipe.

L. Remove unstable, soft, and unsuitable materials at the surface upon which pipes shall be laid, and backfill with clean sand or pea gravel to indicated invert elevation.

M. Shape bottom of trench to fit the bottom 1/4 of the circumference of pipe. Fill unevenness with tamped sand. At each pipe joint dig bell holes to relieve the bell of the pipe of all loads, and to ensure continuous bearing of the pipe barrel on the foundation.

N. Minimum size of waste piping installed under floor slab on grade shall be 2-inches.

3.3 SERVICE CONNECTIONS

A. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

3.4 CONNECTIONS

A. Piping Runouts to Fixtures: Provide drainage and vent piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by the Plumbing Code.

B. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

3.5 FIELD QUALITY CONTROL

A. Inspections:
   1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the Authority Having Jurisdiction.

2. During the progress of the installation, notify the Plumbing Official Having Jurisdiction, at least forty-eight (48) hours prior to the time such inspection must be made. Perform tests specified below in the presence of the Plumbing Official.
    a. Rough-In Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
    b. Final Inspection: Arrange for a final inspection to observe the tests specified and to insure compliance with the requirements of the Plumbing Code.
3. Re-Inspections: Whenever the piping system fails to pass the test or inspection, make the required corrections, and arrange for re-inspection.
4. Reports: Prepare inspection reports, signed by the Plumbing Official.

B. Piping System Test: Test drainage and vent system in accordance with the procedures of the Authority Having Jurisdiction, or in the absence of a published procedure, as follows.
1. Subject all waste and vent piping, including building drain, and building sewer to a water test.
2. Tightly close all openings in the piping system except the highest opening, and fill the system with water to the point of overflow.
3. Maintain water in the system, or in the portion under test, for at least fifteen (15) minutes before inspection starts; the system shall then be tight to all points. No section shall be tested with less than a 10-foot head of water.
4. Close roof drains at the lowest point and fill with water to the point of overflow.

3.6 ADJUSTING AND CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Clean drain strainers, domes, and traps. Remove dirt and debris.

3.7 PROTECTION

A. Protect drains during remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of day or whenever work stops. Piping shall not be left open ended during construction.

C. Exposed ABS or PVC Piping: Protect plumbing vents exposed to sunlight with two (2) coats of water-based latex paint. Color selected by Architect.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section specifies the following:
   1. Drainage Piping Specialties:
      a. Trap Seal Devices
      b. Flashing Flanges
      c. Vent Flashing Sleeves
      d. Cleanouts
      e. Floor Drains

1.2 DEFINITIONS

A. Building Drain: That part of the lowest piping of a drainage system which receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the building sewer to a point 5'-0" outside the building wall.

B. Building Sewer: That part of the horizontal piping of a drainage system which extends from the end of the building drain and conveys its discharge to a public sewer, private sewer, individual sewage disposal system, or other point of disposal.

C. Drainage System: Includes all the piping within a public or private premises which conveys sewage, rain water or other liquid wastes to a point of disposal. It does not include the mains of public sewer systems or a private or public sewage treatment or disposal plant.

D. Vent System: Pipe or pipes installed to provide a flow of air to or from a drainage system, or to provide a circulation of air within such system to protect trap seals from siphonage and back pressure.

1.3 SUBMITTALS

A. Submit under provisions of Division 1.

1.4 CLOSEOUT SUBMITTALS

A. Submit under provisions of Division 1.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the provisions of the following:
   1. Plumbing Code Compliance: Comply with applicable portions of International Plumbing Code and Denver Amendments.

2. ANSI Compliance: Comply with applicable ANSI standards pertaining to materials, products, and installation of soil and waste systems.
3. ASSE Compliance: Comply with applicable ASSE standards pertaining to materials, products, and installation of soil and waste systems.
4. ASTM Compliance: Comply with applicable ASTM Standards pertaining to materials, products, and installation of soil and waste systems.
5. CISPI Compliance: Comply with applicable CISPI Standards pertaining to materials, products, and installation of soil and waste systems.
6. PDI Compliance: Comply with applicable PDI standards pertaining to products and installation of soil and waste systems.
7. PVC, PP and ABS Pipe: Only Contractor's personnel which have received training in the installation of this material and meet the manufacturer's qualifications shall do the assembly of such material.

PART 2 - PRODUCTS

2.1 DRAINAGE PIPING SPECIALTIES

A. Acceptable Manufacturers:
1. Josam Mfg. Co.
2. Smith (Jay R.) Mfg. Co.
3. Tyler Pipe; Subs. of Tyler Corp.
4. Zurn Industries Inc; Hydromechanics Division
5. Wade
6. Woodford
7. Precision Plumbing Products
8. Watts
9. Sure Seal

B. Trap Seal Devices:
1. Device shall have ASSE1072 approval.

C. Flashing Flanges: Cast iron watertight stack or wall sleeve with membrane flashing ring. Provide underdeck clamp and sleeve length as required.

D. Vent Flashing Sleeves: Cast iron caulking type roof coupling for cast iron stacks, cast iron threaded type roof coupling for steel stacks, and cast bronze stack flashing sleeve for copper tubing.

E. Cleanouts:
1. Cleanout Plugs: Cast brass, threads complying with ANSI B2.1, and Local Plumbing Code.
2. Floor Cleanout: Round, cast iron body with recessed bronze closure plug; scoriated polished bronze frame and cover plate.
3. Wall Cleanout: Cleanout tee with raised head brass plug tapped for 1/4-20 thread; flat style chrome plated wall cover plate with holes for 1/4-inch bolt; 1/4-20 threaded bolt with chrome plated flat head.

4. Surface Cleanout: Cast iron body ferrule with raised head brass plug. Medium duty cast iron manhole cover and ring 12-inch diameter to be set in concrete pad, Neenah No. R-1791-A.
5. Line Cleanout: Cast iron tapped cleanout ferrule with raised head brass plug.

F. Floor Drains:
1. See plumbing fixture schedule on drawings.

G. Floor Sinks:
1. See plumbing fixture schedule on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General: Install piping in accordance with Authorities Having Jurisdiction, except where more stringent requirements are indicated.

B. Inspect piping before installation to detect apparent defects. Mark defective materials with white paint and promptly remove from site.

C. Verify all dimensions by field measurements. Verify that all drainage and vent piping and specialties may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

D. Verify all existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.

E. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation.

F. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed.

G. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF PIPING SPECIALTIES

A. Provide flashing for all floor drains, floor cleanouts and shower drains above grade. Make watertight with Chloraloy 240 underslab moisture vapor barrier as manufactured by the Nobel Co. of Grand Haven, Michigan. Extend flashing at least 24-inch from drain rim into floor membrane or on structural floor. Fasten flashing to drain clamp device and make watertight, durable joint. Provide flashing collar extension with all drains and cleanouts installed above grade.

B. Cleanouts: Lubricate plugs with mixture of graphite and linseed oil. Prior to building turnover remove cleanout plugs, re-lubricate and reinstall using only enough force to ensure permanent leakproof joint.

1. Above Ground Cleanouts: Install in above ground piping and building drain piping as indicated, and:
   a. As required by Plumbing Code;
   b. At each change in direction of piping greater than 45 degrees below slab;
   c. At minimum intervals of 50-feet;
   d. At base of each vertical soil or waste stack;
   e. At sinks and urinals on grade;
   f. At each upper terminal;
   g. At egress of building (surface cleanout).
   h. At each water closet or toilet group.
2. Cleanout Covers: Install floor and wall cleanout covers for concealed piping, types as indicated, and in accessible locations.

C. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.

D. Vent Flashing Sleeves: Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

E. Floor Drains:
1. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.
2. Trap all drains connected to the sanitary sewer with minimum trap size that of drain connected.
3. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.
4. Position drains so that they are accessible and easy to maintain.
5. Provide with P-trap the same size as the floor drain unless otherwise noted on Mechanical Drawings.
6. Provide flashing membrane for all floor drains in structure above slab on grade level.

F. Trap Seal Devices: Install per manufacturer’s instructions.

3.3 SERVICE CONNECTIONS

A. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

3.4 FIELD QUALITY CONTROL

A. Inspections:
1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the Authority Having Jurisdiction.
2. During the progress of the installation, notify the Plumbing Official Having Jurisdiction, at least forty-eight (48) hours prior to the time such inspection must be made. Perform tests specified below in the presence of the Plumbing Official.
   a. Rough-In Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.

b. Final Inspection: Arrange for a final inspection to observe the tests specified and to insure compliance with the requirements of the Plumbing Code.

3. Re-Inspections: Whenever the piping system fails to pass the test or inspection, make the required corrections, and arrange for re-inspection.
4. Reports: Prepare inspection reports, signed by the Plumbing Official.

B. Piping System Test: Test drainage and vent system in accordance with the procedures of the Authority Having Jurisdiction, or in the absence of a published procedure, as follows.

1. Subject all waste and vent piping, including building drain, roof drain and building sewer to a water test.
2. Tightly close all openings in the piping system except the highest opening, and fill the system with water to the point of overflow.
3. Maintain water in the system, or in the portion under test, for at least fifteen (15) minutes before inspection starts; the system shall then be tight to all points. No section shall be tested with less than a 10-foot head of water.

3.5 ADJUSTING AND CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Clean drain strainers, domes, and traps. Remove dirt and debris.

3.6 PROTECTION

A. Protect drains during remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of day or whenever work stops. Piping shall not be left open ended during construction.

END OF SECTION 221319

SECTION 221413 - STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section specifies the following:
   1. Pipe and Tube Materials:
      a. Roof Drainage
   2. Drainage Piping Specialties:
      a. Flashing Flanges
      b. Cleanouts
      c. Roof Drains

1.2 DEFINITIONS

A. Drainage System: Includes all the piping within a public or private premises which conveys rain water to a point of disposal. It does not include the mains of public sewer systems or a private or public sewage treatment or disposal plant.

1.3 SUBMITTALS

A. Submit under provisions of Division 1.

1.4 CLOSEOUT SUBMITTALS

A. Submit under provisions of Division 1.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the provisions of the following:
   1. Plumbing Code Compliance: Comply with applicable portions of 2006 International Plumbing Code and Denver Amendments.
   2. ANSI Compliance: Comply with applicable ANSI standards pertaining to materials, products, and installation of soil and waste systems.
   3. ASSE Compliance: Comply with applicable ASSE standards pertaining to materials, products, and installation of soil and waste systems.
   4. ASTM Compliance: Comply with applicable ASTM Standards pertaining to materials, products, and installation of soil and waste systems.
   5. CISPI Compliance: Comply with applicable CISPI Standards pertaining to materials, products, and installation of soil and waste systems.
   6. PDI Compliance: Comply with applicable PDI standards pertaining to products and installation of soil and waste systems.

7. PVC, PP and ABS Pipe: Only Contractor's personnel which have received training in the installation of this material and meet the manufacturer's qualifications shall do the assembly of such material.

PART 2 - PRODUCTS

2.1 ROOF DRAINAGE

A. Above Grade – 30 Feet of Head or Less:
   1. Pipe 1-1/2 Inch to 10-Inch: Service class hubless cast iron soil pipe: CISPI 301, ASTM A888.
      a. Fittings: CISPI 301, hubless cast iron, long sweep bends.
      b. Joining Material: ASTM A888, assembly of stainless steel shield and clamp, and CISPI 310, ASTM C564 elastomeric sealing sleeve.
   2. Pipe 2-Inch to 15-Inch: Service class cast iron hub-and-spigot soil pipe, ASTM A74.
      a. Fittings: ASTM A74 service class cast iron, hub and spigot compression joint, long sweep bends.
      b. Neoprene Compression Gaskets: ASTM C564.
   3. Manufacturers (Cast Iron Pipe):
      a. Tyler Pipe
      b. AB&I
      c. Charlotte Pipe & Foundry

B. Below Grade:
   1. Pipe 2-Inch to 15-Inch: Service class cast iron hub-and-spigot soil pipe, ASTM A74.
      a. Fittings: ASTM A74 service class cast iron, hub and spigot compression joint, long sweep bends.
      b. Neoprene Compression Gaskets: ASTM C564.
   2. Manufacturers (Cast Iron Pipe):
      a. Tyler Pipe
      b. AB&I
      c. Charlotte Pipe & Foundry
   3. Pipe 2-Inch to 16-Inch: Iron Pipe Size (IPS) Polyvinyl Chloride (PVC) Schedule 40 DWV.
      a. Manufactured from virgin Type 1, Grade 1 PVC 1120 (Cell Class 12454-B) per ASTM D-1784.
      b. Meet the dimensional, physical properties, and tolerances of ASTM D-1785 and ASTM D-2665.
      c. Mark pipe with ASTM D-2665, nominal pipe size, and the symbols PVC and DWV at 5-foot intervals.
      d. Fittings: ASTM D2665, PVC, solvent cement with long sweep bends. Injection molded conforming to National Sanitation Standard 14.
      e. Joining Material:
         1) Solvent cement suitable for type and size of pipe installed as recommended by the pipe manufacturer.
         2) Make solvent cement joints from a two-step process with primer manufactured for thermoplastic piping systems and solvent cement conforming to ASTM D-2564.

2.2 DRAINAGE PIPING SPECIALTIES

A. Acceptable Manufacturers:
   1. Josam Mfg. Co.
   2. Smith (Jay R.) Mfg. Co.
   3. Tyler Pipe; Subs. of Tyler Corp.
   4. Zurn Industries Inc; Hydromechanics Division
   5. Wade
   6. Woodford
   7. Precision Plumbing Products
   8. Watts

B. Flashing Flanges: Cast iron watertight stack or wall sleeve with membrane flashing ring. Provide underdeck clamp and sleeve length as required.

C. Cleanouts:
   1. Cleanout Plugs: Cast brass, threads complying with ANSI B2.1, and Local Plumbing Code.
   2. Floor Cleanout: Round, cast iron body with recessed bronze closure plug; scoriated polished bronze frame and cover plate.
   3. Wall Cleanout: Cleanout tee with raised head brass plug tapped for 1/4-20 thread; flat style chrome plated wall cover plate with holes for 1/4-inch bolt; 1/4-20 threaded bolt with chrome plated flat head.
   4. Surface Cleanout: Cast iron body ferrule with raised head brass plug. Medium duty cast iron manhole cover and ring 12-inch diameter to be set in concrete pad, Neenah No. R-1791-A.
   5. Line Cleanout: Cast iron tapped cleanout ferrule with raised head brass plug.

D. Roof Drains:
   1. Cast iron body with sump, removable cast iron vandal-proof dome strainer, cast iron flashing flange and cast iron ring with integral gravel stop, underdeck clamp.
   2. Overflow Drain: Cast iron body with sump, removable cast iron vandal-proof dome strainer, cast iron flashing flange and cast iron clamp with integral gravel stop, cast iron underdeck clamp, 2-inch high water dam standpipe under dome strainer.
   3. Down Spout Nozzle: Cast bronze body and flange. RE: Architect for finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General: Install piping in accordance with Authorities Having Jurisdiction, except where more stringent requirements are indicated.

B. Inspect piping before installation to detect apparent defects. Mark defective materials with white paint and promptly remove from site.

C. Verify all dimensions by field measurements. Verify that all drainage piping and specialties may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

D. Verify all existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.

E. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed.

F. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PIPING INSTALLATION

A. Install plumbing drainage piping with 1/4-inch per foot (2 percent) downward slope in direction of drain for piping 3-inch and smaller, and 1/8-inch per foot (1 percent) for piping 4-inch and larger.

B. Install 1-inch thick extruded polystyrene over underground drainage piping above frost line and not under building. Provide width to extend minimum of 12-inch beyond each side of pipe. Install directly over pipe, centered on pipe centerline.

C. Make changes in direction for drainage and vent piping using appropriate 45 degree wyes, half-wyes, or long sweep quarter, sixth, eighth, or sixteenth bends.

D. Provide thrust restraints consisting of bracing to structure and rodded joints at branches and changes in direction for cast iron pipe 5-inches and larger suspended within the building.

E. Provide sway bracing to prevent shear at joints on cast iron piping suspended in excess of 18-inches on single rod hangers.

F. Install underground drain piping to conform with the plumbing code, and in accordance with the Cast Iron Soil Pipe Institute Engineering Manual.

G. Lay piping beginning at low point of system, true to grades and alignment indicated, with unbroken continuity of invert.

H. Place bell ends or groove ends of piping facing upstream.

I. Install gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements.

J. Remove unstable, soft, and unsuitable materials at the surface upon which pipes shall be laid, and backfill with clean sand or pea gravel to indicated invert elevation.

K. Shape bottom of trench to fit the bottom 1/4 of the circumference of pipe. Fill unevenness with tamped sand. At each pipe joint dig bell holes to relieve the bell of the pipe of all loads, and to ensure continuous bearing of the pipe barrel on the foundation.

3.3 INSTALLATION OF PIPING SPECIALTIES

A. Backwater Valves: Install in sanitary building drain piping as indicated, and as required by the Plumbing Code. For interior installation, provide minimum 13-inch diameter cleanout cover flush to floor centered over backwater valve cover and of adequate size to remove valve cover for service.

B. Cleanouts: Lubricate plugs with mixture of graphite and linseed oil. Prior to building turnover remove cleanout plugs, re-lubricate and reinstall using only enough force to ensure permanent leakproof joint.
   1. Above Ground Cleanouts: Install in above ground piping and building drain piping as indicated, and:
      a. As required by Plumbing Code;
      b. At each change in direction of piping greater than 45 degrees below slab;
      c. At minimum intervals of 50-feet;
      d. At base of each vertical soil or waste stack;
      e. At egress of building (surface cleanout).
   2. Cleanout Covers: Install floor and wall cleanout covers for concealed piping, types as indicated, and in accessible locations.

C. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.

D. Roof Drains:
   1. Install roof drains at low points of roof areas, in accordance with the roof membrane manufacturer's installation instructions.
   2. Install drain flashing collar or flange so that no leakage occurs between roof drain and adjoining roofing. Maintain integrity of waterproof membranes, where penetrated.
   3. Position roof drains so that they are accessible and easy to maintain.
   4. Install overflow roof drains with the inlet flow line located a maximum 2-inch above the lowest point of roof.

3.4 SERVICE CONNECTIONS

A. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

3.5 FIELD QUALITY CONTROL

A. Inspections:
   1. Do not enclose, cover, or put into operation drainage piping system until it has been inspected and approved by the Authority Having Jurisdiction.
   2. During the progress of the installation, notify the Plumbing Official Having Jurisdiction, at least forty-eight (48) hours prior to the time such inspection must be made. Perform tests specified below in the presence of the Plumbing Official.
      a. Rough-In Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.

b. Final Inspection: Arrange for a final inspection to observe the tests specified and to insure compliance with the requirements of the Plumbing Code.

3. Re-Inspections: Whenever the piping system fails to pass the test or inspection, make the required corrections, and arrange for re-inspection.
4. Reports: Prepare inspection reports, signed by the Plumbing Official.

B. Piping System Test: Test drainage and vent system in accordance with the procedures of the Authority Having Jurisdiction, or in the absence of a published procedure, as follows.
1. Subject all roof drain piping to a water test.
2. Tightly close all openings in the piping system except the highest opening, and fill the system with water to the point of overflow.
3. Maintain water in the system, or in the portion under test, for at least fifteen (15) minutes before inspection starts; the system shall then be tight to all points. No section shall be tested with less than a 10-foot head of water.
4. Close roof drains at the lowest point and fill with water to the point of overflow.

3.6 ADJUSTING AND CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Clean drain strainers, domes, and traps. Remove dirt and debris.

3.7 PROTECTION

A. Protect drains during remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of day or whenever work stops. Piping shall not be left open ended during construction.

C. Exposed ABS or PVC Piping: Protect plumbing vents exposed to sunlight with two (2) coats of water-based latex paint. Color selected by Architect.

END OF SECTION 221413

SECTION 221429 - SUMP PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of Sump Pumps Work required by this section is indicated on drawings and schedules, and by requirements of this section.

B. Types of Pumps specified in this section include the following:
   1. Pedestal Type Sump Pumps
   2. Submersible Sump Pumps

C. Pumps furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 22 sections.

D. Refer to other Division 22 sections for insulation of pump housings; vibration control of plumbing pumps; not work of this section.

E. Refer to Division 26 sections for the following work; not work of this section.
   1. Power supply wiring from power source to power connection on pumps. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.
   2. Interlock wiring between pumps; and between pumps and field-installed control devices.
      a. Interlock wiring specified as factory-installed is work of this section.

F. Provide the following Electrical Work as work of this section, complying with requirements of Division 26 sections:
   1. Control wiring between field-installed controls, indicating devices, and pump control panels.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing pumps with characteristics, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:
   1. HI Compliance: Design, manufacture, and install plumbing pumps in accordance with HI "Hydraulic Institute Standards".
   2. UL Compliance: Design, manufacture, and install plumbing pumps in accordance with UL 778 "Motor Operated Water Pumps".
   3. UL and NEMA Compliance: Provide electric motors and components which are listed and labeled by Underwriters Laboratories and comply with NEMA Standards.
   4. SSPMA Compliance: Test and rate sump and sewage pumps in accordance with Sump and Sewage Pump Manufacturers Association (SSPMA) and provide certified rating seal.

C. Certification, Pump Performance: Provide pumps whose performances, under specified operating conditions, are certified by manufacturer.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's pump specifications, installation and start-up instructions, and current accurate pump characteristic performance curves with selection points clearly indicated.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to plumbing pumps. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

D. Maintenance Data: Submit maintenance data and parts lists for each type of pump, control, and accessory; including "trouble-shooting" maintenance guide. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual; in accordance with requirements of Division 1.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Handle plumbing pumps and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged plumbing pumps or components; replace with new.

B. Store plumbing pumps and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

C. Comply with Manufacturer's rigging and installation instructions for unloading plumbing pumps, and moving them to final location.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. Submersible Sump Pumps:
      a. Hydromatic Pumps
      b. Goulds Pumps, Inc.
      c. Weil Pump Co.
      d. Weinman Pump LFE Corp.; Fluids Control Division
      e. Zoeller Co.
      f. Metropolitan Industries, Inc.

2.2 PUMPS

A. General: Provide factory-tested pumps, thoroughly cleaned, and painted with one (1) coat of machinery enamel prior to shipment. Type, size, and capacity of each pump is listed in pump schedule. Provide pumps of same type by same manufacturer.

B. Provide discriminating liquid sensor for ail detection.

2.3 SUBMERSIBLE SUMP PUMPS

A. General: Provide submersible sump pumps as indicated, of size and capacity as scheduled.

B. Pump: Cast iron shell, bronze impeller, stainless steel shaft, factory-sealed grease lubricated ball bearings, ceramic mechanical seal, and perforated steel strainer.

C. Motor: Hermetically sealed, capacitor-start, with built-in overload protection, electrical characteristics as scheduled. Provide 10-feet of 3-conductor PVC cord and molded grounding plug.

D. Controls: Float-operated switch.

E. Oil Sensor: Provide sensor with shut down capabilities upon oil sensing.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which plumbing pumps are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF PUMPS

A. General: Install plumbing pumps where indicated, in accordance with manufacturer's published installation instructions, complying with recognized industry practices to ensure that plumbing pumps comply with requirements and serve intended purposes.

B. Access: Provide access space around plumbing pumps for service as indicated, but in no case less than that recommended by manufacturer.

C. Support: Refer to Division 22 section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for support and mounting requirements of plumbing pumps.

D. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
   1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

E. Piping Connections: Refer to Division 22 plumbing piping sections. Provide piping, valves, accessories, gauges, supports, and flexible connections as indicated.

3.3 ADJUSTING AND CLEANING

A. Alignment: Check alignment, and where necessary, realign shafts of motors and pumps within recommended tolerances by manufacturer, and in presence of manufacturer’s service representative.

B. Start-Up: Lubricate pumps before start-up. Start-up in accordance with manufacturer's instructions.

C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 221429

SECTION 223200 - DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following fuel-fired water heaters:
   1. On-Demand, tankless, gas water heaters.
   2. Water heater accessories.

1.3 SUBMITTALS

A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Product Certificates: For each type of instantaneous water heater, signed by product manufacturer.

D. Manufacturer Seismic Qualification Certification: Submit certification that commercial water heaters, accessories, and components will withstand seismic forces defined in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment." Include the following:

   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
      a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
      b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Source quality-control test reports.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For water heaters to include in emergency, operation, and maintenance manuals.

H. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain same type of water heaters through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of water heaters and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. ASHRAE/IESNA 90.1-2004Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

E. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

F. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including storage tank and supports.
   b. Faulty operation of controls.
   c. Deterioration of metals, metal finishes, and other materials beyond normal use.
2. Warranty Period(s): From date of Substantial Completion:
   a. Instantaneous, Gas Water Heaters:
      1) Heat Exchanger: Three years.
      2) Controls and Other Components: Three years.

PART 2 - PRODUCTS

2.1 INSTANTANEOUS, GAS WATER HEATERS

A. Description: Comply with ANSI Z21.10.3/CSA 4.3, except storage is not required.
   1. Manufacturers:
      a. Rinnai
   2. Construction: Copper piping or tubing complying with NSF 61 barrier materials for potable water, without storage capacity.
      a. Tappings: ASME B1.20.1 pipe thread.
      b. Pressure Rating: 150 psig (1035 kPa).
      c. Heat Exchanger: Copper tubing.
      d. Insulation: Comply with ASHRAE/IESNA 90.1-2004.
      e. Burner: For use with tankless water heaters and for natural-gas fuel.
      f. Automatic Ignition: Direct electronic ignition.
      g. Temperature Control: Adjustable thermostat.
      h. Jacket: Metal with enameled finish.
      i. Venting: Rolux concentric all weather vent system; terminate 38” above roof. Comply with Manufacturer’s requirements.
   3. Support: Bracket for wall mounting.
   4. Capacity and Characteristics:
      a. See equipment schedule on drawings.

2.2 WATER HEATER ACCESSORIES

A. Gas Shutoff Valves: ANSI Z21.15/CGA 9.1, manually operated. Furnish for installation in piping.

B. Gas Pressure Regulators: ANSI Z21.18, appliance type. Include pressure rating, capacity, and pressure differential required between gas supply and water heater.

C. Gas Automatic Valves: ANSI Z21.21, appliance, electrically operated, on-off automatic valve.

D. Pressure Relief Valves: Include pressure setting less than working-pressure rating of water heater.

   1. Gas Water Heaters: ANSI Z21.22/CSA 4.4.

E. Piping Manifold Kits: Water heater manufacturer's factory-fabricated inlet and outlet piping arrangement for multiple-unit installation. Include piping and valves for field assembly that is capable of isolating each water heater and of providing balanced flow through each water heater.

2.3 SOURCE QUALITY CONTROL

A. Test and inspect water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Prepare test reports.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

A. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

B. Install seismic restraints for commercial water heaters. Anchor to substrate.

C. Install gas water heaters according to NFPA 54.

D. Install gas shutoff valves on gas supplies to gas water heaters without shutoff valves.

E. Install gas pressure regulators on gas supplies to gas water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.

F. Install pressure relief valves in water piping for water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

G. Install water heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Domestic Water Piping Specialties" for hose-end drain valves.

H. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

I. Install pressure gage(s) on outlet piping of commercial, fuel-fired water heater piping. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.

J. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve and thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty valves and to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

K. Fill water heaters with water.

L. Charge compression tanks with air.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
   1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain instantaneous water heaters. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 223200

SECTION 223300 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of Plumbing Fixtures Work required by this section is indicated on drawings and schedules and by requirements of this section.

1.2 QUALITY ASSURANCE

A. Codes and Standards:
   1. ASHRAE Standard 18: "Method of Testing for Rating Drinking Water Coolers with Self-Contained Mechanical Refrigeration Systems".
   2. ARI Standard 1010: "Drinking-Fountains and Self-Contained Mechanically-Refrigerated Drinking-Water Coolers".
   3. ANSI Standard A117.1: "Specifications for Making Buildings and Facilities Accessible To and Usable By Physically Handicapped People".
   4. Public Law 90-480: "Architectural Barriers Act of 1968".
   5. UL Standard 399: "Drinking-Water Coolers".
   6. Public Law 101-336: "Americans With Disabilities Act".
   7. NSF Standard 61: "Drinking Water Components".
   8. Energy Conservation Act - 1992: "Energy Conservation Standards".

B. Where fixtures are specified as ADA Accessible, it shall be the sole responsibility for all manufacturers and/or suppliers to provide plumbing fixtures and related trim which meet or exceed the ADA Requirements.

1.3 SUBMITTALS

A. Submit under provisions of Division 1 and below.

B. Color Charts: Submit manufacturer's standard color charts for cabinet finishes and fixture colors.

C. Submit certification of compliance with specified ANSI, UL, and ASHRAE Standards.

D. Submit certification of compliance with performance verification requirements specified in this Section.

1.4 CLOSE-OUT SUBMITTALS

A. Submit under provisions of Division 1.

B. Extra Stock:
   1. Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt in a quantity of one (1) device for each ten (10) fixtures.
   2. Furnish faucet repair kits complete with all necessary washers, springs, pins, retainers, packings, O-rings, sleeves, ceramic discs and/or seats in a quantity of one (1) kit for each forty (40) faucets.

C. Maintenance Data: Submit Maintenance Data and Spare Parts Lists for each type of manufactured plumbing fixtures, valves and trim. Include this data, product data, and shop drawings in Maintenance Manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer subject to compliance with requirements, provide products by one of the following:
   1. Lavatories, Sinks, Service Sinks, Water Closets, Urinals:
      a. American Standard U.S. Plumbing Products
      b. Sloan
      c. Kohler Co.
      d. ToTo
   2. Stainless Steel Sinks:
      a. Elkay Mfg. Co.
      b. Just Mfg. Co.
   3. Faucets:
      a. American Standard; U.S. Plumbing Products
      b. Chicago Faucet Co.
      c. Delta Faucet Co./Cambridge Brass
      d. Elkay Mfg. Co.
      e. Kohler Co.
      f. T & S Brass
      g. Sloan Valve Co.
   4. Flush Valves:
      a. Sloan Valve Co.
   5. Water Closet Seats:
      a. Bemis Mfg. Co.
      b. Beneke Corp.
      c. Forbes-Wright Industries, Inc.; Church Products
      d. Olsonite Corp.; Olsonite Seats
   6. Drinking Fountains:
      a. Kohler
      b. Sunroc Corp.
      c. Elkay
   7. Fixture Supports:
      a. Josam Mfg. Co.
      b. Wade
      c. Jay R. Smith
      d. Zurn Industries, Inc.

8. Mop Service Basins:
    a. Oberon
    b. Fiat
    c. Stern-Williams
9. Food Waste Disposers:
    a. In-Sink-Erator
    b. Waste King
    c. Whirlaway
10. ADA Sink/Lavatory Pipe Insulation:
    a. Truebro
    b. Plumberex Pro-Extreme Series
11. Stops, Supplies, Drains and P-Traps:
    a. McGuire
    b. Dearborn
    c. Brass Craft
    d. American Standard
    e. Kohler

2.2 WATER CLOSETS

A. See plumbing fixture schedule on drawings.

2.3 URINALS

A. See plumbing fixture schedule on drawings.

2.4 LAVATORIES

A. See plumbing fixture schedule on drawings.

2.5 SINKS

A. See plumbing fixture schedule on drawings.

2.6 MOP SERVICE BASIN

A. See plumbing fixture schedule on drawings.

2.7 DRINKING FOUNTAIN

A. Drinking Fountain

2.8 FITTINGS, TRIM, AND ACCESSORIES

A. Supplies and Stops for Lavatories and Sinks: Polished chrome-plated, loose keyed angle stop having 1/2-inch inlet and 3/8-inch O.D. x 12-inch long flexible tubing outlet, and wall flange and chrome-plated cast brass escutcheon with set screw. Quantity to match trim specified.

B. Traps for Drinking Fountains and Lavatories: Chrome-plated cast brass, 1-1/4 inch adjustable "P" trap with cleanout, waste to wall and chrome-plated cast brass escutcheon with set screw.

C. Traps for Sinks: Chrome-plated cast brass, 1-1/2 inch adjustable "P" trap with cleanout, waste to wall and chrome-plated cast brass escutcheon with set screw.

D. Escutcheons: Chrome-plated cast brass with set screw.

E. All handicapped compliant lavatories, supplies and waste, shall be insulated with molded vinyl covers, Truebro Inc. Lav-Guard Insulation Kit, or equivalent by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Examine rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures.

C. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

D. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings, and pertinent codes and regulations, the original design, and the referenced standards.

B. Comply with the installation requirements of ANSI A117.1 and Public Law 90-480 with respect to plumbing fixtures for the physically handicapped. Arrange flush valve handles with proper orientation to meet ADA requirements.

C. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.

D. Set shower receptor and mop basins in a leveling bed of cement grout.

E. Install a stop valve in an accessible location in the water connection to each fixture.

F. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork.

G. Seal fixtures to walls and floors using silicone sealant as specified in Division 7. Match sealant color to fixture color.

H. Visible parts of fixture brass and accessories shall be chrome-plated.

I. External finishes on all trim shall not be chrome-plated plastic.

J. Where possible, fixtures shall be the product of one manufacturer. Where possible, fittings of same type shall be the product of one manufacturer.

K. Solidly attach floor-mounted water closets to floor with hex expansion shield of cast iron closet flanges.

3.3 FIELD QUALITY CONTROL

A. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.

B. Inspect each installed unit for damage. Replace damaged fixtures.

3.4 ADJUSTING

A. Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow and stream.

B. Replace washers of leaking or dripping faucets and stops.

C. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

3.5 CLEANING

A. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

3.6 PROTECTION

A. Provide protective covering for installed fixtures, water coolers, and trim.

B. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by the Owner.

3.7 MOUNTING HEIGHTS SCHEDULE

A. Fixture mounting height and rough-in dimensions shall be as indicated on the Architectural Drawings and Specifications.

END OF SECTION 223300

SECTION 230000 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including the General and Supplementary Conditions, Division-1 Conditions specification sections apply to the Division 23 specifications and drawings.

B. Related Sections: Refer to all sections in Division 23. Refer to Division 26 specification section and Division 26 drawings.

1.2 SUMMARY

A. This Section specifies the basic requirements for mechanical installations and includes requirements common to more than one (1) section of Division 23. It expands and supplements the requirements specified in sections of Division 1.

B. Attention is called to the fact that this is a LEED project. Project requirements include compliance with all Division 1 LEED criteria, including, but not limited to:
   1. Construction Indoor Air Quality (IAQ) Management Plan, and construction waste management and disposal requirements.
   2. Product Data for temporary MERV 8 filtration if systems will be used during construction.
   3. Document LEED credit impact for product substitution.
   4. Six photographs at three difference occasions (18 total) during construction of the different SMACNA requirements, along with a brief description of the SMACNA approach employed, documenting implementation of the IAQ management measures, such as protection of ducts, floor mopping/sweeping, cleaning of air handling units, installation of filters, and on-site stored or install absorptive materials.
   5. Low-Emitting Adhesives and Sealants requirements.
   6. Low-Emitting Paints and Coatings requirements.
   7. Coordination with commissioning agent and commissioning requirements.

1.3 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

B. Extend all grease fittings to an accessible location.

C. Furnish hinged steel access doors with concealed latch, whether shown on drawings or not, in all walls and ceilings for access to all concealed valves, shock absorbers, air vents, motors, fans,

balancing cocks, and other operating devices requiring adjustment or servicing. Refer to Division 1 for access door specification and Division 23 for duct access door requirements.

D. The minimum size of any access door shall not be less than the size of the equipment to be removed or 24-inch x 24-inch if used for service only.

E. Furnish doors to trades performing work in which they are to be built, in ample time for building-in as the work progresses. Whenever possible, group valves, cocks, etc., to permit use of minimum number of access doors within a given room or space.

F. Factory manufactured doors shall be of a type compatible with the finish in which they are to be installed. In lieu of these doors, shop fabricated access doors with DuroDyne hinges may be used.

G. Access doors in fire-rated walls and ceilings shall have equivalent UL label and fire rating.

1.4 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment shop drawings and manufacturer's requirements for actual provided equipment for rough-in requirements.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

A. Refer to Division 1.

B. Execute and inspect all work in accordance with all Underwriters, local and state codes, rules and regulations applicable to the trade affected as a minimum, but if the plans and/or specifications call for requirements that exceed these rules and regulations, the greater requirement shall be followed. Follow recommendations of NFPA, SMACNA, EPA, OSHA and ASHRAE.

C. Comply with standards in effect at the date of these Contract Documents, except where a standard or specific date or edition is indicated.

D. The handling, removal and disposal of regulated refrigerants shall be in accordance with U.S. EPA, state and local regulations.

E. After entering into contract, Contractor will be held to complete all work necessary to meet these requirements without additional expense to the Owner.

1.6 REQUIREMENTS OF LOCAL UTILITY COMPANIES

A. Comply with rules and regulations of local utility companies. Include in bid the cost of all valves, valve boxes, meter boxes, meters and such accessory equipment which will be required for the project.

1.7 PERMITS AND FEES

A. Refer to Division 1.

B. Contractor shall pay all tap, development, meter, etc., fees required for connection to municipal and public utility facilities.

C. Contractor shall arrange for and pay for all inspections, licenses and certificates required in connection with the Work.

1.8 MECHANICAL INSTALLATIONS

A. Drawings are diagrammatic in character and do not necessarily indicate every required offset, valve, fitting, etc.

B. Drawings and specifications are complementary. Whatever is called for in either is binding as though called for in both.

C. Drawings shall not be scaled for rough-in measurements or used as shop drawings. Where drawings are required for these purposes or have to be made from field measurement, take the necessary measurements and prepare the drawings.

D. Before any Work is installed, determine that equipment will properly fit the space; that required piping grades can be maintained and that ductwork can be run as contemplated without interferences between systems, with structural elements or with the work of other trades.

E. Coordinate the installation of mechanical materials and equipment above and below ceilings with suspension system, light fixtures, and other building components.
   1. Coordinate ceiling cavity space carefully with all trades. In the event of conflict, install mechanical and electric systems within the cavity space allocation in the following order of priority.
      a. Plumbing waste, vent piping and roof drain mains and leaders
      b. Supply, return and exhaust ductwork
      c. Fire sprinkler mains and leaders
      d. Electrical conduit
      e. Domestic hot and cold water piping
      f. Fire sprinkler branch piping and sprinkler runouts

F. Verify all dimensions by field measurements.

G. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.

H. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.

I. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

J. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials.

K. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.

L. Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

M. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

1.9 EXCAVATING AND BACKFILLING

A. General:
   1. Provide all necessary excavation and backfill for installation of Mechanical Work.
   2. In general, follow all regulations of OSHA as specified in Part 1926, Subpart P, "Excavations, Trenching and Shoring". Follow specifications of Division 23 as they refer specifically to the Mechanical Work.

B. Contact Owners of all underground utilities to have them located and marked, at least two (2) business days before excavation is to begin. Also, prior to starting excavation, brief employees on marking and color codes and train employees on excavation and safety procedures for natural gas lines. When excavation approaches gas lines, expose lines by carefully probing and hand digging.

C. Provide all necessary pumping, cribbing and shoring.

D. Walls of all trenches shall be a minimum of 6-inch clearance from the side of the nearest mechanical work. Install pipes with a minimum of 6-inch clearance between them when located in same trench.

E. Pipe Trenching:
   1. Dig trenches to depth, width, configuration, and grade appropriate to the piping being installed. Dig trenches to 6-inches below the level of the bottom of the pipe to be installed. Install 6-inch bed of pea gravel or squeegee, mechanically tamp to provide a firm bed for piping, true to line and grade without irregularity. Provide depressions only at hubs, couplings, flanges, or other normal pipe protrusions.

F. Backfilling shall not be started until all work has been inspected, tested and accepted. All backfill material shall be reviewed by the Soils Engineer. In no case shall lumber, metal or other debris be buried in with backfill.

G. Trench Backfill:
   1. Backfill to 12-inches above top of piping with pea gravel or squeegee, the same as used for piping bed, compact properly.

2. Continue backfill to finish grade, using friable material free of rock and other debris. Install in 6-inch layers, each properly moistened and mechanically compacted prior to installation of ensuing layer. Compaction by hydraulic jetting is not permissible.

H. After backfilling and compacting, any settling shall be refilled, tamped, and refinished at this Contractor's expense.

I. This Contractor shall repair and pay for any damage to finished surfaces.

J. Complete the backfilling near manholes using pea gravel or squeegee, installing it in 6-inch lifts and mechanically tamping to achieve 95 percent compaction.

K. Use suitable excavated material to complete the backfill, installed in 6-inch lifts and mechanically compacted to seal against water infiltration. Compact to 95 percent for the upper 30-inches below paving and slabs and 90 percent elsewhere.

1.10 CUTTING AND PATCHING

A. This Article specifies the cutting and patching of mechanical equipment, components, and materials to include removal and legal disposal of selected materials, components, and equipment.

B. Refer to Division 1.

C. Do not endanger or damage installed work through procedures and processes of cutting and patching.

D. Arrange for repairs required to restore other work, because of damage caused as a result of mechanical installations.

E. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.

F. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
1. Uncover work to provide for installation of ill-timed work;
2. Remove and replace defective work;
3. Remove and replace work not conforming to requirements of the Contract Documents;
4. Remove samples of installed work as specified for testing;
5. Install equipment and materials in existing structures;
6. Upon written instructions from the Architect, uncover and restore work to provide for Architect observation of concealed work.

G. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including, but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new work.

H. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

I. Provide and maintain an approved type of temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

1.11 TEMPORARY FACILITIES

A. Light, Heat, Power, Etc.:
   1. Responsibility for providing temporary electricity, heat and other facilities shall be as specified in Division 1.

B. Use of Permanent Building Equipment for Temporary Heating or Cooling:
   1. Permanent building equipment shall not be used without written permission from the Owner. If this equipment is used for temporary heating or cooling, it shall be adequately maintained per manufacturer's instructions and protected with filters, strainers, controls, reliefs, etc. The guarantee period shall not start until the equipment is turned over to the Owner for his use.

1.12 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Refer to the Instructions to Bidders and Division 1, PRODUCT REQUIREMENTS.
   1. Substitutions will only be considered during the bid period.

1.13 MECHANICAL SUBMITTALS

A. Refer to the Conditions of the Contract (General and Supplementary), Division 1 and AIA Document A201 (1987) Edition, "SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES".

B. The manufacturer's material or equipment listed in the schedule or identified by name on the drawings are the types to be provided for the establishment of size, capacity, grade and quality. If alternates are used in lieu of the scheduled names, the cost of any changes in construction required by their use shall be borne by Contractor.

C. All equipment shall conform to the State and/or Local Energy Conservation Standards.

D. Submittal of shop drawings, product data, and samples will be accepted only when submitted by and stamped by the Contractor. Data submitted from subcontractors and material suppliers directly to the Engineer will not be processed unless prior written approval is obtained by the Contractor.

E. Before starting Work, prepare and submit to the Architect all shop drawings and descriptive equipment data required for the project. Unless each item is identified with specification section and sufficient data to identify its compliance with the specifications and drawings, the item will be returned "Revise and Resubmit". Continue to submit shop drawings after each Engineer's action, until a "Reviewed" action is received. The Contractor shall submit the total number of sets as called for in Division 1 to the Architect for final distribution. Submittals shall include the following specified materials and, in addition, any materials not listed below but which are specified in the individual sections of Division 23 which follow.
   1. Pipe Markers
   2. Sanitary and storm drainage piping, fittings and joining materials

3. Water treatment equipment, including water softeners
4. Plumbing fixtures, trim, fittings and rough-in dimensions, cleanouts and drains
5. Domestic water piping, fittings and joining materials
6. Domestic water heaters and domestic hot water generators
7. Water hammer arresters
8. Process piping
9. Valves, including pressure relief and pressure regulating
10. Pumps
11. Tanks, including expansion and fuel storage
12. Sprinkler equipment
13. Standpipe and fire hose equipment
14. Thermometers and pressure gauges
15. Boilers, burners, trim and feed equipment
16. Piping specialties, including hot water and steam
17. Supports, anchors and seals
18. Expansion compensators
19. Flexible pipe connectors
20. Water flow meters
21. Vibration isolators
22. Insulation, including plastic pipe fitting insulation covers and manufacturer's installation instructions
23. Heat exchangers
24. Terminal heat transfer units
25. Air conditioning equipment and specialties
26. Fans, ductwork, dampers, louvers, grilles, registers and diffusers
27. Automatic control systems

F. Wiring diagrams, control panelboards, motor test data, motors, starters and controls for electrically operated equipment furnished by mechanical trades.

G. Identify each item with specification section and sufficient data to certify its compliance with the specifications.
   1. Include compliance with LEED requirements.

1.14 MECHANICAL COORDINATION DRAWINGS

A. Prepare and submit a complete set of Coordination Drawings as necessary or required by the Engineer showing major elements, components, and systems of mechanical equipment and materials in relationship with other trades, sub-trades and building components. Prepare drawings to an accurate scale of 1/4"=1'-0" or larger. Indicate the locations of all equipment and materials, including clearances for installing and maintaining insulation, servicing and maintaining equipment, valve stem movement, and similar requirements. Indicate movement and positioning of large equipment into the building during construction.

B. Review in detail all floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate with all trades and integrate all installations. Indicate locations where space is limited, and where sequencing and coordination of installations are of importance to the efficient flow of the work, including (but not necessarily limited to) the following:
   1. Mechanical equipment room layouts;
   2. Specific equipment installations, including:

a. Boilers;
b. Pumps and Compressors;
c. Tanks and Heat Exchangers;
d. Air Handling Units;

3. Work in pipe spaces, chases, trenches, and tunnels;
4. Exterior wall penetrations;
5. Plenums which contain piping, ductwork, or equipment in congested arrangement;
6. Installations in mechanical riser shafts, at typical sections and crucial offsets and junctures;
7. Pipe expansion loops;
8. Numbered valve location diagrams;
9. Exterior underground lines in common excavation;
10. Manifold piping for multiple equipment units;
11. Boiler/Water Heater flue and roof penetrations.
12. Building automation and temperature control.

1.15 PRODUCT LISTING

A. Prepare listing of major mechanical equipment and materials for the project, within two (2) weeks of signing the Contract Documents and transmit to the Mechanical Engineer.

B. Unless otherwise specified, all materials and equipment shall be of domestic (USA) manufacture and shall be of the best quality used for the purpose in commercial practice.

C. Provide all information requested.

D. Submit this listing as a part of the submittal requirement specified in Division 1, "PRODUCTS AND SUBSTITUTION".

E. When two (2) or more items of same material or equipment are required (plumbing fixtures, pumps, valves, air conditioning units, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in work, except as otherwise indicated.

F. Provide products which are compatible within systems and other connected items.

1.16 NAMEPLATE DATA

A. Provide permanent operational data nameplate on each item of mechanical equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

1.17 DELIVERY, STORAGE, AND HANDLING

A. Refer to Division 1.

B. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

C. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage, dirt, dust and moisture.

D. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

E. Provide factory-applied plastic end-caps on each length of pipe and tube, except for concrete, corrugated metal, hub-and-spigot, clay pipe. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

F. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.

G. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

1.18 RECORD DOCUMENTS

A. Refer to Division 1. The following paragraphs supplement the requirements of Division 1.

B. Keep a complete set of record document prints in custody during entire period of construction at the construction site.

C. Mark drawing prints to indicate revisions to piping and ductwork, size and location both exterior and interior; including locations of coils, dampers and other control devices, filters, boxes, and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned to column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.); RFI's; change orders; concealed control system devices. Changes to be noted on the drawings shall include final location of any piping or ductwork relocated more than 1'-0" from where shown on the drawings.

D. Mark Equipment Schedules on the drawings with changes to Manufacturer, Model Number, and data based on reviewed shop drawings.

E. At the completion of the project, mark all valve tag numbers on the drawings and turn these drawings over to the General Contractor for his submission to the Architect. This Contract will not be considered completed until these record drawings have been received and reviewed by the Architect.

1.19 OPERATION AND MAINTENANCE DATA

A. Refer to Division 1.

B. No later than four (4) weeks prior to the completion of the project, submit minimum of one (1) sets of Operating and Maintenance Manuals, as specified in sections of Division 1.

C. The Testing and Balancing Report shall be submitted and received by the Engineer at least five (5) calendar days prior to the Contractor's request for final observation time frame requirements. Final Observation(s) will not proceed without T&B Report. Include in the O&M Manual after review with "Review" or "Make Corrections Noted" has been accomplished.

D. In addition to the information required by Division 1 for maintenance data, include the following information:
   1. Description of mechanical equipment, function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
   2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
   3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
   4. Servicing instructions and lubrication charts and schedules.
   5. Manufacturer's service manuals for all mechanical equipment provided under this Contract.
   6. Include the valve tag list.
   7. Name, Address and Telephone Number of party to be contacted for twenty-four (24) hour service for each item of equipment.
   8. Starting, stopping, lubrication, equipment identification numbers and adjustment clearly indicated for each piece of equipment.
   9. Complete parts list.
   10. Mechanical warranties.

E. This Contract will not be considered completed, nor will final payment be made, until all specified material, including Testing and Balancing Report, is received in this Operating and Maintenance Report and the manual is reviewed by the Architect.

1.20 LUBRICATION OF EQUIPMENT

A. Refer to Division 1. The following paragraphs supplement the requirements of Division 1.

B. Contractor shall properly lubricate all mechanical pieces of equipment which he provided before turning the building over to the Owner. He shall attach a linen tag or heavy duty shipping tag on the piece of equipment showing the date of lubrication and the type and brand of lubricant used.

C. Furnish the Engineer with a typewritten list in quadruplicate, of each item lubricated and type of lubricant used, no later than two (2) weeks before completion of the project, or at time of acceptance by the Owner of a portion of the building and the mechanical systems involved.

1.21 WARRANTIES

A. Refer to Division 1 for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements. In any case, the entire mechanical system shall be warranted no less than one (1) year from the time of acceptance by the Owner.

B. Compile and assemble the warranties specified in Division 23, into a separated set of vinyl covered, three-ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment to include date or beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.22 CLEANING

A. Refer to Division 1.

B. Refer to Division 23, "TESTING, ADJUSTING AND BALANCING" for requirements for cleaning filters, strainers, and mechanical systems prior to final acceptance.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

1.23 LEED REQUIREMENTS

A. Refer to Division 1.

B. Comply with SMACNA IAQ Guideline for Occupied Buildings under Construction. During construction meet or exceed the recommended Control Measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 1995, Chapter 3, as summarized below:

1. HVAC Protection – Use temporary heaters whenever feasible. Seal all duct and equipment openings with plastic. If permanently installed air handlers are used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8, as determined by ASHRAE 52.2-1999, shall be used over each return air grille. Replace all filtration media immediately prior to occupancy. All leaks in ducts and air handlers should be repaired promptly.
2. Source Control – For Contractor information, all paints, carpet, caulks, adhesives, sealants are specified as low-VOC and non-toxic. Recover, isolate and ventilate containers housing toxic materials. Avoid exhaust fumes from idling vehicles and gasoline fueled tools.
3. Pathway Interruption – During construction, isolate areas of work to prevent contamination of clean or spaces. Ventilate using 100% outside air to exhaust contaminated air directly to the outside during installation of VOC emitting materials.

Use pressure differentials or barriers between work and clean areas to prevent contaminated air from entering clean areas.

4. Housekeeping – Protect building materials from weather and store in a clean area prior to unpacking for installation. Clean all coils, air filters, and fans before performing testing and balancing procedures. Institute cleaning activities designed to control contaminants in building spaces.
5. Scheduling – Complete applications of wet and odorous materials such as VOCs in paints, sealants, and coatings before installing absorbing materials such as ceiling tiles, carpets, insulation, gypsum products, and fabric-covered furnishings. Avoid exposure of all interior materials to moisture.
6. Protect stored on-site or installed absorptive materials from moisture damage.
7. If owner authorizes the use of permanent heating, cooling, and ventilating systems during construction period as specified in Division 01 Section "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2-1999 at each return-air inlet for the air-handling system used during construction. Replace all filtration media with filter media having a MERV 13 according to ASHRAE 52.2-1999 immediately prior to occupancy.
8. FLUSH OUT - The space may be occupied following delivery of a minimum of 3,500 cu.ft. of outdoor air / sq.ft. of floor area to the space. This corresponds to operating both rooftop units continuously at peak design conditions and minimum outside air for a period of 250 hours. Once the space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm/sq.ft. of outside air. These conditions shall be maintained until a total of 10,500 cu.ft./sq.ft. of outside air has been delivered to the space. This corresponds to operating both rooftop units continuously at peak design conditions and minimum outside air for a period of 583 hours.
    a. Once the construction schedule is determined, contact Engineer to determine final flushout requirements based upon time of year and time available prior to occupancy.

END OF SECTION 230000

SECTION 230100 - M&E COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Carefully coordinate the interface between Division 23 (Mechanical) and Division 26 (Electrical) before submitting any equipment for review or commencing installation.

B. Responsibility: Unless otherwise indicated, all motor and controls for Division 23 equipment shall be furnished, set in place and wired in accordance with the following schedule:

COORDINATION SCHEDULE				
ITEM	**Furnished Under**	**Set in Place Under**	**Power Wiring Under**	**Control Wiring Under**
Equipment Motor	23	23	26	--
Automatically Controlled Starters/Contactors:				
Separate	23	26	26	23
Factory Mounted and Wired	23	23	26	23
Manually Controlled Starter/Contactors:				
Separate	23	26	26	23
Factory Mounted and Wired	23	23	26	23
Special Duty Type Motor (Part Winding, etc.)	23	26	26	23
Disconnect Switches (Note 1)	26	26	26	--
Variable Frequency Drives	23	26	26	23
Contactors	26	26	26	--
Thermal Overload Switches (Note 1)	26	26	26	--
Manual Operating Switches (Note 2)	26	26	26	--
Control Relays (Note 2)	23	23	26	23
Control Transformers	23	23	26	23
Control Circuit Outlets	26	26	26	--
Thermostats (Note 2)	23	23	--	23
Push Button Stations, Pilot Lights (Note 2)	23	23	26	23
Thermostat and Controls Integral with Equipment or Directly Attached to Ducts, Pipes, etc. (Note 2)	23	23	26	23
Equipment in Temperature Control Panels (Note 2)	23	23	26	23

COORDINATION SCHEDULE				
ITEM	**Furnished Under**	**Set in Place Under**	**Power Wiring Under**	**Control Wiring Under**
Standalone Control Panels (Note 2)	23	23	26	23
Valve Motors Damper Motors, Solenoid Valves, etc. (Note 2)	23	23	--	23
EP Valves or Switches, P.E. Switches, etc. (Note 2)	23	23	26	23
Fire Alarm System	26	26	26	26
Smoke Detectors Including Relays for Fan Control (Note 3)	26	23	26	23
Fire/Smoke Dampers	23	23	26	26
Equipment Interlock	23	23	N/A	23
Boiler and Water Heaters	23	23	26	23
Sub-Meters	23	26	26	23

Notes:

(1) If furnished as part of factory wired equipment, furnish and set in place under Division 23, wiring and connections under Division 26.

(2) If float switches, line thermostats, P.E. switches, time switches, or other controls carry the FULL LOAD CURRENT to any motor, they shall be furnished and set in place under Division 23, but they shall be connected under Division 26. If they do not carry the FULL LOAD CURRENT to any motor, they shall be furnished, set in place and wired under Division 23.

(3) Wiring from alarm contacts to alarm system by Division 26; all control function wiring by Division 23. Division 23 to coordinate locations with Division 26.

C. Control Wiring:
   1. Consists of wiring in pilot circuits of contactors, starters, sensors, controllers, and relays, and wiring for valve and damper operators.

D. Connections:
   1. Make connections to all controls directly attached to ducts, piping and mechanical equipment with flexible connections.

E. Starters:
   1. Provide magnetic starters for all three phase motors and equipment complete with:
      a. Control transformers.
      b. 120V holding coils.
      c. Integral hand-off auto switch.
      d. Auxiliary contacts required for system operation plus one (1) spare.

F. Remote Switches and Pushbutton Stations:
   1. Provide all remote switches and/or pushbutton stations required for manually operated equipment (if no automatic controls have been provided) complete with pilot lights of an approved type lighted by current from load side of starter.

G. Special Requirement:
   1. Motor, starters and other electrical equipment installed in moist areas or areas of special conditions, such as explosion proof, shall be designed and approved for installation in such areas with appropriate enclosure.

H. Identification:
   1. Provide identification of purpose for each switch and/or pushbutton station furnished. Identification may be either engraved plastic sign or permanent mounting to wall below switch, or stamping on switch cover proper. All such identification signs and/or switch covers in finished areas shall match other hardware in the immediate area.

I. Control Voltage:
   1. Maximum allowable control voltage is 120V. Fully protect control circuit conductors in accordance with National Electrical Code.
   2. Fully coordinate the requirements of each division with regard to supplying a complete DDC Control System. J-Boxes and control transformer connections shall be provided under Division 26. The transformers shall be furnished and set in place under Div. 23.

PART 2 - PRODUCTS

2.1 MOTOR HORSEPOWER

A. In general, all motors 3/4 HP and above shall be three phase, all motors less than 3/4 HP shall be single phase.

B. Voltage and phase of motors as scheduled on the electrical drawings shall take precedence in the case of a conflict between the mechanical and electrical drawings or general conditions 2.1 A., above.

C. Work under Division 23 includes coordinating the electrical requirements of all mechanical equipment with the requirements of the work under Division 26, before ordering the equipment.
   1. If motor horsepowers are changed under the work of Division 23, without a change in duty of the motor's driven device, coordination of additional electrical work (if any) and additional payment for the work (if any) shall be provided under the section of Division 23 initiating the change. Increases or decreases in motor horsepower from that specified shall not be made without written approval from the Architect.

PART 3 - EXECUTION

Not used.

END OF SECTION 230100

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of Piping Specialties Work required by this section is indicated on drawings and schedules and by requirements of this section.

B. Types of Piping Specialties specified in this section include the following:
   1. Escutcheons
   2. Dielectric Fittings
   3. Mechanical Sleeve Seal
   4. Fire and Smoke Barrier Penetration Seal
   5. Drip Pan
   6. Pipe Sleeve
   7. Sleeve Seals

C. Piping Specialties furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 23 sections.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of piping specialties of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:
   1. FCI Compliance: Test and rate "Y" type strainers in accordance with FCI 73-1 "Pressure Rating Standard for "Y" Type Strainers." Test and rate other type strainers in accordance with FCI 78-1 "Pressure Rating Standard for Pipeline Strainers Other than "Y" Type."
   2. ASME B 31.9 "Building Services Piping" for materials, products, and installation.
   3. Safety valves and pressure vessels shall bear the appropriate ASME label.
   4. Fabricate and stamp air separators and compression tanks to comply with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
   5. ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualification" for qualifications for welding processes and operators.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions, and dimensioned drawings for each type of manufactured piping specialty. Include pressure drop curve or chart for each type and size of pipeline strainer. Submit schedule showing manufacturer's figure number, size, location, and features for each required piping specialty.
   1. Include compliance with LEED requirements.

B. Shop Drawings: Submit for fabricated specialties, indicating details of fabrication, materials, and method of support.

C. Maintenance Data: Submit maintenance data and spare parts lists for each type of manufactured piping specialty. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Divisions 23.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. Combination Pressure and Temperature Relief Valves:
      a. Amtrol, Inc.
      b. Bell & Gossett ITT; Fluid Handling Division
      c. Spirax Sarco
      d. Watts Regulator Co.
   2. Pressure Reducing Valves:
      a. Amtrol, Inc.
      b. Armstrong Pumps, Inc.
      c. Bell & Gossett ITT; Fluid Handling Division
      d. Taco, Inc.
      e. Keckley
   3. Air Vents (Manual and Automatic):
      a. Armstrong Machine Works.
      b. Bell & Gossett ITT; Fluid Handling Division
      c. Hoffman Specialty ITT; Fluid Handling Division
      d. Spirax Sarco
   4. Air Separators:
      a. Amtrol, Inc.
      b. Armstrong Pumps, Inc.
      c. Bell & Gossett ITT; Fluid Handling Division
      d. Taco, Inc.
      e. The John Wood Co.
      f. Spirotherm
   5. Pump Suction Diffusers:
      a. Amtrol, Inc.
      b. Armstrong Pumps, Inc.
      c. Bell & Gossett ITT; Fluid Handling Division
      d. Taco, Inc.
      e. Victaulic Company of America
   6. Hydronic System Safety Relief Valves:
      a. Kunkle Valve Co., Inc.
      b. Lunkenheimer Co.
      c. Watts Regulator Co.
      d. Lonergan
      e. Keckley
      f. Bell & Gossett ITT; Fluid Handling Division

g. Conbraco
7. Pressure Regulating Valves:
   a. A.W. Cash Valve Mfg. Corp.
   b. Armstrong Machine Works, A-Y Division
   c. Fisher Controls International, Inc.
   d. Hoffman Specialty ITT; Fluid Handling Division
   e. Leslie Co.
   f. Spirax Sarco
   g. Spence Engineering Co., Inc.
   h. Wilkins Regulator/Division Zurn Industries Inc.
   i. Watts Regulator Co.
8. Pipe Escutcheons:
   a. Chicago Specialty Mfg. Co.
   b. Producers Specialty & Mfg. Corp.
   c. Sanitary-Dash Mfg. Co.
9. Low Pressure Strainers:
   a. Armstrong Machine Works
   b. Hoffman Specialty ITT; Fluid Handling Division
   c. Metraflex Co.
   d. R-P&C Valve; Division White Consolidated Industries, Inc.
   e. Spirax Sarco
   f. Trane Co.
   g. Victaulic Co. of America
   h. Watts Regulator Co.
10. Dielectric Fittings:
   a. B & K Industries, Inc.
   b. Capital Mfg. Co.; Division of Harsco Corp.
   c. Eclipse, Inc.
   d. Epco Sales, Inc.
   e. Perfection Corp.
   f. Rockford-Eclipse Division
11. Mechanical Sleeve Seal:
   a. Thunderline Corp.
   b. "Metraseal" by Metraflex Co.
12. Fire and Smoke Barrier Penetration Seal:
   a. Electrical Products Division/3M
   b. Dow Corning
   c. Flame Stop, Inc.
   d. MetaCaulk

2.2 HYDRONIC PIPING SPECIALTIES

A. General: Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one (1) type is indicated, selection is Installer's option.

B. Hydronic System Safety Relief Valves: Diaphragm operated, cast iron or brass body valve, with low inlet pressure check valve, inlet strainer removable without system shutdown, and non-corrosive valve seat and stem. Select valve size, capacity, and operating pressure to suit system. Valve shall be factory-set at operating pressure to suit system and have the capability for field adjustment. Safety relief valve shall be designed, manufactured, tested and labeled in accordance with the requirements of Section IV of the ASME Boiler and Pressure Vessel Code. Valve body shall be cast iron, with all wetted internal working parts made of brass and rubber; 125 psig working pressure and 250 degree F maximum operating temperature. Select valve to suit actual system pressure and BTU capacity. Set valve to relieve at 10 psi above operating pressure.

C. Manual Air Vent: Bronze body and nonferrous internal parts; 150 psig working pressure, 212 degree F operating temperature; manually coin operated and having discharge outlet connection and 1/8-inch NPT male connection.

D. Automatic Air Vent: Float type vent designed to vent automatically; bronze body and nonferrous internal parts. 150 psig working pressure, 240 degree F operating temperature. 1/4-Inch discharge connection and 1/2-inch inlet connection.

E. Air Separators: Cast iron; constructed and labeled for minimum 175 psig water working pressure and 300 degree F operating temperature; integral weir designed to decelerate system flow and direct released air into compression tank; inline inlet and outlet connections; screwed connections up to and including 3-inch NPS; flanged connections for 4-inch NPS and above; threaded blowdown connection; sized as indicated for full system flow capacity.

F. Pump Suction Diffusers: Cast iron body, with threaded connections for 2-inch and smaller, flanged connections for 2-1/2 inch and larger; 175 psig working pressure, 300 degree F maximum operating temperature; and complete with the following features:
   1. Inlet vanes with length 1-1/2 times pump suction diameter or greater.
   2. Cylinder strainer with 3/16-inch diameter openings with total free area equal to or greater than five (5) times cross-sectional area of pump suction, designed to withstand pressure differential equal to pump shutoff head.
   3. Disposable fine mesh strainer to fit over cylinder strainer (start-up strainer).
   4. Permanent magnet, located in flow stream, removable for cleaning.
   5. Adjustable foot support, designed to carry weight of suction piping.
   6. Blowdown tapping in bottom; gauge tapping in side.

2.3 PIPE ESCUTCHEONS

A. General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.

B. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.

C. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.

2.4 LOW PRESSURE PIPELINE STRAINERS

A. General: Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 125 psi working pressure, with Type 304 stainless steel screens, with 3/64-inch perforations at 233 per square inch.

B. Threaded Ends, 2-Inch and Smaller: Cast iron body, screwed screen retainer with centered blowdown fitted with pipe plug.

C. Threaded Ends, 2-1/2 Inch and Larger: Cast iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.

D. Flanged Ends, 2-1/2 Inch and Larger: Cast iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.

E. Butt Welded Ends, 2-1/2 Inch and Larger: Schedule 40 cast carbon steel body, bolted screen retainer with off-center blowdown fitted with pipe plug.

F. Grooved Ends, 2-1/2 Inch and Larger: Tee pattern, ductile-iron or malleable-iron body and access end cap, access coupling with EDPM gasket.

2.5 DIELECTRIC FITTINGS

A. General: Provide standard products recommended by manufacturer for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and stop corrosion.

B. Dielectric Waterway Fittings:
   1. ASTM-A53 Xinc electroplated steel pipe casing with inert, non-corrosive thermoplastic lining (NSF/FDA listed).
   2. Thread x thread ends 1/2-inch x 3-inch through 4-inch x 6-inch.
   3. Groove x thread ends 1/2-inch x 4-inch through 4-inch x 6-inch.
   4. Listed by IAPMO/IPC and SBCC PST and ESI.
   5. Dielectric unions are not an acceptable substitute for dielectric waterway fittings.

C. Dielectric Flange Insulation Kits:
   1. Field-assembled, companion flange assembly, full face or ring type.
   2. Neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
   3. Provide separate companion flanges and steel bolts and nuts.
   4. Rated at 175 psi conforming to ANSI B16.42 (iron) B16.24 (bronze).
   5. Factory certified to withstand minimum of 600 volts on a dry line without flashover.
   6. Meets federal specifications for tensile strength and thread end connections.

2.6 MECHANICAL SLEEVE SEALS

A. General: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure

plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.7 FIRE AND SMOKE BARRIER PENETRATION SEALS

A. General: Provide UL listed products for sealing all openings through fire or fire/smoke rated walls, floors, or ceilings used as passage for mechanical piping.

2.8 FABRICATED PIPING SPECIALTIES

A. Drip Pans: Provide drip pans fabricated from corrosion-resistant sheet metal with watertight joints, and with edges turned up 2-1/2 inch, and with double sloped to drain bottom. Reinforce top, either by structural angles or by rolling top over 1/4-inch steel rod. Provide hole, gasket, and flange at low point for watertight joint and 1-inch drain line connection.

B. Pipe Sleeves: Provide pipe sleeves of one (1) of the following:
   1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gauges: 3-inch and smaller, 20 gauge; 4-inch to 6-inch, 16 gauge; over 6-inch, 14 gauge.
   2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
   3. Iron Pipe: Fabricate from cast iron or ductile iron pipe; remove burrs.

C. Sleeve Seals: Provide sleeve seals for sleeves located in foundation walls below grade, or in exterior walls, of one (1) of the following:
   1. Mechanical Sleeve Seals: Installed between sleeve and pipe.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.

B. Strainers: Install strainers full size of pipeline, in accordance with manufacturer's installation instructions. Install pipe nipple and shutoff full port ball valve with 3/4-inch hose end and brass cap with hose "washer" and chain in strainer blowdown connection. Where indicated, provide drain line from shutoff valve to plumbing drain, full size of blowdown connection.
   1. Provide strainers in supply line ahead of the following equipment, and elsewhere as indicated.
      a. Pumps
      b. Control Valves
      c. Temperature or Pressure Regulating Valves
      d. Solenoid Valves

C. Mechanical Sleeve Seals: Loosely assemble rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form watertight seal.

D. Fire or Fire/Smoke Barrier Penetration Seals: Where pipe penetration occurs in fire or fire/smoke rated walls, provide the following:
   1. Fill the entire length of the opening with sealing compound. Adhere to manufacturer's installation instructions.
   2. Cracks, Voids, or Holes Up to 4-Inch Diameter: Use putty or caulking, one-piece intumescent elastomer, non-corrosive to metal, compatible with synthetic cable jackets, and capable of expanding ten (10) times when exposed to flame or heat, UL-listed.
   3. Openings 4-Inch or Greater: Use sealing system capable of passing three (3) hour fire test in accordance with ASTM E-814, consisting of wall wrap or liner, partitions, and end caps capable of expanding when exposed to temperatures of 250 to 350 degree F, UL-listed.

E. Where pipe penetrations occur in non-fire rated floors, roof slabs, or walls, the space between pipe insert and the sleeve shall be packed on each end with mineral wool or other non-combustible material, positively fastened in place.

F. Provide dielectric waterways or insulating flanges, as required by pipe size, on all connections of dissimilar metals.

3.2 HYDRONIC SPECIALTIES INSTALLATION

A. Manual Air Vent: Provide manual air vents at all high points and drops in the direction of flow, of all mains and risers of the hydronic systems, at heat transfer coils, radiation and elsewhere shown and as required for system air venting.
   1. Provide enlarged air collection standpipe where large air quantities can accumulate.
      1. Provide a 1/2-inch ball valve, reducer and pipe nipple installed between hydronic system pipe and manual air vent.
   2. Provide 1/4-inch discharge pipe from manual air vent discharge connection to nearest floor drain or as indicated.

B. Dip Tube Fittings: Install dip tube fittings in hydronic systems boiler outlet. Run piping to compression tank with 1/4-inch per foot (2 percent) upward slope towards tank. Connect boiler outlet piping.

C. Combination Air Separator/Strainer: Install combination air separator/strainer in hydronic systems pump suction lines. Run piping to compression tank with 1/4-inch per foot (2 percent) upward slope towards tank. Install blowdown piping with gate valve; extend to nearest drain.

D. Pump Suction Diffuser: Install pump suction diffusers on hydronic systems pump suction inlet, adjust foot support to carry weight of suction piping. Install nipple and ball valve in blowdown connection.

3.3 INSTALLATION OF FABRICATED PIPING SPECIALTIES

A. Drip Pans: Locate drip pans under piping as indicated. Hang from structure with rods and building attachments, weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1-inch drain line to drain connection, and run to nearest plumbing drain or elsewhere as indicated.

B. Pipe Sleeves: Install pipe sleeves of types indicated where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by Architect/Engineer. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insert will have free movement in sleeve, including allowance for thermal expansion; but not less than two (2) pipe sizes larger than piping run. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Extend floor sleeves 4-inch above finished floor in all Mechanical Equipment Rooms and pipe chases. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.
   1. Install sheet metal sleeves at interior partitions and ceilings other than suspended ceilings.
   2. Install iron pipe sleeves at exterior penetrations; both above and below grade.
   3. Install steel pipe sleeves except as otherwise indicated.

C. Sleeve Seals: Install in accordance with the following:
   1. Fire and Smoke Penetration Seal: Fill and pack annular space between sleeve and pipe with an approved fire and smoke penetration seal material on both sides.

END OF SECTION 230500

SECTION 230513 - MECH/ELEC REQUIREMENTS FOR MECHANICAL EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section specifies the basic requirements for Electrical Components for Mechanical Equipment. These components include, but are not limited to, motors, starters, and disconnect switches for mechanical equipment.

B. Wiring of field-mounted switches and similar mechanical-electrical devices provided for mechanical systems, to equipment control panels.

C. Specific electrical requirements (i.e. horsepower and electrical characteristics) for mechanical equipment are scheduled on the Electrical Drawings. In case of conflict, Electrical Drawings shall take precedence. Do not purchase motors or electrical equipment until power characteristics available at building site location have been confirmed by Contractor.

D. Refer to Table in Section 230100 for Mechanical/Electrical Coordination.

1.2 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of motors, motor starters and drives of types, ratings and characteristics required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Firm with at least three (3) years of successful installation experience on projects utilizing electric motors, similar to that required for this project.

C. NFPA Compliance: Comply with applicable requirements of NFPA 70E, "Standard for Electrical Safety Requirements for Employee Workplaces."

D. UL Compliance: Provide equipment and/or components which are UL-listed and labeled.

E. Standards:
1. NEMA Standards MG 1: Motors and Generators.
2. NEMA Standard ICS 2: Industrial Control Devices, Controllers, and Assemblies.
3. NEMA Standard 250: Enclosures for Electrical Equipment.
4. NEMA Standard KS 1: Enclosed Switches.
5. Comply with National Electrical Code (NFPA 70).

F. Coordination with Electrical Work: Wherever possible, match elements of electrical provisions of Mechanical Work with similar elements of Electrical Work specified in Division 16 sections. Comply with applicable requirements of Division 26 sections for Electrical Work of this section which are not otherwise specified.

1.3 SUBMITTALS

A. Listing, Motors of Mechanical Work: Concurrently, with submittal of mechanical products listing, **submit separate listing** showing rating, power characteristics, efficiencies, power factors, application and general location **of every motor** to be provided with mechanical work. Submit updated information promptly when and if initial data is revised.
   1. Include in listing of motors, notations of whether motor starter is furnished or installed integrally with motor or equipment containing motor.
   2. Use Mechanical/Electrical Coordination Schedule on Drawings as format for submittal.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following manufacturers for each type of product:
   1. Motors:
      a. Century/MagneTek
      b. Baldor
      c. U.S. Motor
      d. Reliance
      e. Siemens-Allis
      f. General Electric
      g. Louis Allis

2.2 MOTORS

A. The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.
   1. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads with a time limit acceptable to the motor manufacturer. Motors shall be capable of starting the driven equipment while operating at 90 percent rated terminal voltage.
   2. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range.
   3. Temperature Rating: Rated for 40 degree C environment with maximum 80 degree C temperature rise for continuous duty at full load (Class B Insulation). Provide Class F insulation for variable frequency drive motors.
   4. Starting Capability: Frequency of starts as indicated by automatic control system, and not less than five (5) evenly time spaced starts per hour for manually controlled motors.
   5. Service Factor: 1.15 for poly-phase motors and 1.35 for single-phase motors.
   6. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque. Design "E" shall not be used.
      a. Frames: NEMA Standard No. 48 or 54; Use driven equipment manufacturer's standards to suit specific application.

b. Bearings:
   1) Ball bearings with inner and outer shaft seals.
   2) Re-greasable, except permanently sealed where motor is normally inaccessible for regular maintenance.
   3) Bearings shall be rated for minimum L-10 life of 40,000 hours.
   4) Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.
   5) For fractional horsepower, light duty motors, sleeve type bearings are permitted.

c. Enclosure Type:
   1) Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation.
   2) Guarded drip-proof motors where exposed to contact by employees or building occupants.
   3) Weather protected Type I for outdoor use; Type II where not housed.

d. Noise Rating: "Quiet".

e. Efficiency: "Energy Efficient" motors shall have a minimum efficiency as scheduled in Table 1 in accordance with IEEE Standard 112, Test Method B. If efficiency not specified, motors shall have a higher efficiency than "average standard industry motors", in accordance with IEEE Standard 112, Test Method B.

TABLE 1* (Premium Efficiency)

HP	3600 RPM EFFICIENCY	1800 RPM EFFICIENCY	1200 RPM* EFFICIENCY	MINIMUM POWER FACTOR
1-1/2	84.0	86.5	86.5	85.0
2	85.5	86.5	87.5	85.0
3	85.5	89.5	88.5	85.0
5	86.5	89.5	89.5	85.0
7-1/2	88.5	91.0	90.2	85.0
10	89.5	91.7	91.7	85.0
15	90.2	93.0	91.7	85.0
20	91.0	93.0	92.4	85.0
25	91.7	93.6	93.0	85.0

* Efficiency and power factors may vary from above values for multi-speed motors and/or special hermetic motors packaged with equipment. For these special applications, motors shall be high-efficiency type and are subject to review by the Engineer.

f. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

7. Phases and Current Characteristics: Unless indicated otherwise, provide squirrel-cage induction polyphase motors for 3/4 HP and larger, and provide capacitor-start single-

phase motors for 1/2 HP and smaller, except 1/6 HP and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections. Do not purchase motors until power characteristics available at building site have been confirmed by Contractor.

8. The Contractor shall be responsible for all additional electrical and other costs involved to accommodate any motors which differ from the scheduled horsepower sizes or correct any motor which does not meet the listed duty or efficiency as called for in Mechanical or Electrical Plans and Specifications.
9. Motors shall be of the same manufacturer, except those that are an integral part of a factory assembled packaged unit. These motors shall likewise meet the conditions of the specification in this section except motors which are part of a motor/compressor assembly are exempted from this requirement.
10. All equipment specified to operate with Variable Frequency Drives shall be provided with invertor-duty motors specifically designed for variable speed operation with high efficiency at part load conditions and constructed with Class F insulation.
11. All motors which will be operated by a Variable Frequency Drive shall be warranted against any damage or defects as a result of being used with a variable frequency drive. VFD driven motors shall have three (3) year warranties.

2.3 STARTERS

A. Motor Starters: Refer to Section 230514.

2.4 DISCONNECT SWITCHES

A. See Division 26 for requirements.

2.5 DRIVES

A. V-Belt Drives:
   1. Capacity of V-Belt Drives at rated RPM shall be not less than 150 percent of motor nameplate horsepower rating.
   2. V-Belt Drive combinations shall be limited to A, B, C and fractional horsepower belts. 3V, 5V and 8V belts and sheaves shall not be used.
   3. All fixed pitch sheaves, including single groove fan sheaves, shall be of the bushed type. Fixed bore sheaves will not be acceptable for adjustable pitch sheaves.
   4. Unit manufacturer shall provide OSHA approved belt guard with tachometer holes.

2.6 VARIABLE FREQUENCY DRIVES

A. Refer to Section 230515.

2.7 EQUIPMENT FABRICATION

A. General: Fabricate mechanical equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or

adjustable mountings as applicable for belt drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives, arranged for lubrication and similar running-maintenance without removal of guards.

PART 3 - EXECUTION

3.1 TEST AND TEST DATA

A. A factory load test shall be performed on each motor of 1,000 watt input or greater to assure compliance with the energy-efficiency section of this specification.

B. Typical test data on every motor to be used on this project shall be made available upon request.

3.2 INSTALLATION

A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, securely anchored to resist torque, drive thrusts, and other external forces inherent in mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws, except motors of 1/3 HP and less may be secured with Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

B. Deliver starters and wiring devices which have not been factory-installed on equipment unit to electrical installer for installation.

C. Install power and control connections for motors to comply with NEC and applicable provisions of Division 26 sections. Install grounding except where non-grounded isolation of motor is indicated.

3.3 INSTALLATION COORDINATION

A. Furnish equipment requiring electrical connections to operate properly and to deliver full capacity at electrical service available.

B. All control wiring to be in accordance with manufacturer's recommendations, and shall be color-coded and individually numbered to facilitate checking.

C. Unless otherwise indicated, all mechanical equipment motors and controls shall be furnished, set in place, and wired in accordance with the schedule contained in Division 1. The exact furnishing and installation of the equipment is left to the Contractors involved. Contractor should note that the intent of the schedule is to have the Division 23 and 26 Contractors responsible for coordinating all control wiring as outlined, whether or not specifically called for by the Mechanical or Electrical Drawings and Specifications. Comply with the applicable requirements of Division 26 for all electrical work which is not otherwise specified. No extras will be allowed for Contractor's failure to provide for these required items. The Contractor shall refer to the Division 26 and Division 23 specifications and plans for all power and control wiring and shall advise the Architect/Engineer of any discrepancies prior to bidding.

END OF SECTION 230513

SECTION 230514 - MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Manual Motor Starters

B. Magnetic Motor Starters

C. Combination Magnetic Motor Starters

D. Reduced Voltage Starters

1.2 RELATED DOCUMENTS

A. Drawings, General and Special Conditions, Division 1 - General Requirements and other applicable technical specifications apply to work of this section.

1.3 RELATED SECTIONS

A. Division 26 - Electrical: All Sections.

B. Section 230513 – Mechanical/Electrical Requirements for Mechanical Equipment.

1.4 REFERENCE STANDARDS

A. Comply with the requirements of the reference standards noted herein, except where more stringent requirements are listed herein or otherwise required by the Contract Documents. A listing of applicable reference standards is contained in Division 1.

B. ANSI/NEMA ICS 6 – 1993: Industrial Control and Systems: Enclosures.

C. NEMA AB 1 - Molded Case Circuit Breakers.

D. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays.

1.5 SUBMITTALS

A. Submit under provisions of Division 1.

B. Provide product data on motor starters and combination motor starters, relays, pilot devices, and switching and overcurrent protective devices.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit Operation and Maintenance Data under provisions of Division 1.

B. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division 1.

B. Store and protect products under provisions of Division 23.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - MOTOR STARTERS

A. Allen-Bradley

B. Cutler Hammer

C. Square-D

D. Siemens

2.2 MANUAL MOTOR STARTERS

A. Manual Motor Starter: NEMA ICS 2; AC general-purpose Class A manually operated non-reversing full-voltage controller for induction motors rated in horsepower, with overload relay for each phase, phase loss protection, phase imbalance, ground fault protection, low-voltage protection, Red pilot light, field-convertible auxiliary contact, and toggle operator.

B. Fractional Horsepower Manual Starter: NEMA ICS 2; AC general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, Red pilot light, and key or toggle operator as indicated.

C. Motor Starting Switch: NEMA ICS 2; AC general-purpose Class A manually operated pole, full-voltage controller for fractional horsepower induction motors, without thermal overload unit, Red pilot light, field convertible auxiliary contact, and toggle operator.

D. Enclosure: ANSI/NEMA ICS 6; Type 1 for Indoor applications, and Type 3R for Outdoor applications.

2.3 MAGNETIC MOTOR STARTERS

A. Magnetic Motor Starters: NEMA ICS 2; AC general-purpose Class A, combination type magnetic controller as specified herein, for induction motors, rated in horsepower.

B. Magnetic Motor Starters shall be circuit breaker or motor circuit protector combination type, with external operator, in common enclosure with starter. External circuit breaker operator environmental rating shall match the enclosure rating. Disconnecting means shall be equipped with provisions enabling locking in the "OFF" position.

C. Full Voltage Starting: Reversing or non-reversing type as indicated.

D. Coil Operating Voltage: Unless otherwise specified, 120 volts, 60 hertz.

E. Size: NEMA ICS 2; Size as shown on Drawings, or as required for the motor horsepower.

F. Overload Relay: NEMA ICS 2; self-powered, adjustable trip electronic type, with selectable trip class operation. Motor protection functions shall include: phase loss, phase unbalance, and ground fault.

G. Enclosure: NEMA ICS 6; Type 1 for Indoor applications, and Type 3R for Outdoor applications.

H. Auxiliary Contacts: NEMA ICS 2; two (2) field-convertible contacts in addition to seal-in contact.

I. Selector Switches: NEMA ICS 2; HAND/OFF/AUTO, maintained type, in front cover.

J. Indicating Lights: NEMA ICS 2; RUN: Red LED type, in front cover with press-to-test lamp testing feature.

K. Relays: NEMA ICS 2; as required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motor control equipment in accordance with manufacturer's instructions.

B. Select and adjust electronic overloads to match installed motor characteristics.

C. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

D. Floor mounted equipment shall be on a 4-inch concrete housekeeping pad.

E. Provide Nameplates per Division 26.

END OF SECTION 230514

SECTION 230515 - VARIABLE FREQUENCY CONTROLLERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Variable Frequency Drives (VFDs)

1.2 RELATED DOCUMENTS

A. Drawings, General and Special Conditions, General Requirements, and other applicable technical specifications apply to work of this section.

1.3 RELATED SECTIONS

A. Division 26 – Electrical; All Sections

B. Section 230513 - Mechanical/Electrical Requirements for Mechanical Equipment

C. Section 230514 – Motor Controllers

1.4 REFERENCE STANDARDS

A. Comply with the requirements of the reference standards noted herein, except where more stringent requirements are listed herein or otherwise required by the Contract Documents.

B. NFPA 70 - National Electrical Code.

C. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.

D. NEMA AB 1 – Molded Case Circuit Breakers.

E. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.

F. NEMA ICS 3.1 - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems.

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

H. ANSI/UL Standard 508.

I. IEEE Standard 519-1992; For Voltage and Total Demand Distortion.

J. FCC Rules and Regulations, Part 15, Subpart J; For Radiated RFI.

1.5 SUBMITTALS

A. Submit under provisions of Division 1.

B. Shop Drawings: Include front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.

C. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

D. Test Reports: Indicate field test and inspection procedures and test results.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F. Manufacturer's Field Reports: Submit under provisions of Division 1.

G. Manufacturer's Field Reports: Indicate Start-Up Inspection findings.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 1.

B. Operation Data: Include instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.

C. Maintenance Data: Include routine preventive maintenance schedule.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc., and conforming to referenced standards as suitable for purpose specified and indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division 1.

B. Store, protect, and handle products under provisions of Division 23.

C. Accept controllers on site in original packing. Inspect for damage.

D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

E. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as on Shop Drawings.

1.10 MAINTENANCE SERVICE

A. Furnish service and maintenance of controller for two (2) years from Date of Substantial Completion.

1.11 EXTRA MATERIALS

A. Provide two (2) of each air filter.

B. Provide three (3) of each fuse size and type.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. All VFDs provided for this project shall be of a single manufacturer.

B. Approved Manufacturers:
1. Asea Brown Boveri (ABB)
2. Robicon
3. Toshiba
4. Honeywell

2.2 GENERAL

A. The VFD shall convert incoming 3-phase 60 Hz AC power to a variable frequency, variable voltage AC output suitable for control of a standard NEMA Design B induction motor over a 10:1 speed range.

B. The VFD shall consist of a 3-phase full-wave converter section to rectify the incoming AC source, a filtered DC bus section, and a sinusoidal PWM output section utilizing IGBT type output transistors, and utilizing sensorless torque vector control logic, as specified below.

C. The VFD shall maintain a near unity power factor regardless of speed or load (0.95 or better for drives larger than 5 HP).

D. Inverter section shall utilize insulated gate bipolar transistors (IGBTs) with a minimum rating of 1200 VDC, and have an adjustable carrier frequency range of 1 to 6 kHz through 100 HP.

E. The VFD and options shall be tested to ANSI/UL Standard 508 and listed by either UL or ETL.

F. The VFD torque characteristic shall match the driven load.

G. Input Power: 480 Volt, 3-phase, 60 Hz.

H. The VFD shall include an integral disconnect to isolate the VFD from input power.

I. Voltage Tolerance: ±10%; Frequency tolerance ±3%.

J. The VFD output shall be rated for continuous duty with full load amp ratings that meet or exceed NEC Table 430-150. The VFD shall have overload capability of 110 percent rated current for 60 seconds. Output voltage range shall not exceed input rated voltage.

K. Ambient Operating Conditions: Temperature, 0-40 degrees C; Relative Humidity, 0-95 percent, non-condensing, 5600 feet elevation, without deration.

L. All printed circuit boards and power subassemblies shall be burned in at elevated temperature (50 degrees C minimum) for forty-eight (48) hours minimum. The completed, assembled VFD shall be functionally tested under motor load before shipment to ensure proper operation. The manufacturer shall provide certification that these tests have been completed.

2.3 BASIC FEATURES

A. Provide with "BACNET" capability for remote readout and functional interface with Building Automation Systems (BAS).
   1. Provide capability for BAX to read power consumption.

B. Control power transformer with fused primary and 24V or 120V fused secondary.

C. VFD AC line input high-speed semi-conductor type current-limiting fuses rated 200,000 AIC minimum.

D. Operator Controls:
   1. "HAND-OFF-AUTO" Selector Switch. In "AUTO' position, drive starts and stops motor from remote contact closure, and motor speed shall be proportional to a remote speed control signal. In "HAND" position, motor is started and stopped from VFD Keypad/Display Module, and the motor speed shall be as set through the VFD Keypad/Display Module.
   2. Pilot Lights: LED Type. 22.5mm IEC Style, Red "VFD On", White "Control Power On", and Amber "VFD Fault".

E. Keypad/Display Module:
   1. A multi-line alpha-numeric backlit display capable of displaying at minimum motor speed (Hz), motor current (A), motor voltage (V), elapsed time meter (Hrs.), inverter load (%) and all drive programming parameters.
   2. Keypad to enable starting and stopping, and manual speed adjustment when the selector switch is in "HAND" position.

F. Programmable Relay Outputs (three minimum) capable of indicating the following:

1. VFD in Run Mode
2. VFD at Zero Speed
3. VFD Fault

G. Terminals for field-installed external safeties.

H. Field-selectable Auto Restart on power source failure.

I. Adjustable voltage boost for starting high torque loads.

J. Drive shall be capable of starting into a spinning motor by matching frequency and phase angle to the motor back EMF.

K. Critical Speed Avoidance: Drive shall allow the User to avoid operation at resonant speeds. Selected speeds shall be stepped over. Four (4) critical speeds shall be capable of being avoided, with an adjustable bandwidth for each critical speed.

L. Signal Follower: In Auto Speed mode, motor speed shall be proportional to an external 4-20 ma speed control signal. Loss of reference signal shall cause drive to go to programmable preset speed.

2.4 MOTOR PROTECTION

A. For all installations where the conductors from the VFD to the motor exceed 100 feet in length, provide a minimum 3 percent reactance motor protecting dv/dt filter at the VFD output terminals.

2.5 ADJUSTMENTS

A. Acceleration Time: 2 to 20 Second minimum range.

B. Deceleration Time: 2 to 20 Second minimum range.

C. Volts/Hz Ratio: Programmable.

D. Voltage Boost: Programmable.

E. Critical Speed Lockout: Four (4) critical speeds with adjustable bandwidth.

F. Current Limit: 30 to 110 percent sine wave current rating.

G. Carrier Frequency Range: 1 to 6 kHz through 100 HP and 1 to 3 kHz above 100 HP.

H. Output Frequency Range: 0 to 80 Hz minimum range.

I. All drive parameters shall be stored in non-volatile memory (EEPROM).

2.6 PROTECTIVE FEATURES

A. VFD shall have built-in protection for power source transients, over-voltage, under-voltage, and phase loss. VFD shall not require an input isolation transformer for transient protection.

B. DC bus over-voltage protection.

C. Instantaneous shutdown when load current exceeds 150 percent.

D. Adjustable electronic Class 20 inverse time characteristic over-current overload protection for the motor.

E. The VFD shall be capable of withstanding randomly applied short circuit current applied across the output terminals without damage.

F. Protection of VFD for any external disconnects between the drive and the motor. Provide control terminals for connection of disconnect switch auxiliary contacts, which will immediately stop the drive when opened.

G. DC bus discharge circuit for protection of service personnel, with "BUS CHARGED" indicator.

H. Troubleshooting Diagnostic Features:
   1. Indicator lights on inverter power module to indicate correct operation (or failure) of individual power switching devices.
   2. Indicator lights to show drive fault/ready states, and reason for fault shutdown, including: Instantaneous overload, motor overload, output or DC bus over-voltage, or source over-voltage, under-voltage, or phase loss. The VFD shall store in memory at minimum the previous five (5) alarms.

2.7 FABRICATION

A. Wiring Terminations: Match conductor materials and sizes indicated.

B. Enclosure:
   1. For Dry, Indoor Applications: NEMA 250, Type 1.
   2. For Wet, Indoor, Temperature Controlled Applications, NEMA 250, Type 4, with ventilation provisions, or closed loop heat exchanger, as required for adequate VFD cooling. Any powered enclosure ventilation or heat exchanger shall be configured to operate from a single point of electrical connection, common with the VFD.
   3. For Outdoor Applications: NEMA 250, Type 4, with NEMA 250, Type 3R rain shield. In addition, provide panel heaters, and/or panel closed loop heat exchanger or panel air conditioner as required to maintain the temperature within the VFD enclosure, within the allowable operating temperature range of the VFD. Any panel heaters and/or air conditioners shall be configured to operate from a single point of electrical connection, common with the VFD.

C. Finish: Manufacturer's standard enamel.

2.8 SOURCE QUALITY CONTROL

A. Inspect and production-test each product specified in this section.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surface is suitable for controller installation.

B. Do not install controller until building environment can be maintained within the service conditions required by the manufacturer.

3.2 PREPARATION

A. For floor-mounted VFDs, provide concrete housekeeping pad under the provisions of Division 26.

3.3 INSTALLATION

A. Install controller where indicated, in accordance with manufacturer's written instructions and NEMA ICS 3.1.

B. Tighten accessible connections and mechanical fasteners after placing controller.

C. Install fuses in fusible switches.

D. Provide engraved plastic nameplates under the provisions of Division 26.

E. Provide neatly typed label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

3.4 FIELD QUALITY CONTROL

A. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.

3.5 START-UP SERVICE

A. Provide minimum two (2) hours of start-up service for each VFD. Service shall be performed by factory-trained service technicians.

B. Technician shall verify correct installation, start-up the drive, adjust all required operating parameters, and verify proper operation in all operating modes.

C. Owner Training: Provide minimum eight (8) hours training in operation and trouble-shooting procedures for the installed drives.

3.6 ADJUSTING

A. Make final adjustments to installed drive to assure proper operation of fan system. Obtain performance requirements from installer of driven loads.

3.7 CLEANING

A. Touch up scratched or marred surfaces to match original finish.

3.8 DEMONSTRATION

A. Provide systems demonstration under provisions of Division 26.

B. Demonstrate operation of controllers in automatic and manual modes.

END OF SECTION 230515

SECTION 230519 - METERS AND GAUGES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of Meters and Gauges required by this section is indicated on drawings and/or specified in other Division 23 sections.

B. Types of Meters and Gauges specified in this section include the following:
   1. Temperature Gauges and Fittings:
      a. Glass Thermometers
      b. Thermometer Wells
      c. Temperature Gauge Connector Plugs
   2. Pressure Gauges and Fittings:
      a. Pressure Gauges
      b. Pressure Gauge Cocks
      c. Pressure Gauge Connector Plugs
   3. Flow Measuring Meters:
      a. Venturi Tube Flow Measuring Elements
      b. Calibrated Balancing Valves
      c. Pitot Tube Flow Meters

C. Meters and gauges furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 23 sections.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of meters and gauges, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:
   1. UL Compliance: Comply with applicable UL Standards pertaining to meters and gauges.
   2. ANSI and ISA Compliance: Comply with applicable portions of ANSI and Instrument Society of America (ISA) Standards pertaining to construction and installation of meters and gauges.
   3. Certification: Provide meters and gauges whose accuracies, under specified operating conditions, are certified by manufacturer.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of meter and gauge. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit meter and gauge schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gauge.

B. Maintenance Data: Submit maintenance data and spare parts lists for each type of meter and gauge. Include this data and product data in Maintenance Manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. Glass Thermometers:
      a. Ernst Gauge Co.
      b. Marshalltown Instruments, Inc.
      c. Miljoco Corp.
      d. Weiss Instruments, Inc.
      e. Dwyer
   2. Temperature Gauge Connector Plugs:
      a. Fairfax Company
      b. Peterson Equipment Co.
      c. Universal Lancaster
      d. Sisco
      e. MG Piping Products Co.
   3. Pressure Gauges:
      a. Ametek/U.S. Gauge
      b. Marsh Instrument Co.; Unit of General Signal
      c. Marshalltown Instruments, Inc.
      d. Miljoco Corp.
      e. Weiss Instruments, Inc.
      f. MG Piping Products Co.
      g. Dwyer
   4. Pressure Gauge Connector Plugs:
      a. Fairfax Company
      b. Peterson Equipment Co.
      c. Universal Lancaster
      d. Sisco
      e. MG Piping Products Co.
      f. Miljoco Corp.
   5. Venturi Tube Flow Measuring Elements:
      a. Gerand
      b. Barco/Aeroquip Corp.
      c. Griswold
      d. Preso
   6. Calibrated Balancing Valves:
      a. "Flowset" - Flow Design, Inc.
      b. Thrush Products, Inc.
      c. Tour and Anderson, Inc.
      d. Gerand "Balvalve Indicator"
      e. Griswold
      f. Preso

7. Pitot Tube Flow Meters:
   a. Dieterich Standard
   b. Preso

2.2 GLASS THERMOMETERS

A. General: Provide glass thermometers of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.

B. Case: Die cast aluminum finished in baked epoxy enamel, glass front, spring secured, 9-inch long.

C. Adjustable Joint: Die cast aluminum, finished to match case, 180 degree adjustment in vertical plane, 360 degree adjustment in horizontal plane, with locking device.

D. Tube and Capillary: Non-Toxic spirit filled, 1 percent scale range accuracy, shock mounted.

E. Scale: Satin faced, non-reflective aluminum, permanently etched markings.

F. Stem: Copper-plated steel, or brass, for separable socket, length to suit installation.

G. Range: Conform to the following:
   1. Hot Water: 30 Degree - 240 degree F with 2 degree F scale divisions (0 degree - 160 degree C with 2 degree C scale divisions).
   2. Chilled Water: 30 - 180 Degree F with 2 degree F scale divisions (0 degree - 100 degree C with 1 degree C scale divisions).
   3. Steam and Condensate: 50 Degree - 400 degree F with 2 degree F scale divisions (10 degree - 205 degree C with 1 degree C scale divisions).

2.3 THERMOMETER WELLS

A. General: Provide thermometer wells constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2-inch extension for insulated piping. Provide cap nut with chain fastened permanently to thermometer well.

2.4 TEMPERATURE GAUGE CONNECTOR PLUGS

A. General: Provide temperature gauge connector plugs pressure rated for 500 PSI and 200 degree F (93 degree C). Construct of brass and finish in nickel-plate, equip with 1/2-inch NPS fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8-inch O.D. probe assembly from dial type insertion thermometer. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.

2.5 PRESSURE GAUGES

A. General: Provide pressure gauges of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.

B. Type: General Use, 1 percent accuracy, ANSI B40.1 Grade A, phospher bronze bourdon type, bottom connection.

C. Case: Stainless steel, drawn steel, or brass, glass lens, 4-1/2 inch diameter.

D. Connector: Brass with 1/4-inch male NPT. Provide protective syphon when used for steam service.

E. Scale: White coated aluminum, with permanently etched markings.

F. Range: Conform to the following:
1. Water: 0 - 100 PSI.

2.6 PRESSURE GAUGE COCKS

A. General: Provide pressure gauge cocks between pressure gauges and gauge tees on piping systems. Construct gauge cock of brass with 1/4-inch female NPT on each end, and "T" handle brass plug.

B. Syphon: 1/4-Inch straight coil constructed of brass tubing with 1/4-inch male NPT on each end.

C. Snubber: 1/4-Inch brass bushing with corrosion resistant porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.

2.7 PRESSURE GAUGE CONNECTOR PLUGS

A. General: Provide pressure gauge connector plugs pressure rated for 500 PSI and 200 degree F (93 degree C). Construct of brass and finish in nickel-plate equip with 1/2-inch NPS fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8-inch O.D. probe assembly from dial type insertion pressure gauge. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.

2.8 VENTURI TUBE FLOW MEASURING ELEMENTS

A. Primary flow measuring elements shall consist of Venturi tubes. Arrange piping in accordance with manufacturer's published literature. In horizontal pipes, place connections slightly above horizontal centerline of pipe.

B. Provide each primary element with integral tab, or metal tag on stainless steel wire, extending outside pipe covering on which is stamped or clearly printed in plainly visible position the following information:
1. Manufacturer's name and address.
2. Serial number of meter to which element is to be connected.
3. Name, number, or location of equipment served.
4. Specified rate of flow.
5. Multiplier (including unity, where applicable) to be applied to meter reading.

C. Provide taps with shutoff valves and quick connecting hose fittings for portable meters or double-ferrule compression fittings for connection to tubing for permanently located meters or recorders.

D. Manufacturer shall certify Venturi tubes for actual piping configuration. Any necessary piping changes required for certification shall be provided without cost to Owner. Insert type tubes may be furnished, provided they meet specification requirements in other respects.

E. Provide Venturi with throat diameter such that specified rate of flow will register scale reading of between 20 percent and 80 percent of full scale value.

F. Venturi sizes and beta ratios shall be selected so that design flow rates shall read between 20 percent and the full scale range on a linear meter (e.g. between 10-inch and 50-inch on a 0-50-inch meter), with permanent pressure loss of not more than 25 percent of indicated flow rate differential pressure.

G. Provide Venturi tubes of solid brass or bronze. Tubes larger than 2-inch shall have flanges or butt weld connections and may be cast iron or steel. Steel tubes may be fabricated or cast with cadmium or zinc-plating. Line throats of cast iron tubes with bronze and plate cast iron portion with cadmium.

H. Tubes shall be calibrated and tested by independent testing laboratory and performance data furnished with shop drawings.

I. Connections for attachment to portable flow meter hoses shall be readily accessible.

2.9 CALIBRATED BALANCING VALVES

A. General: Provide as indicated, calibrated balance valves equipped with readout valves to facilitate connecting of differential pressure meter to balance valves. Equip each readout valve with integral EPT check valve designed to minimize system fluid loss during monitoring process. Provide calibrated nameplate to indicated degree of closure of precision machined orifice. Construct balancing valve with internal EPT O-ring seals to prevent leakage around rotating element. Provide balance valves with preformed polyurethane insulation suitable for use on heating and cooling systems, and to protect balance valves during shipment.

B. Balancing Valve Manufacturer shall select valve sizes to provide meter readings between 7-inch and 25-inch w.g. at rated GPM.

2.10 PITOT TUBE FLOW METERS

A. Provide permanently mounted meters consisting of bellows type differential pressure element and either indicating or recording and integrating element as noted in schedule or indicated on drawings.

B. Differential pressure elements and indicating or recording and integrating elements generally shall be direct-connected, but pneumatic electric or electronic transmission elements shall be used when particular installation precludes use of direct-connected units. Pneumatic, electric or electronic transmission elements shall be provided wherever pressure-sensing lines required for, direct transmission would exceed 150-feet in length or cannot be graded properly. Connect each flow meter to primary element as specified and provide with all piping, wiring, and accessories required for complete installation. Provide flow metering equipment supplied by single manufacturer or coordinated by single supplier.

C. Permanently mounted meter installations (primary flow measuring element and flow meter) shall have overall accuracy of + 2 percent of full scale flow over range of 20 percent to 100 percent of full-scale flow. Engineer and manufacture primary elements of meters in accordance with ASME recommendations for flow meters.

D. Design bellows type differential pressure elements (meter bodies) for full-scale pressure differential of 50-inch w.g. to 100-inch w.g. Design shall incorporate rupture-proof stainless steel or copper metal bellows and torque tube drive requiring no lubrication. Design forged meter bodies for not less than 150 percent of maximum system pressure and fully protect against surges, with provision for venting and draining. Provide meter bodies with integral, adjustable pulsation dampers.

E. Provide meter with complete copper tubing connections of approved sizes between differential pressure elements (meter bodies) and Venturi tubes. Include necessary vent and drain valves as recommended by meter manufacturer.

F. Dials shall be flush type reading directly in gallons per minute.

G. Enclose recording and integrating elements of each recording and integrating meter in dust-tight case. Arrange case for flush panel mount. Elements shall record flow continuously on seven (7) day, 123-inch diameter linear chart. Integrators shall be of 7-figure direct-reading type with either 15-second or continuous operating cycle. Furnish one (1) year supply of charts, pens, and ink for each meter and deliver to Contracting Officer.

H. Design remote transmitters and receivers so that normal changes in air supply system pressure or in electric power supply system voltage or frequency will not affect accuracy of meters. Measuring circuits shall be relieved of all work required to move mechanical parts.

2.11 METER KIT

A. Provide portable flow meters with bellows type differential pressure element and minimum 5-inch diameter indicating dial.

B. Design pressure elements for full-scale pressure differential of 50-inch or 100-inch water gauge. Design shall incorporate rupture-proof metal beryllium or stainless steel bellows and torque tube drive requiring no lubrication. Design forged bodies for not less than 150 percent of maximum surge pressure, fully protected against surges, with full provision for venting and draining. Provide integral, adjustable pulsation dampers.

C. Dials of portable meters shall have square root scales not less than 12-inch in developed length. Dials shall read from 0 to 10 gpm to which multiplier is to be applied, as required; also provide

with uniform scale reading from 0-inch to 10-inch w.g., to which multiplier of 10 to be applied (100-inch at full scale), or from 0-inch to 5-inch w.g., to which multiplier of 10 is to be applied (50-inch at full scale).

D. Engineer and manufacture in accordance with ASME recommendations for flow meters. Provide portable meters with overall accuracy of + 5 percent.

E. Provide flow meter with factory-fabricated carrying case with integral carrying handle. Case shall be fitted to hold meter and following accessories.
   1. Two (2) 10-foot lengths of connecting hose with suitable female connectors for connecting to Venturi tube pressure tap nipples. Design hose for operating pressure of minimum of 150 percent of maximum system operating pressure.
   2. Completely assembled 3-valve manifold with two (2) block valves and vent and drain valves shall be piped and mounted on base, which shall be designed for use laying flat on stationary base.
   3. Bound set of descriptive bulletins, installation and operating instructions, parts list, and set of curves showing flow verses pressure differential for each orifice or Venturi tube with which meter is to be used.
   4. Metal instruction plate, secured inside cover, illustrating use of meter. Deliver meter with case to Owner.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which meters and gauges are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF TEMPERATURE GAUGES

A. General: Install temperature gauges in vertical upright position, and tilted so as to be easily read by observer standing on floor.

B. Locations: Install in the following locations, and elsewhere as indicated:
   1. At inlet and outlet of each hydronic boiler.

C. Thermometer Wells: Install in piping tee where indicated, in vertical upright position. Fill well with oil or graphite, secure cap.

D. Temperature Gauge Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap. Provide portable temperature gauge for each plug connection.

3.3 INSTALLATION OF PRESSURE GAUGES

A. General: Install pressure gauges in piping tee with pressure gauge cock, located on pipe at most readable position.

B. Locations: Install in the following locations, and elsewhere as indicated:
   1. At suction and discharge of each pump.

C. Pressure Gauge Cocks: Install in piping tee with snubber. Install syphon for steam pressure gauges.

D. Pressure Gauge Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap. Provide portable pressure gauge for each plug connection.

E. All pressure gauges shall have coil syphon and isolation gauge cock, "snubber" valve, to service the gauge and isolate it from the pipe system service without having to drain the piping system.

3.4 INSTALLATION OF FLOW MEASURING METERS

A. General: Install flow measuring meters on piping systems located in accessible locations at most readable position.

B. Calibrated Balance Valves: Install on piping with readout valves in vertical upright position. Maintain minimum length of straight unrestricted piping equivalent to three (3) pipe diameters upstream of valve.

3.5 ADJUSTING AND CLEANING

A. Adjusting: Adjust faces of meters and gauges to proper angle for best visibility.

B. Cleaning: Clean windows of meters and gauges and factory-finished surfaces. Replace cracked or broken windows, repair any scratched or marred surfaces with manufacturer's touch-up paint.

END OF SECTION 230519

SECTION 230529 - SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of Supports and Anchors required by this section is indicated on drawings and/or specified in other Division 23 sections.

B. Types of Supports and Anchors specified in this section include the following:
   1. Horizontal-Piping Hangers and Supports
   2. Vertical-Piping Clamps
   3. Hanger-Rod Attachments
   4. Building Attachments
   5. Saddles and Shields
   6. Miscellaneous Materials
   7. Anchors
   8. Equipment Supports

C. Supports and anchors furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 23 sections.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:
   1. Regulatory Requirements: Comply with applicable Mechanical Codes pertaining to product materials and installation of supports and anchors.
   2. Duct Hangers: SMACNA Duct Manuals.
   3. MSS Standard Compliance:
      a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor. Submit pipe hanger and support schedule showing manufacturer's figure number, size, location, and features for each required pipe hanger and support.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of assembly of components.

C. Product certificates signed by the manufacturer of hangers and supports certifying that their products meet the specified requirements.

D. Maintenance Data: Submit maintenance data and parts list for each type of support and anchor. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. Pipe Hangers and Supports:
      a. B-Line Systems Inc.
      b. Carpenter and Patterson, Inc.
      c. Fee & Mason Mfg. Co.; Division Figgie International
      d. PHD Manufacturing, Inc.
      e. Elcen Metal Products Company
      f. Michigan Hanger Company
      g. Unistrut Metal Framing Systems
      h. Hilti USA.
   2. Saddles and Shields:
      a. Pipe Shields, Inc.
      b. Insulation Pipe Supports Manufacturing
      c. Insulated Saddle Shield Insert Product Inc.
      d. Michigan Hanger Company
      e. Component Products Co.
      f. Value Engineered Products, Inc.
      g. Snappitz Pipe Inserts
   3. Roof Pipe Supports:
      a. MAPA
      b. Advanced Supply Products
      c. Erico
      d. Gutterpiller
      e. Mifab MANU
      f. Miro Industries
      g. PHP Systems
      h. S-5
   4. Concrete Inserts and Anchors:
      a. Phillips Drill Company
      b. Michigan Hanger Company
      c. Elcen Metal Products Company
      d. Ramset/Red Head
      e. Hilti USA.
      f. Star fasteners
      g. B-Line

2.2 PIPE HANGERS AND SUPPORTS

A. Hangers and support components shall be factory fabricated of materials, design, and manufacturer complying with MSS SP-58.
   1. Components shall have galvanized coatings where installed for piping and equipment that will not have field-applied finish.
   2. Pipe attachments shall have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.

B. Adjustable Clevis Hanger: MSS Type 1
   1. Steel Pipe, size 3/8-inch thru 12-inch, B-Line B3100
   2. Copper Pipe, size 1/2-inch thru 4-inch, B-Line B3104CT

C. Adjustable Swivel Ring: MSS Type 10
   1. Steel Pipe, size 1/2-inch thru 2-inch, B-Line B3170NF
   2. Copper Pipe, size 1/2-inch thru 2-inch, B-Line B3100

D. Standard Pipe Clamps: MSS Type 8
   1. Steel Pipe, size 3/4-inch thru 20-inch, B-Line B3373
   2. Copper Pipe, size 1/2-inch thru 4-inch, B-Line B3773CT

E. Floor Stand Pipe Saddle Support: MSS Type 37
   1. Steel Pipe, size 1 1/2-inch thru 12-inch, B-Line B3095

F. Hanger Rods: Continuous threaded steel, sizes as specified.

2.3 UPPER ATTACHMENTS

A. Beam Clamps
   1. All thread rod sized 3/8-inch and 1/2-inch: B-Line B3034
   2. All thread rod sizes 5/8- inch: B-Line B3033
   3. All thread rod sizes 3/4-inch and up: B-Line B3055

2.4 CONCRETE INSERTS AND ANCHORS

A. Inserts: Case shall be of galvanized carbon steel with square threaded concrete insert nut for hanger rod connection; 3/4-inch lateral adjustment; top lugs for reinforcing rods, nail holes for attaching to forms. Michigan Hanger Models 355 and 355N or equal Unistrut or Elcen. This type of upper attachment is to be used for all areas having poured in place concrete construction.

B. Anchors: Carbon steel, zinc plated. Installation shall be in holes drilled with carbide-tipped drill bits or by use of self-drilling anchors.
   1. Provide anchors suitable for the location of installation and designed to withstand all forces and movements acting in the anchor. Manufacture pipe anchors in accordance with MSS SP 58. Provide a safety factor of four (4) for the anchor installation.
   2. Powder driven fasteners subject to approval of Structural Engineer. Each fastener shall be capable of holding a test load of 1,000 pounds whereas the actual load shall not exceed 50 pounds.

3. Self-drilling expansion shields. The load applied shall not exceed one-fourth the proof test load required.
4. Machine bolt expansion anchor. The load applied shall not exceed one-fourth the proof test load required.

2.5 SADDLES AND THERMAL SHIELD INSERTS

A. General: Provide thermal shield inserts under all insulated piping hangers and thermal shield inserts on all piping through floors, wall and roof construction penetrations. Size saddles and shields for exact fit to mate with pipe insulation or a minimum of 1-inch thick for uninsulated pipe thermal shield inserts.

B. Thermal Shield Inserts: Provide 100-psi average compressive strength, waterproof, asbestos free calcium silicate, encased with a sheet metal enclosure. Insert and shield shall cover the entire circumference on vertical pipes, or the bottom half circumference of the pipe on horizontal mounting supports, and shall be of length recommended by the manufacturer for pipe size and thickness of insulation or the thickness of the wall, roof or floor construction.

C. Thermal Mechanical Pipe Shields: Self-locking insulated pipe supports/shields shall be provided at hanger, support, and guide locations on pipe requiring insulation. The insert shall consist of either hydrous calcium silicate or polyisocyanurate foam insulation (urethane) encircling the entire circumference of the pipe with a 360 degree PVC or Galvanized steel jacket.

2.6 MISCELLANEOUS MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36.

B. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix ratio shall be 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

C. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS Standards.

D. Pipe Guides: Provide factory-fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

2.7 ROOF PIPE SUPPORTS

A. Factory fabricated roof support system for piping application. Base shall be compatible with roofing membrane. For support materials other than metal, such materials shall be UV resistant. All metal components shall be corrosion resistant by either galvanization or zinc plating.

B. Supports shall be designed to support the piping system and installed in accordance to manufacturer's requirements.

C. Install with supplemental pad under support base as required by roofing system design.

D. B-Line C-port CE Series

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 PREPARATION

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments. **Review Structural Drawings to obtain structural support limitations.**

B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at Project Site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified. **Provide Shop Drawing showing method and support locations from structure.**

3.3 INSTALLATION OF BUILDING ATTACHMENTS

A. Install building attachments within concrete or on structural steel. Space attachments within maximum piping span length indicated in MSS SP-69 and tables this section. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert to forms. Where concrete with compressive strength less than 2,500 psi is indicated, install reinforcing bars through openings at top of inserts.

B. New Construction:
   1. Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.
   2. Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying pipe over 4-inch or ducts over 60-inch wide.
   3. Where concrete slabs form finished ceiling, finish inserts flush with slab surface.
   4. Use drop-in anchors for concrete structures.
   5. Use beam clamps for steel structures.

C. Existing Construction:

1. In existing concrete construction, drill into concrete slab and insert and tighten expansion anchor bolt. Connect anchor bolt to hanger rod. Care must be taken in existing concrete construction not to sever reinforcement rods or tension wires.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

A. Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69 and SP-89. Arrange for grouping of parallel runs of horizontal piping to be supported together on field fabricated, heavy-duty trapeze hangers where possible. Install supports with maximum spacings complying with MSS SP-69 and tables this section. Where piping of various sizes is supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.

C. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

D. Install hangers and supports to allow controlled movement of piping systems, to permit freedom of movement between pipe anchors, to facilitate action of expansion joints, expansion loops, expansion bends and similar units and within 1'-0" of each horizontal elbow.

E. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

F. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31.9 Building Services Piping Code is not exceeded.

G. Insulated Piping: Comply with the following installation requirements:
   1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
   2. Saddles: Install Protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.
   3. Thermal Shield Inserts: Install thermal shield inserts MSS Type 40 on cold and chilled water piping that has vapor barrier. Thermal shield inserts shall span an arc of 180 degrees and shall have dimensions in inches not less than the following:

NPS	Length	Thickness
1/4 thru 3-1/2	12	0.048
4	12	0.060
5 and 6	18	0.060
8 thru 14	24	0.075
16 thru 24	24	0.105

4. Pipes 8-inches and larger shall have wood inserts.
5. Insert material shall be at least as long as the protective shield.
6. Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

H. Install refrigerant and hydronic piping (copper and steel) hangers with the following minimum rod sizes and maximum spacing:

	Sch. 40 Steel Pipe		
Pipe Size	Maximum Hanger Spacing (ft.)	Maximum Vertical Spacing (ft.)	Minimum Rod Size (in.)
1/2"	7	15	3/8
3/4"	7	15	3/8
1"	7	15	3/8
1-1/4"	7	15	3/8
1-1/2"	9	15	3/8
2"	10	15	3/8
2-1/2"	11	15	1/2
3"	12	15	1/2
4"	12	15	5/8
5"	12	15	5/8
6"	12	15	3/4
8"	12	15	3/4
10"	12	15	7/8
12"	12	15	7/8
Based on MSS-69, IMC & IFGC.			

Pipe Size	Type K, L, M Copper Pipe		
	Maximum Hanger Spacing (ft.)	Maximum Vertical Spacing (ft.)	Minimum Rod Size (in.)
1/2"	5	10	3/8
3/4"	5	10	3/8
1"	6	10	3/8
1-1/4"	6	10	3/8
1-1/2"	8	10	3/8
2"	8	10	3/8
2-1/2"	9	10	1/2
3"	10	10	1/2
4"	10	10	1/2
5"	10	10	1/2
6"	10	10	5/8
Based on MSS-69 & IMC.			

I. Support vertical runs at each floor.

J. Install steel natural gas piping with the following minimum rod size and maximum spacing:

Size (NPS)	Maximum Span in Feet	Minimum Rod Size - Inches
1/2	6	3/8
3/4 to 1	8	3/8
1-1/4 or larger (horizontal)	10	1/2
Vertical, all sizes	Every floor level	

K. Provide copper or copper plated hangers and supports for copper piping or provide sheet lead packing between hanger or support and piping.

L. Place a hanger within 1-foot (0.305 m) of each horizontal elbow.

M. Use hangers which are vertically adjustable 1-1/2 inch (38.1 mm) minimum after piping is erected. Provide and tighten tap locking nut on each hanger.

N. Support vertical steel and copper piping at every story height but at not more than 15-foot intervals for steel and 10-feet for copper.

O. Where several pipes can be installed in parallel and at same elevation, provide trapeze hangers.

P. Where practical, support riser piping independently of connected horizontal piping.

Q. Support steam supply and condensate return pipe runs on steel yoke and pipe roll hangers with protection saddles.

R. Each pipe drop to equipment shall be adequately supported. All supporting lugs or guides shall be securely anchored to the building structure.

S. Install all couplings with torque wrench, torqued to inch-pounds as specified by the manufacturer.

T. Hang all insulated pipe at the point of support in the following manner:
   1. Hanger: See Paragraph 2. 3 B.
   2. All insulated pipes (≥ 2"d) shall have thermal shield insert at all support points. All piping shall have thermal shield inserts at each penetration through wall, floor and roof.
   3. Clevis Hangers: Install 180-degree waterproof, asbestos free, calcium silicate thermal shield insert with 180 degree galvanized steel protection shield.
   4. Steel Yoke and Pipe Roll Hangers: Provide steel protection saddle welded to the pipe. Fill the voilds with fiberglass insulation.
   5. Trapeze Hangers Utilizing Unistrut Clamps or U-Bolts: Provide 360 degree waterproof, asbestos free, calcium silicate thermal shield insert with 360 degree steel protection saddle.
   6. All hangers shall be properly sized to accommodate the thermal shield insert and no hanger shall penetrate or crush any of the insulating material.

U. Install anchors and fasteners in accordance with manufacturer's recommendations and the following:
   1. In the event a self-drilling expansion shield or machine bolt expansion shield is considered to have been installed improperly, the Contractor shall make an acceptable replacement or demonstrate the stability of the anchor by performing an on-site test under which the anchor will be subjected to a load equal to twice the actual load.
   2. Powder-driven fasteners may be used only where they will be concealed after the construction is complete. Where an occasional fastener appears to be improperly installed, additional fastener(s) shall be driven nearby (not closer than six (6) inches) in undisturbed concrete. Where it is considered that many fasteners are improperly installed, the Contractor shall test load any fifty (50) successively driven fasteners. If 10 percent or more of these fasteners fail, the Contractor shall utilize other fastening means as approved and at no additional cost to the Owner.
   3. Hangers for piping and ducts shall be attached to cellular steel floor decks with steel plates and bolted rod conforming to the steel deck manufacturer's requirements. Where the individual hanger load exceeds the capacity of a single floor deck attachment, steel angles, beams or channels shall be provided to span the number of floor deck attachments required.
   4. Welding may be used for securing hangers to steel structural members. Welded attachments shall be designed so that the fiber stress at any point of the weld or attachment will not exceed the fiber stress in the hanger rod.

3.5 EQUIPMENT SUPPORTS

A. Fabricate structural steel stands to suspend equipment from structure above or support equipment above floor.

B. Grouting: Place grout under supports for piping and equipment.

C. Concrete bases for the mechanical equipment indoors or outdoors will be provided by the General Contractor only if shown on the Architectural or Structural Drawings. Otherwise, all bases shall be provided by this Contractor.

D. Housekeeping bases shall be 4-inch thick minimum, extended 4-inch beyond machinery bedplates.

E. This Contractor shall be responsible for the proper size and location of all bases and shall furnish all required anchor bolts and sleeves. If bases are provided by the General Contractor, furnish him with templates showing the bolt locations.

F. Equipment shall be secured to the bases with anchor bolts of ample size. Bolts shall have bottom plates and pipe sleeves and shall be securely imbedded in the concrete. All machinery shall be grouted under the entire bearing surface. After grout has set, all wedges, shims and jack bolts shall be removed and the space filled with non-shrinking grout. This Contractor shall provide lead washers at all equipment anchor bolts.

G. Construct equipment supports mounted above floor of structural steel members or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

H. Provide rigid anchors for ducts and pipes immediately after vibration connections to equipment. See also Section 230548.

3.6 FLASHING AND SAFING

A. Flash and counterflash where mechanical equipment passes through weather or water-proofed walls, floors, and roofs per roof manufacturers instructions.

3.7 SLEEVES AND SEALS

A. General:
   1. Encase all insulated pipes penetrating fire rated walls and floors in 360 degree metal-shielded insulation inserts as manufactured by Pipe Shields, Inc. or equal. Extend insulation insert on all non-potable, chilled water and refrigerant lines 1-inch beyond sheet metal shield.

B. Pipes:
   1. New Construction: Pipes penetrating fire rated concrete or masonry construction, whether insulated or not, shall be provided with sheet metal or pipe sleeves fitted into place at time of construction. In poured concrete, the sleeves shall be steel pipe with a full circle, continuously welded water stop plate to also act as a sleeve anchor. When installing Link-Seal the sleeve and Link-Seal shall be of matched sizes. Otherwise,

sleeves shall be of such size to provide all around clearance of 1/4-inch to 1-inch. Seal entire space between pipe and sleeve with fire stopping as specified in “Seals”.

2. Existing Construction: For existing construction or masonry construction, prepare pipe opening by carefully cutting or core drilling, install sheet metal sleeve, and fill any open space with fire stopping material. Cutting of concrete or masonry shall be done after approval of Structural Engineer.
3. Sleeves in non-fire rated or non-bearing walls, floors or ceilings, new or existing construction, shall be steel pipe or galvanized sheet metal with lock-type longitudinal seam. Pack all annular spaces on each end with mineral wood or other non-combustible material, positively fastened in place. Asbestos is not acceptable.
4. At Contractor's option, where uninsulated pipes penetrate cast-in-place concrete floors, the "ProSet Systems," Atlanta, Georgia, sleeving may be employed.
5. For pipes penetrating foundation walls, water-proofing membrane floors or other places where water leakage could be encountered, install Link-Seal wall sleeves by Thunderline Corporation in manner recommended by the manufacturer.

C. Seals:
   1. General:
      a. Seal all holes or voids where mechanical systems penetrate fire rated floors and walls with a fire stopping sealant having a fire rating equal to or greater than that of the construction being penetrated, but not less than two (2) hours. The sealant shall meet the requirements of ASTM E-814, ASTM E-119 and UL-1479. It shall be installed with strict adherence to the manufacturer's instructions and according to the product's UL Laboratory listing. The use of asbestos in any form is not permitted.
   2. Types of Seals:
      a. Intumescent (3M Company CP25 Caulk and 303 Putty)
      b. Expanding Foam (Dow Corning 3-6548 Silicone RTV Foam)
      c. Refractory Putty (SOHIO Carborundum Fire Putty)
   3. Method of Use:
      a. Intumescent Type: For insulated pipe, install insulation through the sleeve with a continuous vapor seal if required. Install intumescent seal in the annular space between the pipe insulation and the pipe sleeve. Refer to manufacturer's data sheets for maximum annular space allowable and thickness of material required to maintain the rating of the construction being penetrated in conformance with applicable UL Fire Stop Classification for the product.
      b. Expanding Foam: For insulated pipe, terminate the insulation on both sides of the wall or floor being penetrated and fill the space between the construction and the bare pipe with the foam. For uninsulated pipe, continue pipe through the penetration and proceed as with insulated pipe.
      c. Refractory Putty: For insulated pipe, provide a 360 degree metal-shielded calcium silicate insulation insert as specified in Paragraph A. Pack and seal the entire space between shield and sleeve with refractory putty. When sealing bare pipe, omit the metal-shielded insert.

3.8 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for pipe anchors and equipment supports. Install and align fabricated anchors in indicated locations.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so that no roughness shows after finishing.

3.9 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Touch-Up Painting: Immediately after erection of anchors and supports, clean field welds and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA-1 requirements for touch-up of field-painted surfaces.
   1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

C. For galvanized surfaces, clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 230529

SECTION 230548 – NOISE AND VIBRATION CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of Vibration Control Work required by this section is indicated on Drawings and Schedules, and/or specified in other Division 23 sections.

B. Types of Vibration Control Products specified in this section include the following:
1. Fiberglass Pads and Shapes
2. Neoprene Pads
3. Vibration Isolation Springs
4. Neoprene Mountings
5. Spring Isolators, Free-Standing
6. Spring Isolators, Vertically-Restrained
7. Flexible Pipe Connectors

C. Vibration Control Products furnished as integral part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 23 sections.

D. Refer to other Division 23 sections for equipment foundations; Hangers; Sealants; Gaskets; requirements of electrical connections to equipment isolated on vibration control products; requirements of duct connections to air handling equipment isolated on vibration control products.

E. Noise Criteria
1. Noise levels due to mechanical or electrical equipment, ductwork, grilles, registers, terminal devices, diffusers, etc., shall not exceed sound pressure levels in all 8 octave bands corresponding to NC levels per ASHRAE handbook as indicated.

Room	***NC Criterion***
Studio	NC-20-25
Meeting Spaces	NC-30
Staff Conference Room	NC-30
Private Study/Collaborative Space	NC-30
Music Listening	NC-30
Community Learning Plaza	NC-35
Senior Librarian Office	NC-35
Collections and Computing	NC-35
Reference and Periodicals	NC-35
Staff Workroom	NC-35
Service Point, Holds, Self checks	NC-35
Children’s Program Space	NC-35
Arts and Crafts	NC-35
Staff Lounge	NC-35

2. Penetrations by ducts, pipes and conduit for partitions and slabs within areas designated between NC-20 and NC-30 and within mechanical and electrical rooms/areas shall be sleeved, packed and sealed airtight with non-hardening sealant as described herein.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of vibration control products, of type, size, and capacity required, whose products have been in satisfactory use in similar service for not less than five (5) years.
   1. Except as otherwise indicated, obtain Vibration Control Products from single manufacturer.
   2. Engage Manufacturer to provide technical supervision of installation of support isolation units produced, and of associated inertia bases (if any).

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of vibration control product. Submit schedule showing size, type, deflection, and location for each product furnished.
   1. Include data for each type and size of unit, showing isolation efficiency, stiffness, natural frequency and transmissibility at lowest operating speed of equipment.
   2. For spring units, show wire size, spring diameter, free height, solid-compression height, operating height, fatigue characteristics, ratio of horizontal to vertical stiffness and bases of spring-rated selection for range of loading weights.
   3. Include performance certifications from manufacturers.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weights, required clearances, and method of assembly of components. Detail bases and show location of equipment anchoring points coordinated with equipment manufacturer's shop drawings.
   1. Shop drawings showing structural design and details of inertia bases, steel beam bases and other custom-fabricated work not covered by manufacturer's submitted data.
      a. Furnish templates, anchor bolts and sleeve for equipment bases, foundations and other support systems for coordination of vibration isolation units with other work.
   2. Submit shop drawings indicating scope of vibration isolation work and locations of units and flexible connections. Include support isolation points for piping and ductwork including risers, air housings and inertia bases.
      a. Include schedule of units, showing size or manufacturer's part number, and weight supported and resulting deflection of each unit.

C. Maintenance Data: Submit maintenance data for each type of vibration control product. Include this data, product data and shop drawings in maintenance manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. Vibration Control Products:
      a. Mason Industries, Inc.

b. Kinetics Noise Control.
c. Vibration Mounting and Controls (Korfund)

2. Silencer Products:
   a. Industrial Acoustics Company
   b. Rink Corporation
   c. Aero Acoustic Corporation
3. Pipe Lagging:
   a. Sound solutions or equal

2.2 VIBRATION CONTROL MATERIALS AND SUPPORT UNITS

A. GENERAL
1. The static deflection of isolators shall be as specified below.
2. All mounting systems exposed to weather and other corrosive environments shall be protected with factory corrosion resistance. All metal parts of mountings (except springs and hardware) shall be hot dip galvanized. Springs shall be cadmium plated and neoprene coated. Nuts and bolts shall be cadmium plated.

B. Fiberglass Pads and Shapes: Glassfiber of not more than 0.18 mil diameter, produced by multiple-flame attenuation process, molded with manufacturer's standard fillers and binders through ten (10) compression cycles at three (3) times rated load bearing capacity, to achieve natural frequency of not more than 12 Hertz, in thicknesses and shapes required for use in vibration isolation units.

C. Neoprene Pads: Oil-resistant neoprene sheets of manufacturer's standard hardness and cross-ribbed or waffled pattern.
1. Mason Industries Type W

D. Neoprene Mountings: Provide neoprene mountings consisting of neoprene element bonded between two (2) steel plates that are neoprene-covered to prevent corrosion. Provide minimum rated deflection of 0.35-inch. Provide threaded hole in upper plate and two (2) holes in base plate for securing to equipment and to substrate.
1. Mason Industries Type ND

E. Waffle Pads
1. Type WP (Waffle Pads) shall be 5/16” thick neoprene pads ribbed or waffled on both sides. The pads shall be manufactured with bridge bearing quality neoprene, and selected for a maximum durometer of 50 and designed for 15% strain. Where required, steel load-spreading plates shall be incorporated between the equipment and the neoprene pad.
2. If the isolator is bolted to the structure, a neoprene vibration isolation washer and sleeve (Uniroyal Type 620/660 or as approved) shall be installed under the bolt head between the steel washer and the base plate.
3. Type WP: Mason Industries Type W, Super W, or as approved.

F. Isolation Hangers: Hanger units formed with brackets and including manufacturer's standard compression isolators of type indicated. Design brackets for five (5) times rated loading of units. Fabricate units to accept misalignment of 15 degree off center in any direction before contacting hanger box, and for use with either rod or strap type members, and including acoustical washers to prevent metal-to-metal contacts.

1. Provide vibration isolation spring Type C with cap in lower pad-type isolator rubber hanger element in bottom, securely retained in unit.
2. Provide neoprene element, with minimum deflection of 0.35-inch, securely retained in hanger box.
3. Unless otherwise specified, the static deflection of isolation hangers shall be 2".
4. Mason Industries Type 30N

G. Spring and neoprene mounts
1. Type SPNM (Spring and Neoprene Mounts) shall have a free-standing and laterally stable steel spring without any housing. Springs shall be designed so that the ratio of the horizontal to vertical spring constant is between one and two. The spring diameter shall be not less than 80% of the compressed height of the spring at rated load. Loaded springs shall have a minimum additional travel to solid equal to 50% of the specified static deflection.
2. Unless otherwise specified, the minimum static deflection of SPNM isolators for equipment mounted on grade slabs shall be 1", and the minimum static deflection for equipment mounted above grade level shall be 2".
3. Two Type WP isolation pads sandwiching a 16-gauge stainless or galvanized steel separator plate shall be bonded to the isolator baseplate.
4. Unless otherwise specified, isolators need not be bolted to the floor for indoor installations. If the base plates are bolted to the structure, a neoprene vibration isolation washer and sleeve (Uniroyal Type 620/660 or as approved) shall be installed under the bolt head between the steel washer and the base plate.
5. Type SPNM: Mason Industries Type SLFSW or as approved.

H. Neoprene Mounting Sleeves
1. Neoprene mounting sleeves for hold-down applications of equipment with vibration isolators shall be Uniroyal Type 620/660 or as approved.

I. Pipe flexible connectors
1. Flexible connectors for pipes shall be neoprene Mason Type MFNEC, MFTNC or as approved. Control cables (Mason Type ACC or equivalent) may be used to prevent axial elongation in the connector. Rigid control rods shall not be used for this purpose.

2.3 DUCT SILENCERS

A. Rectangular duct silencers shall have outer casings of not less than 22-gauge galvanized steel. Seams shall be lock formed and mastic filled. The internal baffles (splitters) shall be not less than 24-gauge galvanized perforated steel having an open area of about 30%. The nosings shall be full radius or airfoil shape.

B. The sound absorbing media shall be not less than 4.5 pcf glass/mineral fiber packed under 5% compression. The fiber fill shall be incombustible, mildew resistant and vermin proof. The sound absorbing material shall be protected from erosion.

C. If the silencer is installed in a location exposed to water or weather, the fill shall be completely encapsulated in Mylar bagging.

2.4 PIPE LAGGING

A. Foil-faced noise barrier with 1-inch thick quilted fiberglass sound absorber; Model B-10 Lag / QFA-3.

PART 3 - If the silencer is supplied in modular sections, the silencer shall meet or exceed the specification for single-module silencers with respect to insertion loss, pressure drop, regenerated noise and air leakage.EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which vibration control units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Owner or his representative.

3.2 PERFORMANCE OF ISOLATORS

A. General: Comply with minimum static deflections recommended by ASHRAE, for selection and application of vibration isolation materials and units as indicated.

B. Manufacturer's Recommendations: Except as otherwise indicated, comply with manufacturer's recommendations for selection and application of vibration isolation materials and units to achieve minimum static deflection and displacement requirements.

3.3 APPLICATIONS

A. General: Except as otherwise indicated, select vibration control products in accordance with ASHRAE Handbook, 1999 HVAC Applications Volume, Chapter 42 "Sound and Vibration Control", Table 34.

B. Piping: For piping connected to equipment mounted on vibration control products, install isolation hangers Type 30N, as indicated, and for first three (3) points of support for pipe sizes 4-inch and less, for first four (4) points of support for pipe sizes 6-inch through 8-inch, and for first six (6) points of support for pipe sizes 10-inch and over.

C. All equipment, piping, etc. shall be mounted on or suspended from approved foundations and supports as specified herein or as shown on the drawings.

D. All floor-mounted equipment shall be erected on 4” thick concrete housekeeping pads over the complete floor area of the equipment. These pads shall be integrally keyed to structural slab. Wherever vibration eliminating devices and/or concrete inertia blocks are specified, these items shall, in all cases, be in turn mounted on concrete housekeeping pads unless otherwise specified.

E. Furnish and install neoprene mounting sleeves for hold-down bolts to prevent any metal to metal contact.

F. All equipment shall be provided with lateral restraining isolators as required to limit horizontal motion to 1/4” maximum, under all operating conditions. Lateral restraining isolators shall have the same having the same static deflection as equipment being isolated,

G. Piping, ductwork, conduit or mechanical equipment shall be supported from building structure, not hung from or supported on other equipment, pipes, or ductwork.

H. All wiring connections to mechanical equipment on isolators shall be made with flexible conduit fabricated in a slack shape.

I. Elastomeric isolators that will be exposed to temperatures below 32° F shall be fabricated from natural rubber instead of neoprene.

J. Springs shall be sized to be non-resonant with equipment forcing frequencies or support structure natural frequencies.

3.4 INSTALLATION

A. General: Except as otherwise indicated, comply with manufacturer's instructions for installation and load application to vibration isolation materials and units. Adjust to ensure that units do not exceed rated operating deflections or bottom out under loading, and are not short-circuited by other contacts or bearing points. Remove space blocks and similar devices (if any) intended for temporary protection against overloading during installation.

B. Install units between substrate and equipment as required for secure operation and to prevent displacement by normal forces.

C. Adjust leveling devices as required to distribute loading uniformly onto isolators. Shim units as required where substrate is not level.

D. Locate isolation hangers as near overhead support structure as possible.

E. Flexible Pipe Connectors: Install on equipment side of shutoff valves, horizontally and parallel to equipment shafts wherever possible. The connectors shall be used to connect piping diameter 2” or greater to reciprocating or rotating equipment.

F. Air Handling Units
   1. The entire equipment cabinet shall be mounted directly on no less than four (4) Type SPNM isolators with a static deflection of 1” under actual load conditions for on grade locations, and 2” for above grade locations. The bottom of the air handler cabinet shall contain appropriate structural steel and must be structurally sufficient to be supported in this manner. Structural steel rails can be used for additional support if required.
   2. Internal spring isolation as the sole means of vibration isolation will not be approved.

G. Fan Units
   1. Equipment, inclusive of all drain pans and associated motors, shall be supported from structure from no less than four (4) isolation hangers or SPNM mounts with static deflection of 1” under actual load conditions.
   2. Provide flexible duct connections to and from the isolated unit.

H. Split (DX) Air Conditioning Units
   1. Ductwork shall be connected via flexible connections.
   2. All condensing units above grade or on roof shall be isolated by means of WP neoprene pads. Units shall be supported off roofing by concrete pavers or suitable concrete blocks.

I. Inline Pumps
   1. Inline pumps 3 HP and over shall be supported on Type SPNM spring isolators. Elbow-type neoprene (or appropriate material) flexible pipe couplings shall be used on each side of pump. The vertical load shall be carried by the supports, not by the flexible couplings.
   2. Inline pumps less than 3HP shall be supported as above, with neoprene-type hangers.

J. Heating Water Piping
   1. Heating water piping over 2" in diameter shall be vibration isolated from building structure by means of spring isolation hangers with a static deflection of 1" under actual load conditions.
   2. Where pipes rise in a vertical chase and are supported from a structure with isolation hangers and require lateral bracing, neoprene riser guides shall be mounted around the pipe to limit lateral movement and to prevent direct contact with the supporting structure.

K. Duct Isolation
   1. Ducts shall be connected to fans, fan casings and fan plenums by means of flexible connectors. Flexible connectors shall be installed to prevent metal-to-metal contact across flexible connection. Flexible duct connectors shall not be used outside the mechanical room unless expressly shown on the drawings.

L. Duct Silencers
   1. Duct silencers shall be furnished and installed as shown on the mechanical drawings and as called for in the silencer schedule.

M. Sheet metal and piping penetrations of shafts, floor slab and/or partitions
   1. There shall be no direct contact of sheet metal or piping with shaft walls, floor slabs and/or partition.
   2. All openings around pipes and ducts in the structure surrounding the mechanical equipment and surrounding noise-critical spaces (rated NC-20 to NC-30) shall be sealed packed with caulking for the full depth of the penetration, as described herein, and as shown on the drawings. This includes all slab penetrations and penetrations of noise critical walls.

N. Duct Penetrations
   1. Where each duct passes through a wall, floor or ceiling of a noise-critical space (rated NC-20-30), there shall be a clear annular space of 1 inch (1") between the duct and structure. After all of the ductwork is installed the Contractor shall check the clearance, pack the voids full depth with mineral fiber batt insulation and caulk both ends with a non-aging, non-hardening sealant backed by a polyethylene foam rod or permanently flexible firestop material. Where there is not sufficient access space to pack around all sides of a duct (for example, at the underside of a slab), place a short stub duct in the wall, pack and caulk around it and then attach the inlet and outlet ducts to each end.

O. Pipe Penetrations
   1. HVAC, Domestic Water, Sewer, and Vent Piping
      a. Where a pipe passes through a wall, ceiling or floor slab of a noise critical space (rated NC-20-30), an opening shall be provided with an internal diameter 2" larger than the external diameter of the pipe passing through it. After all of the piping is installed in that area, the Contractor shall check the clearance and correct it, if necessary, to within 1/2". Then the void shall be packed full depth with glass/mineral fiber and sealed at both ends, 1" deep, with sealant backed by foam

rod.

3.5 EXAMINATION OF RELATED WORK

A. Installer of vibration isolation work shall observe installation of other work related to vibration isolation work, including work connected to vibration isolation work; and, after completion of other related work (but before equipment start-up), shall furnish written report to Engineer listing observed inadequacies for proper operation and performance of vibration isolation work. Report shall cover, but not necessarily be limited to the following:
   1. Equipment installations (performed as work of other sections) on vibration isolators.
   2. Piping connections, including flexible connections.
   3. Ductwork connections, including provisions for flexible connections.
   4. Passage of piping and ductwork, which is to be isolated through walls and floors.

B. Do not start-up equipment until inadequacies have been corrected in manner acceptable to vibration isolation installer.

3.6 ADJUSTING AND CLEANING

A. Clean each vibration control unit, and verify that each is working freely, and that there is no dirt or debris in immediate vicinity of unit that could possibly short-circuit unit isolation.

3.7 DEFLECTION MEASUREMENTS

A. Upon completion of vibration isolation work, prepare report showing measured equipment deflections theoretical floor deflection and isolation efficiency for each major item of equipment.

END OF SECTION 230548

SECTION 230553 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of Mechanical Identification Work required by this section is indicated on drawings and/or specified in other Division 23 sections.

B. Types of Identification Devices specified in this section include the following:
   1. Plastic Pipe Markers
   2. Plastic Tape
   3. Valve Tags
   4. Valve Schedule Frames
   5. Underground-Type Plastic Line Marker
   6. Engraved Plastic-Laminate Signs
   7. Plasticized Tags
   8. Lettering and Graphics

C. Refer to Division 26 sections for Identification Requirements of Electrical Work; not work of this section.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:
   1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.
   1. Include compliance with LEED requirements.

B. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), size of valve, and variations for identification (if any). Only tag valves which are intended for emergency shutoff and similar special uses, such as valve to isolate individual system risers, individual floor branches or building system shut-off valves. In addition to mounted copies, furnish extra copies for Maintenance Manuals as specified in Division 1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. Brady (W.H.) Co.; Signmark Division
   2. Brimar Industries, Inc.
   3. Industrial Safety Supply Co., Inc.
   4. Seton Name Plate Corp.
   5. Holbi.

2.2 MECHANICAL IDENTIFICATION MATERIALS

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 23 sections. Where more than single type is specified for application, selection is Installer's option, but provide single selection for each product category.

2.3 PLASTIC PIPE MARKERS

A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.

B. Insulation: Furnish 1-inch thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125 degree F (52 degree C) or greater. Cut length to extend 2-inch beyond each end of plastic pipe marker.

C. Small Pipes: For external diameters less than 6-inch (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one (1) of the following methods:
   1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
   2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4-inch wide; full circle at both ends of pipe marker, tape lapped 1-1/2 inch.

D. Large Pipes: For external diameters of 6-inch and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than three (3) times letter height (and of required length), fastened by one (1) of the following methods:
   1. Steel spring or non-metallic fasteners.
   2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2 inch wide; full circle at both ends of pipe marker, tape lapped 3-inches.
   3. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.

E. Lettering: Comply with piping system nomenclature as specified, scheduled, shown, or to match existing building lettering nomenclature system and abbreviate only as necessary for each application length.

F. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

2.4 PLASTIC TAPE

A. General: Provide manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

B. Width: Provide 1-1/2 inch wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6-inch, 2-1/2 inch wide tape for larger pipes.

C. Color: Comply with ANSI A13.1, except where another color selection is indicated.

2.5 UNDERGROUND-TYPE PLASTIC LINE MARKERS

A. General: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6-inch wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried pipe.

B. Provide multi-ply tape consisting of solid aluminum foil core between 2-layers of plastic tape.

2.6 VALVE TAGS

A. Brass Valve Tags: Provide 19-gauge polished brass valve tags with stamp-engraved piping system abbreviation in 1/4-inch high letters and sequenced valve numbers 1/2-inch high, valve normal position 1/4-inch high letters, and with 5/32-inch hole for fastener.
   1. Provide 1-1/2 inch diameter tags, except as otherwise indicated.
   2. Fill tag engraving with Black enamel.

B. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), and solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

C. Access Panel Markers: Provide manufacturer's standard 1/16-inch thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8-inch center hole to allow attachment.

2.7 VALVE SCHEDULE

A. Valve Schedule shall be printed on company letterhead and shall include the following columns:
   1. Valve Tag Number (*example*: HWS-1)
   2. Service (*example*: ISOLATE AHU-1 HEATING COIL)
   3. Room Number (location of valve)
   4. Size of Valve
   5. Type of Valve
   6. Normal Position of the Valve (open or closed)

B. Frame: For each page of valve schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with non-glare type plexiglass.

2.8 ENGRAVED PLASTIC-LAMINATE SIGNS

A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, Black with White core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. Thickness: 1/8-Inch, except as otherwise indicated.

C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.9 PLASTICIZED TAGS

A. General: Manufacturer's standard pre-printed or partially pre-printed accident-prevention tags, of plasticized card stock with matt finish suitable for writing, approximately 3-1/4 inch x 5-5/8 inch, with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary wording (As examples; DANGER, CAUTION, DO NOT OPERATE).

2.10 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified, scheduled and approved by the Owner/Engineer. Provide numbers, lettering and wording as indicated and approved by the Owner/Engineer for proper identification and operation/maintenance of mechanical systems and equipment.

B. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as designated on the drawings or schedule as well as service.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 PIPING SYSTEM IDENTIFICATION

A. General: Install pipe markers of the following type on each system indicated to receive identification, and include arrows to show normal direction of flow.

B. Plastic pipe markers, with application system as indicated under "MATERIALS" in this section. Install on pipe insulation segment where required for hot non-insulated pipes.

C. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.

D. Near each valve and control device.

E. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.

F. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.

G. At access doors, manholes and similar access points which permit view of concealed piping.

H. Near major equipment items and other points of origination and termination.

I. Spaced intermediately at maximum spacing of 25-foot along each piping run, except reduce spacing to 15-foot in congested areas of piping and equipment.

J. On piping above removable acoustical ceilings.

3.3 UNDERGROUND PIPING IDENTIFICATION

A. General: During back-filling/top-soiling of each exterior underground piping systems, install continuous underground-type plastic line marker, located directly over buried line at 6-inch to 8-inch below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16-inch, install single line marker. For tile fields and similar installations, mark only edge pipelines of field.

3.4 VALVE IDENTIFICATION

A. General: Provide valve tag on valves in each piping system. List each tagged valve in valve schedule for each piping system.
   1. Building services main shutoff valves.
   2. Each individual system main shutoff valves.
   3. Each individual system riser shutoff valves.
   4. Each individual system floor shutoff valves.
   5. Each individual system major branch shutoff valves.

B. Provide the following columns and information for each valve:
   1. Valve Tag Number (*example*: HWS-1)
   2. Service (*example*: ISOLATE RTU-1 HEATING COIL)

3. Room Number (location of valve)
4. Size of Valve
5. Type of Valve
6. Normal Position of the Valve (open or closed)

C. Mount valve schedule frames and schedules in mechanical equipment rooms where directed by Architect/Owner/Engineer.

D. Where more than one (1) major mechanical equipment room is shown for project, install mounted valve schedule in each major mechanical equipment room, and repeat only main valves which are to be operated in conjunction with operations of more than single mechanical equipment room.

3.5 MECHANICAL EQUIPMENT IDENTIFICATION

A. General: Install minimum 2-inch x 4-inch engraved plastic laminate equipment marker on each individual items of mechanical equipment. Provide signs for the following general categories of equipment.
1. Main building systems control and operating valves, including safety devices and hazardous units such as gas outlets.
2. Room thermostats, except gun tag labels are acceptable for room thermostats.
3. Fuel-burning units including boilers.
4. Pumps, condensers and similar motor-driven units.
5. Heat exchangers and similar equipment.
6. Fans and blowers.
7. HVAC units.
8. Tanks and pressure vessels.
9. Water treatment systems and similar equipment.

B. Lettering Size: Minimum 1/4-inch high lettering for name of unit.

C. Text of Signs: In addition to the identified unit, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

3.6 ADJUSTING AND CLEANING

A. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

END OF SECTION 230553

SECTION 23 05 93 - TESTING, ADJUSTING & BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Divisions 1 and 23 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. This section covers Testing and Balancing of Environmental Systems including but not limited to air distribution systems, hydronic distribution systems, and the equipment and apparatus connected thereto. The testing and balancing of all environmental systems shall be the responsibility of one (1) testing, balancing and adjusting firm.
   1. Test, Adjust, and Balance all of the following mechanical systems:
      a. Supply Air Systems;
      b. Return Air Systems;
      c. Exhaust Air Systems;
      d. Hydronic Systems;
      e. Pumps;
      f. Refrigeration Equipment;
      g. Temperature Control System;
      h. Heat Generating Equipment;
   2. Report any systems for excessive sound and vibration levels.

1.3 QUALIFICATIONS OF CONTRACTOR

A. Procure the services of an independent testing and balancing Agency specializing in the testing, adjusting and balancing of environmental systems to perform the above mentioned work. An independent agency is defined as an organization that is not engaged in engineering design or is not a division of a mechanical contractor entity that installs mechanical systems. It shall be an agency certified by NEBB or TABB. Testing and balancing work shall be directly supervised by a NEBB certified Supervisor or Professional Engineer on the Testing and Balancing Agency's staff. The Supervisor shall represent the Testing and Balancing Agency in progress meetings as requested, and shall be available for interpreting all material found in the Balance Report.
   1. All field work shall be performed by qualified technicians who are currently certified by either NEBB or TABB Test and Balance Certification Agencies.

1.4 CONTRACTOR QUALIFICATIONS REVIEW

A. The Mechanical Contractor shall submit the name of the Testing and Balancing Agency to the Architect within thirty (30) days of contract award to ensure that the Testing and Balancing Agency is on the project from the outset of construction.

B. Any testing and balancing agency desiring to offer their services for this Work shall submit their qualifications to the Architect, not less than seven (7) working days before the bid date. Review and recommendations to Owner will be given on each request and action on the recommendation will be given in writing prior to bidding the work. Agencies meeting the qualifications of the Specification are those Agencies approved by the Owner.

1.5 CODES AND STANDARDS

A. ASHRAE: ASHRAE Handbook, Applications Volume, Chapter 36, Testing, Adjusting, and Balancing.

B. NEBB: "Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems."

1.6 SUBMITTALS

A. Upon award of the Contract, the Contractor shall submit the name of the Test and Balance Agency who will be performing the work. The submittal shall include a complete list of all technicians who will be performing the field work and include a photocopy of their current certification by either NEBB or TABB Certification Agencies.

B. Only those technicians included in the submittal shall perform the work. Any personnel or staff used to perform the work who are not included in the submittal shall be grounds for rejecting the Test and Balance Report and the Project in whole.

1.7 PROJECT CONDITIONS

A. Air and water testing and balancing shall not begin until the system has been completed and is in full working order.

B. Put all heating, ventilating and air conditioning systems and equipment into full operation and continue operation of same during each working day of testing and balancing. Preliminary Testing and Balancing requirements shall be ascertained prior to the commencement of work through a review of the project plans and specifications. In addition, visual observations at the site during construction shall be made to determine the location of required balancing devices, that they are being installed properly, and in an accessible location for the need. Report in writing any deficiencies to the Contractor and Mechanical Engineer immediately.

C. Before any air balance work is done, the system shall be checked for duct leakage, assure filters are installed, see that filters are changed if they are dirty, check for correct fan rotation, equipment vibration, and check automatic dampers for proper operation. All volume control dampers and outlets shall be wide open at this time.

D. Before any hydronic balancing work is done, the system shall be checked for plugged strainers, proper pump rotation, proper control valve installation and operation, air locks, proper system static pressure to assure a full system, proper flow meter and check valve installation. All throttling devices and control valves shall be open at this time.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate scheduling of Work with the Contractor.
   1. Schedule TABB work to coincide with testing and verification of the temperature control systems where practical.
   2. Coordinate system start-up and performance verification with the Engineer as TABB work is in progress.
   3. Coordinate and comply with commissioning requirements and respond to commissioning agent findings.

B. Provide written notification to the Project Manager five (5) working days prior to commencing TABB and a schedule for completing the work.

C. Provide written notification to the Contractor within twenty-four (24) hours of an equipment failure preventing TABB work from proceeding.

PART 2 - PRODUCTS

2.1 INSTRUMENTS

A. Calibration and maintenance of instruments shall be in accordance with manufacturer's standards and recommendations and requirements of NEBB.

B. Calibration histories for each instrument shall be available for examination.

C. Use a true RMS amp and harmonic distortion electrical test meter, FLUKE Model 41 or equal to test and record operating and performance measurements for all motors operating with variable frequency drives.

PART 3 - EXECUTION

3.1 TEMPERATURE CONTROLS

A. Operate all temperature control systems with the Temperature Control Contractor's representative for proper sequence of operation and calibration. Report in writing any deficiencies to the Engineer immediately.

3.2 REQUIREMENTS OF WORK

A. Provide all necessary fan belts and sheaves to balance all fans to the specified air delivery for the actual field conditions.
   1. Test and Balance Agency shall provide fan belt and sheave replacement necessary for final balance condition for specified air quantity when the VFD is operating at design conditions and 60Hz for final field conditions, without placing the motor over its nameplate amp rating.

B. Balance all air and water flows at terminals within +5 percent to -5 percent of design flow quantities for individual terminals. And +5 percent to –10 percent of individual air outlets or inlets. Measure and record the following data:

C. Air Balance:

1. Air supply, return and exhaust systems with air quantities for each air device; air handling units including supply, return, mixed, and outside temperatures and fan data including CFM, static pressure, fan RPM, voltage, rated motor amperage, motor running amperage before and after final balance, listed motor power factor and motor running power factor reading. Air diffusion patterns shall be set to minimize objectionable drafts and noise.
2. The supply, return and exhaust fan static pressure shall be set by the balancing firm and the Control Contractor if the systems have fan volume control. The duct static shall be confirmed both through the instrumentation installed on the job and by the Balancing Agency. The system shall be tested in all operating modes (including minimum outside air with full return air, full outside air, modulated damper position, and full cooling with the design diversity). System static pressure and fan motor amperages shall be recorded in all modes. The fan speed resulting in satisfactory system performance shall be determined at full design delivery, inlet or outlet fan. Volume control dampers shall be in the wide open position and variable frequency drive is at 100 percent of design RPM and one (1) path presenting the greatest resistance to flow shall be fully open and unobstructed.
3. Provide full pitot traverse and CFM measurements at each fan in addition to terminal device measurements.
4. Air volume and air temperature rise or drop across each coil, filter, dampers, etc., of air handling section.
5. Measure, adjust, set, balance and record outside air, return air and exhaust/relief air quantities for all air handling systems and supply fans.

   Air quantities shall be determined by direct airflow measuring procedures wherever possible, where duct/inlet conditions do not allow for accurate direct measurement of outside air the following method shall be used:

   Outside Air CFM = Supply Fan Total CFM
   -Return Fan Total CFM

   In addition to the direct measuring of airflow quantities, measure and record outside air, return air and mixed air temperatures, determine thermal/mass energy balance and provide calculations to verify measured airflow quantities. Adjusting and setting the outside air quantity as a percentage of damper position will not be acceptable.

D. Final adjustments shall include but not be limited to the following:

ITEM	**ADJUSTMENT**
Fan: Belt Drive	RPM. Include sheave and belt exchange to deliver air flow within limits of installed motor horsepower and mechanical stress limits of the fan. Determine the limiting fan tip speed before increasing RPM. Final fan speed setting shall allow for predicted filter loading and shall establish proper duct

ITEM	ADJUSTMENT
	pressures for operation of zone CFM regulators. Include motor sheave replacement for fans with variable speed drives. The fan motor must be adjusted to full rated motor RPM with the drive set at 60HZ. Fans can be set to deliver airflow only after the fan motor has been properly set.
Fan: Direct Drive	RPM with speed taps. Set fan speed on tap which most closely approaches design CFM. Report tap setting on equipment data sheet as high, medium or low. RPM with speed control rheostat. Set output of fan at design CFM by adjusting the SCR. After adjustment, check fans ability to re-start after powering down. Increase setting if required for proper starting.
Terminal Boxes	VAV Boxes with heat. Set regulators to provide design maximum, minimum, heating and cooling CFM. VAV Boxes: Set volume at 100 percent maximum and scheduled minimum of design CFM. Check control sequence operation to assure proper sequencing. Reset PE switches as required when furnished with terminal box.
Air Devices	All diffusers and registers shall be measured and balanced.
Motor Starter Thermal Heaters	Division 23 Furnished Magnetic and Manual Starters. Furnish and exchange thermals as required for proper motor protection.
Variable Frequency Drives	Test, measure and record true RMS amperage, THD for voltage and amperage for each variable frequency drive at both the input power to the drive and the output power to the motor in both the drive mode and through the across the line by-pass mode. Fans with variable speed drives shall be adjusted so that the fan motor is at full RPM with the variable speed drive at 60 HZ. This will required replacement of the sheave on the motor. Once the motor operates at the full rated motor RPM with the drive at 60 HZ, the fan shall be adjusted to design conditions.

E. Hydronic Balance:

1. Inlet and outlet water temperatures and pressures (or system steam pressure) of all air handling unit coils, reheat coils, unit heaters, convectors, finned tube radiation, and other heat transfer equipment, as well as the corresponding media flows, and air temperature rise or drops.
2. Circulating pump flow rates, pressures, running amperage, and full load amperage at design flow and shutoff conditions.
3. The hydronic system shall be proportionally balanced being certain that the path to one (1) terminal is fully open. Total system flow shall be adjusted at the pump by restricting the discharge balancing valve. If the pump must be severely restricted, the impeller may have to be trimmed. This decision will be the responsibility of the Contractor, Supplier, and the Mechanical Engineer.

F. When necessary as determined by the Mechanical Engineer, the Test and Balance Agency shall provide additional testing and measurements as required by the Mechanical Engineer including, but not limited to, the following:
1. Static pressure gradient profiles throughout ductwork and/or piping systems.
2. Temperature gradient profiles throughout ductwork and/or piping system.
3. Miscellaneous electrical measurements.
4. Smoke tests of room pressure relationships.
This work shall be done immediately upon request with complete cooperation and in an expedient schedule at no additional cost to any other party.

3.3 REPORT OF WORK

A. The Testing and Balancing Agency shall submit six (6) bound copies of the final Testing and Balancing Report at least fifteen (15) calendar days prior to the Contractor's request for final inspection. All data shall be recorded on applicable reporting forms. The report shall include all operating data as listed in Paragraph 3.2 above, a list of all equipment used in the testing and balancing work, and shall be signed by the Supervising Registered Professional Engineer and affixed with their registration stamp, signed and dated in accordance with State Law. Final acceptance of this project will not take place until a satisfactory report is received.

B. When deemed necessary by the Mechanical Consulting Engineer, the Testing and Balancing Agency shall run temperature and/or humidity recordings and shall read any of the report quantities in the presence of the Engineer for verification purposes.

C. When all air balancing is done and all dampers are set, all test holes shall be plugged and all dampers shall be marked with paint. The following information shall be recorded for each fan system in the final report: Design fan and air device inlet or outlet size, actual inlet or outlet size, design and actual CFM and velocity through the orifice, for each terminal in the system. The pitot tube traverse method used and location of pitot tube traverse for determining CFM shall be recorded.

D. Hydronic Systems With Meters: The system shall be balanced proportionally using the flow meters. On completion of the balance, the following information shall be recorded in the report: Flow meter size and brand, required flow rate and pressure drop, valve settings on meters with a readable scale, flow rate in both full coil flow and full bypass modes. Verify the meters are installed per the manufacturer's recommendations and shall notify the Contractor of any deficiencies before utilizing meter.

E. Hydronic Systems Without Meters (Thermal or Terminal Rated Pressure Drop Balance): The system shall be balanced proportionally to the terminal ratings. On completion of the balance, the following information shall be recorded in the report: Design entering and leaving water temperature/pressure drop, final balanced entering and leaving water temperature/pressure drop.

F. When all hydronic balancing is done, all valves shall be marked or the locking rings set. Control valve bypass loops shall be set with the balancing valve to provide equal flow in either mode. Confirm in writing this work has been completed.

G. After all balancing is complete and all coordination with the Contractor and the Engineer is complete, the balancing firm shall furnish aforementioned bound report which shall contain the following information:
   1. RPM, drive sheave information (as installed and as changed), fan nameplate information, motor nameplate information, motor amperage, motor voltage and power factor to all motors (in all operating modes).
   2. Static pressure across all components of the system.
   3. Required and final balanced CFM at each system terminal. Include the terminal size, reading orifice size, and velocities read to attain the CFM.
   4. Pump and motor nameplate information, amperage and voltage to all motors, pressure drop across all system terminals, pressure rise across the pump in PSI and feet of head.
   5. Thermal protection for all motors shall be recorded; also power factor for all motors drawing 1,000 watts or more. Starter brand, model, enclosure type, installed thermal heaters and the rating of the heaters, required thermal heaters and the rating of the heaters if different than installed shall be recorded. Starter heaters shall be changed to the correct size and so noted in the report.
   6. The report shall include a sheet which shall report the method of balance, project altitude, and any correction factors.
   7. A **complete** reduced set of the **Black-line** Mechanical Contract Drawings which shall be included in the report with all equipment, flow measuring devices, terminals (VAV boxes, outlets, inlets, coils, unit heaters, fintube loops, radiant panel loops, schedules, etc.) clearly marked and all equipment designated.
   8. Include in the report all variable frequency drive electrical performance test characteristics for each motor as described in this specification section. Include photocopies of all meter chart recorded <measured data> and/or computer printed output.

H. The Testing and Balancing Agency shall respond and correct all deficiencies within seven (7) days of receiving the Engineer's written review of the Balancing Report. Failure to comply will result in holding retainage of the final payment until all items have been corrected to the satisfaction of the Engineer.

3.4 GUARANTEE OF WORK

A. The Testing and Balancing Agency shall guarantee the accuracy of the tests and balance for a period of ninety (90) days from date of final acceptance of the Test and Balance Report. During this period, the Testing and Balancing Agency shall make personnel available at no cost to the Owner to correct deficiencies that may become apparent in the system balance.

3.5 COMPLETION SERVICES

A. Final Check: Make final checks and do any rebalancing as directed.

B. Report: Submit Balancing Report as specified above, to the Owner. Submit preliminary copy of report to Engineer for spot-checking as described below.

C. Acceptance: Notify Engineer and Owner that work is complete and submit preliminary copy of Balancing Report. Schedule time to meet the Owner and Engineer at the site to perform spot-checking and verification as directed. Test and Balance Agency shall furnish personnel and equipment and spot check:
   1. The TAB representative shall be a member of the same team used during the original testing.
   2. Equipment used during the random testing shall be the same equipment used during the original testing.
   3. The system or equipment being verified shall be in the same operating mode as during the original TAB test.
   4. Up to 10 percent of the air readings shall be re-tested. Ninety percent (90%) of the re-tested readings must be within tolerances of the specifications.
   5. Up to 20 percent of the balanced hydronic component readings shall be re-tested. Ninety percent (90%) of the re-tested readings must be within tolerances of the specifications.
   6. Whenever system verifications do not meet specifications, the entire system shall be re-balanced and rechecked.

END OF SECTION 230593

SECTION 230700 - MECHANICAL INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes:
   1. Piping Insulation, Jackets and Accessories
   2. Ductwork Insulation and Jackets
   3. Equipment Insulation and Covering

B. Refer to other Division 23 sections for Shields, Inserts, and Mechanical Identification.

C. Insulation thickness based on ASHRAE 90.1 recommendations. Ductwork insulation thickness is based on Table 6.2.4.2B, Envelope Criteria Table 5-16 through 5-19 for Exterior, Unvented Attic With Roof Insulation, Unconditioned Space and Indirectly Conditioned Spaces. Piping insulation thickness is based on Table 6.2.4.5.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than three (3) years.

B. Installer's Qualifications: Firm with at least five (5) years successful installation experience on projects with mechanical insulations similar to that required for this project.

C. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics and insulating cements.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's installation instructions and schedule listing materials, thickness, K-value, density, and furnished accessories for each service or equipment specified.
   1. Include compliance with LEED requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard ratings of the products, name of manufacturer, and brand.

B. Protect insulation against dirt, water, chemical, and mechanical damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide product by one of the following:
   1. Insulation:
      a. Armstrong World Industries, Inc. (flexible elastomeric)
      b. Johns-Manville Products Corp. (fiberglass, calcium silicate)
      c. Knauf Fiber Glass (fiberglass)
      d. Manson Insulation Co. (fiberglass, calcium silicate)
      e. Owens-Corning Fiberglas Corp. (fiberglass)
      f. Rubatex Corp. (flexible elastomeric)
   2. Jacketing and Covering Products:
      a. Childers
      b. Ceel-Co.
      c. Johns-Manville Products Corp.
      d. Knauf Fiber Glass
      e. Venture Tape Corporation

2.2 PIPING INSULATION

A. Glass Fiber: ASTM C 547, Type 1, rigid molded, noncombustible (NFPA 259), 0.23 "K" value at 75 degree F mean temperature, maximum service temperature 850 degree F, moisture sorption less than 0.2% by volume. Composite 25/50-flame spread/smoke developed rating (ASTM E 84, UL 723, and NFPA 255).
   1. Vapor Retarder Jacket: ASTM C 1136, 45lbs/in tensile strength (ASTM D 828), beach puncture 50 oz in/in tear minimum (ASTM D 781). White Kraft paper reinforced with glass fiber yarn and bonded to aluminum foil, secured with self-sealing longitudinal laps and butt strips.
   2. Connections: Tacks, pressure sensitive color matching vinyl tape, Perma-Weld adhesive.

B. Calcium Silicate: ASTM C 533, Type I, rigid molded, noncombustible (ASTME E 136), 0.42 "K" value at 300 degree F mean temperature, maximum service temperature 1200 degree F, 160 psi compressive strength for 5 percent compression (ASTM C 165), flexural strength 70 psi (ASTM C 203). 0/0 flame spread/smoke developed rating (ASTM E 84).
   1. Tie Wire: 16-Gauge stainless steel with twisted ends on maximum 12-inch centers.

C. Flexible Elastomeric Foam: ASTM C 534, Type I, flexible, cellular elastomeric, molded, 0.27 "K" value at 75 degree F mean temperature, maximum service temperature 220 degree F, water vapor permeability of 0.10 perm-inch, 25/50-flame spread/smoke developed rating (ASTM E 84, UL 723, and NFPA 255).

D. Field Applied Fittings and Jackets:
   1. Aluminum: 0.016-Inch thick sheet with factory applied moisture barrier, embossed finish with longitudinal slip joints and 2-inch laps, die shaped fitting covers.

2.3 DUCTWORK INSULATION

A. Rigid Fiberglass Board: ASTM C 612, Type IA and IB, 3 lb/cu ft density, 0.23 "K" value at 75 degree F mean temperature, maximum service temperature 450 degree F, moisture sorption less than 5.0% by weight, aluminum foil facing reinforced with fiberglass scrim laminated to UL rated Kraft paper. Composite 25/50-flame spread/smoke developed rating (ASTM E 84, UL 723, and NFPA 90A).
   1. Secure with UL listed pressure sensitive tape and/or outward clinched expanded staples and vapor barrier mastic as needed.

B. Flexible Fiberglass Blanket: ASTM C 553, Type II, 3/4 lb/cu ft density, 1-1/2 inch thickness, 0.27 "K" value at 75 degree F mean temperature at compressed thickness, maximum service temperature 250 degree F, moisture sorption less than 0.2% by volume, aluminum foil facing reinforced with fiberglass scrim laminated to UL rated Kraft paper. Composite 25/50-flame spread/smoke developed rating (ASTM E 84, UL 40, and NFPA 90A).
   1. Secure with UL Listed pressure sensitive tape and/or outward clinched expanded staples and vapor barrier mastic as needed.

C. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.

D. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

E. Round Ducts and Concealed Rectangular Ducts: Adhere flexible insulation to ductwork with adhesive applied in 6-inch wide strips on 16-inch centers. Butt insulation and seal joints and breaks with 2-inch lap of foil adhered over joint.

2.4 EQUIPMENT INSULATION

A. Rigid Fiberglass Board (Low Temperature): ASTM C 612, Type IA and IB, 3 lb/cu ft density, 0.23 "K" value at 75 degree F mean temperature, maximum service temperature 450 degree F, moisture sorption less than 5.0% by weight, aluminum foil facing reinforced with fiberglass scrim laminated to UL rated Kraft paper. Composite 25/50-flame spread/smoke developed rating (ASTM E 84, UL 723, and NFPA 90A).
   1. Secure with UL Listed pressure sensitive tape and/or outward clinched expanded staples and vapor barrier mastic as needed.

B. Flexible Fiberglass Blanket: ASTM C 553, Type II, 1.5 lb/cu ft density, 0.27 "K" value at 75 degree F mean temperature at compressed thickness, maximum service temperature 450 degree F, moisture sorption less than 0.2% by volume, aluminum foil facing reinforced with fiberglass scrim laminated to UL rated Kraft paper. Composite 25/50-flame spread/smoke developed rating (ASTM E 84, UL 40, and NFPA 90A).
   1. Secure with UL listed pressure sensitive tape and/or outward clinched expanded staples and vapor barrier mastic as needed.

C. Calcium Silicate: ASTM C 533, Type I, rigid molded block, noncombustible (ASTME E 136), 0.41 "K" value at 300 degree F mean temperature, maximum service temperature 1200 degree

F, 160 psi compressive strength for 5 percent compression (ASTM C 165), flexural strength 70 psi (ASTM C 203). 0/0 flame spread/smoke developed rating (ASTM E 84).

1. Banded in place, tightly butted, joints staggered and secured with 16 gauge galvanized or stainless steel wire or 1/2-inch x 0.015-inch galvanized steel bands on 12-inch maximum centers for large areas.

D. Jacketing Material for Equipment Insulation: Provide pre-sized glass cloth jacketing material, not less than 7.8 ounces per square yard, or metal jacket at Installer's option, except as otherwise indicated.

E. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape, corner angles, anchors and stud pins as recommended by insulation manufacturer for applications indicated.

F. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions where mechanical insulation is to be installed. Do not proceed until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 HVAC PIPING INSULATION

A. Refrigerant Piping:
   1. Applications:
      a. Suction
      b. Hot Gas
      c. Hot Gas Bypass
   2. Insulation:
      a. Flexible Elastomeric: 1-Inch thickness for 1 1/2-inch pipe and smaller.

B. Cold Piping (40 Degree F (4 Degree C) to Ambient):
   1. Applications:
      a. Cooling coil condensate drain.
      b. Condenser water supply and return when used with plate and frame heat exchanger.
   2. Insulation:
      a. Fiberglass or Flexible Elastomeric: 1/2-Inch thickness up to 1-1/4 inch pipe size, 1-inch thickness for 1-1/2 inch and larger pipe.

C. Hot Low Pressure Piping (Water to 250 Degree F (121 Degree C):
   1. Applications:
      a. Hot water supply and return.
   2. Insulation:

a. Fiberglass: 1-1/2 Inch thickness up to 1-1/4 inch pipe, 2-inch thickness for all other pipe sizes.
b. Fiberglass for runouts up to 2-inch, 1-inch thickness.

3.3 DUCTWORK INSULATION

A. Flexible Fiberglass Blanket:
1. Concealed supply ductwork without liner: 1-1/2 Inch thickness.
2. Return ductwork in unconditioned spaces without liner: 1-1/2 Inch thickness.
3. Exhaust ductwork within 10 ft. of exterior opening without liner: 1-1/2 Inch thickness.
4. Unit housings that are not factory insulated: 1-1/2 Inch thickness.

3.4 EQUIPMENT INSULATION

A. Hot Equipment (Above Ambient Temperature):
1. Applications:
a. Hot water storage tanks.
b. Hot water expansion tanks.
c. Air separators.
2. Insulation:
a. Fiberglass (High Temperature): 2-Inch thickness, except 3-inch thickness for low-pressure boilers and steam-jacketed heat exchangers. Do not use for equipment above 450 degree F (232 degree C).
b. Calcium Silicate: 2-Inch thickness, except 3-inch thickness for low-pressure boilers and steam-jacketed heat exchangers.

3.5 INSTALLATION OF PIPING INSULATION

A. Install insulation after piping system tests have been completed.

B. Clean piping to remove foreign substances and moisture prior to applying insulation.

C. Install insulation products according to manufacturer's written instructions, building codes, and recognized industry standards.

D. Omit insulation on air chambers, unions, balance cocks, flow regulators, drainage piping located in crawl spaces or tunnels, buried piping, and pre-insulated equipment.

E. Omit insulation on hot piping within radiation enclosures or unit cabinets; on cold piping within unit cabinets provided piping is located over drain pan; on heating piping beyond control valve, located within heated space; on condensate piping between steam trap and union; and on unions, flanges, strainers, flexible connections, and expansion joints.

F. Secure longitudinal jacket laps and butt strips according to manufacturer's recommendations.

G. Firmly rub lap and butt strips to pressurize seam and ensure positive closure.

H. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use scraps.

I. Apply insulation to piping with all joints tightly fitted to eliminate voids.

J. Apply insulation on cold surfaces with a continuous, unbroken vapor seal. Hangers, supports, and anchors that are secured directly to cold surfaces must be adequately insulated and vapor sealed to prevent condensation. Seal pipe terminations in chilled water or glycol systems every four (4) pipe sections.

K. Extend surface finishes to protect all surfaces, end, and raw edges of insulation.

L. Protect vapor-barrier jackets on pipe insulation from puncture or other damage. Avoid the use of staples on vapor barrier jackets. Seal vapor barrier penetrations with vapor barrier finish recommended by the manufacturer.

M. Cover valves, fittings and similar items with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded or job fabricated covers (at Installer's option).

N. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where fire-stopping materials are required.

O. Provide thermal shield inserts on all pipe (Refer to 230529). For piping below ambient temperature, apply vapor barrier lap cement on butt joints and seal with 3-inch wide vapor barrier tape.
   1. Minimum insulation insert lengths:
      a. 1-1/2 – 2-1/2 Inch Pipe: 10-Inches
      b. 3 – 6-Inch Pipe: 12-Inches
      c. 8 – 10-Inch Pipe: 16-Inches
      d. 12-Inch and Larger Pipe: 22-Inches

P. Apply galvanized metal shields between hangers or supports and pipe insulation. Form shields to fit the insulation and extend up to the centerline of the pipe. The shield length shall be 4-inches less than the associated insulation hanger insert to allow for vapor retarding butt joints on each side of the shields.

Q. Apply adhesives, mastics and coatings at manufacturer's recommended minimum coverage per gallon.

R. Replace all damaged insulation in whole; Repair of damaged insulation will not be accepted.

S. Install aluminum jacket on exterior piping.
   1. Install metal jackets by overlapping seams 2-inches and securing with metal bands on 24-inch centers. Caulk all seams with clear silicone. Locate longitudinal seams at the bottom of piping. Finish elbows and tees with matching metal fitting covers. Finish other fittings with conventional weather insulation materials with aluminum finish.
   2. Where piping is too small for aluminum jacket install flexible elastomeric pipe insulation with longitudinal joints directed downward and apply two (2) coats of manufacturer's approved U.V. resistant finish.

3.6 INSTALLATION OF DUCTWORK INSULATION

A. Install insulation products according to manufacturer's written instructions, building codes, and recognized industry standards.

B. Do not insulate fiberglass ductwork or lined ductwork.

C. Clean ductwork to remove foreign substances and moisture prior to applying insulation.

D. Apply insulation to ductwork with all joints tightly fitted to eliminate voids

E. Seal all vapor retardant jacket seams and penetrations with UL listed tapes or vapor retardant adhesive as recommended by the manufacturer.

F. Secure insulation to the underside of duct 24-inches or greater with mechanical fasteners or speed clips spaced 18-inches on center. Cut off protruding ends of fasteners after speed clips are installed and seal penetration of vapor barrier.

G. Extend ductwork insulation without interruption through walls, floors and similar penetrations, except where fire-stopping materials are required.

H. Install corner angles on all external corners of insulation in exposed finished spaces before covering with jacketing.

I. Adhere flexible elastomeric sheets to ductwork by compression fit and full coverage of adhesive. Seal butt joints with same adhesive. Apply the same sheet thickness on standing metal duct seams as installed on the duct surface.

3.7 INSTALLATION OF EQUIPMENT INSULATION

A. Install insulation products according to manufacturer's instructions, building codes, and recognized industry standards.

B. Apply insulation as close as possible to equipment by grooving, scoring, and beveling insulation, if necessary. As required, secure insulation to equipment with studs, pins, clips, adhesive, wires, or bands

C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment use vapor retardant cement

D. Provide insulated dual temperature or cold equipment containing fluids below ambient temperature with vapor retardant jackets

E. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.

F. Do not apply insulation to equipment, mufflers, breechings, or stacks while hot.

G. Apply insulation using staggered joint method and double layer construction. Apply each layer of insulation separately.

H. Cover insulated surfaces with layer of insulating cement, troweled in workmanlike manner, leaving smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over with wire netting and joints with 1/4-inch thick cement to remove surface irregularities.

I. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2-inch. Apply over vapor barrier where applicable.

J. Do not insulate manholes, handholes, cleanouts, ASME stamp, or manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.

K. Provide removable insulation sections with aluminum jacket and stainless steel bands to cover parts of equipment which must be opened for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.

L. Provide aluminum jacketing on exterior insulated equipment as recommended by manufacturer. On flexible elastomeric insulation, apply two (2) coats of manufacturer's approved U.V. resistant finish.

3.8 EXISTING INSULATION REPAIR

A. Repair damaged sections of existing mechanical insulation, both previously damaged or damaged during this construction period.

END OF SECTION 230700

SECTION 230900 - DIRECT DIGITAL CONTROL SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. General: The Control System Contractor shall provide a complete new control system using new control devices to replace existing devices. It shall be a digital, distributed microprocessor-based system with an electronic interface, where required. The Control System for this project will be referred to as a Building Automation System (BAS).

B. The Control Contractor will be responsible for all installation, programming, commissioning, testing and performance verification.

C. The Controls Contractor will be responsible for providing all devices required for a complete operating control system.

D. Total quantity and type of control points shall consist of specifications, drawings and as required to complete the Sequence of Operation as specified. Additional points shall be provided as required to meet all sequence of operation functions, safeties and data base. The Drawings and Specifications are not intended to show all details necessary to make the system complete and operable.

E. The Control Contractor shall be responsible for all phases of software design, all equipment, installation and warranty for the BAS. The Control Contractor shall be responsible for supplying and installing all necessary control devices for completing the BAS.
   1. Product shall be Andover Continuum.

F. The system shall include all control device, valves, interlocks, field devices, hardware, software, automatic dampers, piping, fittings, wire, conduit, etc., as specified and required and connected so as to perform all functions and operate according to the specified sequences.

G. This installation shall not be used as a test site for any new products unless explicitly approved by the Owner or Architect/Engineer in writing. Unless approved otherwise, all products (including firmware revisions) used in this installation shall have been used in at least twelve (12) projects prior to this installation. The previous sites may be located anywhere in the U.S.A. This requirement is not intended to restrict the Contractor to the use of any outdated equipment. Therefore, all products used in this installation shall also be currently under manufacture and have available, for at least ten (10) years after completion of the contract, a complete line of spare parts. If the above requirements are mutually exclusive, the Contractor shall include a specific statement to this effect in the Bid.

H. Refer to other Division 23 sections for installation of instrument wells, valve bodies and dampers in mechanical systems.

I. Provide electrical work as required, complying with requirements of Division 26 sections including, but not limited to raceways, wires, cables, electrical identification, supporting devices and electrical connections for equipment. Work includes, but is not limited to, the following:

1. Interlock and control wiring between field-installed controls, indicating devices and unit control panels.
2. The Contractor shall be responsible for all additional electrical and other costs involved to accommodate the temperature control system panel, motors and electrical devices requiring power which differs from the power requirements shown on the Electrical Drawings.

1.2 TRENDING

A. Provide trending and archiving of the HVAC system control points to allow verification of system performance. Trend points shall include all analog sensor readings and all digital and analog signals to the fancoil units, rooftop units, boilers, pumps, control valves, dampers, and other control devices.

B. Trend data shall be archived on the operator's work station or other suitable location, which has the capacity to store 12 months data. Trend data should be collected on a 5 minute interval; contact commissioning agent if data storage capacity is an issue. The trend data file shall be continuously renewed automatically; data more than 12 months old may be deleted. Data shall be retrievable by BAS software to create trend plots of user-selected points and time periods. Data shall also be available for downloading with multiple points organized in a text file in CSV (comma separated value) format for use by MS Excel. In other words, the user should not be required to download data for each data point separately. Include operator training on the use of these trending capabilities. Provide detailed information on this feature in the controls submittal for review by the commissioning agent.

C. Trend data should be organized by HVAC equipment and the system should automatically generate trend plots of the performance of each system showing all appropriate inputs and outputs over user-selected time periods. In addition, add a plot feature to each BAS system graphic which allows the user to enter a date click a "plot" button to automatically generate a 24 hour trend plot for the applicable system or equipment.

1.3 QUALITY ASSURANCE

A. Contractor's Qualifications: Firms regularly engaged in installation and commissioning and servicing of digital control equipment, of types and sizes required, whose firm has been in business in similar service for not less than five (5) years.

B. Only those manufacturers specified are allowed to bid temperature controls. All bidders shall make available, upon the Owner's request, open book unit pricing of all materials and labor.

C. The system shall be installed by competent mechanics, regularly employed by the Temperature Control Contractor.

D. No Field Devices shall be multiplexed to a single I/O point unless specified. Each control or sensing point shall be terminated at a unique location on the BAS panel, Slave or Dedicated Controller and be associated with a unique software point on the BAS.

E. Codes and Standards:
   1. All equipment and the installation shall comply with the requirements of all applicable local and national codes including but not limited to the currently enforced edition of the Uniform Building Code, Uniform Fire Code, Uniform Electrical Code, and all applicable codes of the National Fire Protection Association including the National Electrical Code.
   2. Electrical Standards: Provide electrical products which have been tested, listed and labeled by UL and comply with NEMA Standards.
   3. NEMA Compliance: Comply with NEMA standards pertaining to components and devices for electric control systems.
   4. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.

F. The equipment and software proposed by the supplier shall be currently in manufacture. No custom products shall be allowed unless required by the Specification. All products shall be supported by the manufacturer for a minimum of five (5) years including spare parts, board repairs and software revisions.

G. The Temperature Control Contractor shall cooperate with other contractors performing work on this project necessary to achieve a complete and neat installation. To that end, each contractor shall consult the drawings and specifications for all trades to determine the nature and extent of others work.

H. It will be the responsibility of the Contractor to work in cooperation with the Owner and with all other contractors and employees rendering such assistance and so arrange his work such that the entire project will be delivered complete in the best possible condition and in the shortest time.

1.4 PROPRIETARY INFORMATION

A. Project Documentation: All custom software, programs, code, databases, graphic files and drawings (whether hard copy or CADD based files) prepared for this system shall be the exclusive property of the Owner and shall not be reproduced or distributed without prior written permission from the Owner.

1.5 SUBMITTALS

A. Submit in accordance with Division 1 and 23 submittal requirements.

B. In addition to the requirements set forth in Paragraph A above, the following shall be included in the shop drawing submittals including, but not limited to:
   1. Product Data: Submit manufacturer's technical product data sheets for each control device furnished, each data sheet shall be labeled indicating its' control drawing descriptor and include the following:
      a. Indicating dimensions;
      b. Capacities;
      c. Performance characteristics;
      d. Electrical characteristics;
      e. Finishes of materials;

f. Commissioning, installation instructions and start-up instructions.

2. Control system drawings containing pertinent data to provide a functional operating system and a sequence of operation.
3. Detailed wiring diagrams.
4. A floor plan of each area with a detailed new conduit/wiring layout shall be included. The plan shall indicate all conduit locations within +/- 2-feet of actual installed location. All walls, doors and temperature control devices shall be accurately shown.
5. Schematic flow diagram of system showing fans, pumps, coils, dampers, valves, and all control devices. Identify all control points with labeling.
6. Label each control device with set point or adjustable range of control. Provide a bill of materials with manufacturer's part number.
7. Indicate all required point-to-point electrical wiring. Clearly differentiate between portions of wiring that are existing and portions to be field-installed.
8. Provide details of faces of control panels, including controls, instruments, and labeling.
9. Include verbal description of sequence of operation and reference each device described by schematic symbol used.
10. Provide a detailed listing of all software program code written for each system.
11. Provide a point list with database input information to include a point name, address, base and span, action and other required information.
12. Provide a detailed test plan and procedure for each HVAC system and for each type of terminal unit control including valves. The test plans shall fully define reporting methods, procedure, equipment utilized, milestones for the tests, identifying the simulation programs, and personnel. The test procedures shall be developed from the test plans and shall consist of instructions for test execution and evaluation. A test report form shall be developed for each point and sequence of operation. Commissioning procedures shall be provided for each HVAC system and for each type of terminal unit control system. The procedure shall include set point, prop. band, integral, derivative, mode constraints input, output settings, tuning procedures., etc.

C. Submit manufacturer's installation instructions.

D. Submittal Data and Shop Drawings shall be prepared and submitted in the following formats:
1. All drawings prepared for the project shall be developed using the AutoCad CADD program Rev. 2004 or most current version, (or a CADD package capable of producing AutoCad "DXF" compatible format files).
2. All submittals data shall be the same size for any group of information and shall be in a three (3) screw and post binder. (NO EXCEPTIONS). All the information shall be indexed and tabbed with reference to the specific section of these specifications.
3. The format for different groups of submittal information are as follows:
   a. Control drawings, building plans (including complete floor plans), schematics and system configurations shall be CADD prepared drawing, bound and indexed. Drawings that cannot represent the total information on an individual ANSI size B (11" x 17") drawing, i.e., a building plan, shall be noted with appropriate match lines, cross references and key plans.
   b. Technical data, sequence of operations, material list, point lists, program listings, I/O schedules, operator's and programmer's manuals, etc., shall be type written, original product data sheets or CADD prepared drawings, ANSI Size A or ANSI Size B.
4. Upon completion of the project and acceptance of systems, the Contractor shall provide to the Owner one (1) set of hard copy As-Built Shop Drawings and diskettes.

E. Shop drawings shall include riser diagram depicting locations of all controllers and workstations, with associated network wiring. Also included shall be individual schematics of each mechanical system showing all connected points with reference to their associated controller. Typicals will be allowed where appropriate.

F. When the Architect/Engineer requires, the Contractor will resubmit with the corrected or additional submittal data. This procedure shall be repeated until all corrections are made to the satisfaction of the Engineer and the submittals are fully reviewed.

G. Contractor agrees that shop drawing submittals processed by the Architect/Engineer are not change orders, that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Architect/Engineer that the Contractor understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install, and by detailing the fabrication and installation methods he intends to use. The Contractor shall be responsible for space requirements, configuration, performance, changes in bases, supports, structural members and openings in structure, and other apparatus that may be affected by their use.

H. Contractor further agrees that if deviations, discrepancies, or conflicts between shop drawing submittals and the contract documents in the form of design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Architect/Engineer, the design drawings and specifications shall control and shall be followed. If alternates do not meet these requirements, it shall be this Contractor's responsibility to remove them and install material originally specified, at no cost to the Owner.

1.6 DELIVERY, STORAGE AND HANDLING

A. Provide factory shipping cartons for each piece of equipment, and control device. Maintain cartons through shipping, storage and handling as required to prevent any equipment damage, and to eliminate all dirt and moisture from equipment. Store all equipment and materials inside and protected from weather.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS AND CONTRACTORS

A. Subject to compliance with requirements, install one (1) of the following systems:
   1. Andover
   2. No Alternates

2.2 GENERAL PRODUCTS DESCRIPTION

A. The Building Automation System (BAS) shall be capable of integrating multiple building function including equipment supervision and control, alarm management, energy management, and historical data collection and archiving. All products and materials installed shall be suitable for the intended application requirements including but not limited to:
   1. Accuracy

2. Rangeability
3. Temperature and pressure ranges
4. Shutoff pressures
5. Differential pressures
6. Repeatability
7. Materials of construction suitable with the environment and/or media in which they are in contact with
8. Code compliance
9. Velocities

B. The BAS shall consist of the following:
1. Standalone DDC panels
2. Standalone application specific controllers (ASCs)
3. Portable Operator's Terminals
4. Personal Computer Operator Workstations
5. High Speed Communication Network (LAN)

The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, standalone DDC panels, and operator devices.

C. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each DDC panel shall operate independently by performing its' own specified control, alarm management, operator I/O, and historical data collection. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

D. Standalone DDC panels shall be able to access any data from, or send control commands and alarm reports directly to, any other DDC panel or combination of panels on the network without dependence upon a central processing device. Standalone DDC panels shall also be able to send alarm reports to multiple operator workstations without dependence upon a central processing device.

E. Shared points will not be allowed.

F. BAS shall allow third party software to operate on personal computer workstation without any degradation to the controls operating normally.

2.3 NETWORKING/COMMUNICATIONS

A. The design of the BAS shall network the existing Denver Public Library's remote operator workstation with this system.

1. General Network Design: Network design shall include the following provisions:
   a. High speed data transfer rates for alarm reporting, quick report generation from multiple controllers and upload/download efficiency between network devices.
   b. Detection and accommodation of single or multiple failures of either workstations, DDC panels, or the network media. The network shall include provisions for automatically reconfiguring itself to allow all operational equipment to perform

their designated functions as effectively as possible in the event of single or multiple failures.

c. In general, the local control network for the DDC system shall be separate from all other networks. The design intent is to minimize interface with other networks.

2. Remote Workstations: The existing Denver Public Library's remote operator workstation shall be able to access this site via the internet, and perform all control functions, all report functions, and all database generation and modification functions. There shall be a single connection between the main temperature control panel and the Library's IT network.

2.4 STANDALONE DDC PANELS

A. General: Standalone DDC panels shall be microprocessor based, multi-tasking, multi-user, real-time digital control processors. Each standalone DDC panel shall consist of modular hardware with plug-in enclosed processors, communication controllers, power supplies, and input/output modules. A sufficient number of controllers shall be supplied to fully meet the requirements of this specification and the Point List.

B. Memory: Each DDC panel shall have sufficient memory to support its' own operating system and data bases including:
1. Control Processes
2. Energy Management Applications
3. Alarm Management
4. Historical/Trend Data for all points
5. Maintenance Support Applications
6. Custom Processes
7. Operator I/O
8. Dial-Up Communications
9. Manual Override Monitoring

C. Point Types: Each DDC panel shall support the following types of point inputs and outputs:
1. Digital Inputs for status/alarm contacts
2. Digital Outputs for On/Off equipment control
3. Analog Inputs for temperature, pressure, humidity, flow and position measurements
4. Analog Outputs for valve and damper position control, and capacity control of primary equipment
5. Pulse Inputs for pulsed contact monitoring

D. Expandability: The system shall be modular in nature, and shall permit easy expansion through the addition of software applications, workstation hardware, field controllers, sensors and actuators.

E. Communication Ports: Standalone DDC panels shall provide at least two data communication ports for simultaneous operation of multiple operator I/O devices such as industry standard laptop workstations, PC workstations, and panel mounted or portable DDC panel Operator's Terminals. Standalone DDC panels shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers, or network terminals.

F. Hardware Override Switches: The operator shall have the ability to manually override automatic or centrally executed commands at the DDC panel via local, point discrete, onboard HAND/OFF/AUTO operator override switches for analog control type points. These override switches shall be operable whether the panel is powered or not.

G. Hardware Override Monitoring: DDC panels shall monitor the status or position of all overrides, and include this information in logs and summaries to inform the operator that automatic control has been inhibited. DDC panels shall also collect override activity information for daily and monthly reports.

H. Local Status Indicator Lamps: The DDC panel shall provide local status indication for each binary input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device.

I. Integrated On-Line Diagnostics: Each DDC panel shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all subsidiary equipment. The DDC panel shall provide both local and remote annunciation of any detected component failures, or repeated failure to establish communication. Indication of the diagnostic results shall be provided at each DDC panel, and shall not require the connection of an operator I/O device.

J. Surge and Transient Protection: Isolation shall be provided at all network terminations, as well as all field point terminations to suppress induced voltage transients consistent with the latest IEEE Standard 587.
   1. Signal wiring shall not be installed in same conduit as high voltage wiring.

K. Powerfail Restart: In the event of the loss of normal power, there shall be an orderly shutdown of all standalone DDC panels to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data, and battery back-up shall be provided to support the real-time clock and all volatile memory for a minimum of seventy-two (72) hours.
   1. Upon restoration of normal power, the DDC panel shall automatically resume full operation without manual intervention.
   2. Should DDC panel memory be lost for any reason, the user shall have the capability of reloading the DDC panel.

2.5 SYSTEM SOFTWARE FEATURES

A. General:
   1. All necessary software to form a complete operating system as described in this specification shall be provided.
   2. The software programs specified in this section shall be provided as an integral part of the DDC panel and shall not be dependent upon any higher level computer for execution.

B. Control Software Description:
   1. Pre-Tested Control Algorithms: The DDC panels shall have the ability to perform all pre-tested control algorithms.
   2. Equipment Cycling Protection: Control software shall include a provision for limiting the number of times each piece of equipment may be cycled within any 1-hour period.

3. Heavy Equipment Delays: The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.
4. Powerfail Motor Restart: Upon the resumption of normal power, the DDC panel shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling, and turn equipment on or off as necessary to resume normal operation.

C. Energy Management Applications: DDC panels shall have the ability to perform any or all of the following energy management routines.
1. Time of Day Scheduling
2. Calendar Based Scheduling
3. Temporary Schedule Overrides
4. Optimal Start
5. Optimal Stop
6. Night Setback Control
7. Enthalpy Switchover (Economizer)
8. Peak Demand Limiting
9. Temperature Compensated Load Rolling
10. Fan Speed/CFM Control
11. Heating/Cooling Interlock
12. Cold Deck Reset
13. Condensing Unit Sequencing

D. Custom Process Programming Capability: DDC panels shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.

E. Alarm Management: Alarm management shall be provided to monitor, buffer, and direct alarm reports to operator devices and memory files. Each DDC panel shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic, and prevent alarms from being lost. At no time shall the DDC panel's ability to report alarms be affected by either operator activity at a PC Workstation or local I/O device, or communications with other panels on the network.
1. Point Change Report Description: All alarm or point change reports shall include the point's English language description, and the time and date of occurrence.
2. Prioritization: The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of three (3) priority levels shall be provided. Each DDC panel shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.
3. The user shall also be able to define under which conditions point changes need to be acknowledged by an operator, and/or sent to follow-up files for retrieval and analysis at a later date.
4. Report Routing: Alarm reports, messages, and files will be directed to a user-defined list of operator devices, or PCs used for archiving alarm information. Alarms shall also be automatically directed to a default device in the event a primary device is found to be off-line.
5. Alarm Messages: In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 65-character alarm message to more fully describe the alarm condition or direct operator response.

6. Each standalone DDC panel shall be capable of storing a library of at least 250 Alarm Messages. Each message may be assignable to any number of points in the panel.
7. Auto-Dial Alarm Management: In Dial-Up applications, only critical alarms shall initiate a call to a remote operator device. In all other cases, call activity shall be minimized by time-stamping and saving reports until an operator scheduled time, a manual request, or until the buffer space is full. The alarm buffer must store a minimum of fifty (50) alarms.

F. Historical Data and Trend Analysis: A variety of Historical Data collection utilities shall be provided to automatically sample, store, and display system data in all of the following ways.
1. Continuous Point Histories: Standalone DDC panels shall store Point History Files for all analog and binary inputs and outputs.
2. The Point History routine shall continuously and automatically sample the value of all analog inputs at (1/2) half-hour intervals. Samples for all points shall be stored for the past (twenty-four) 24-hours to allow the user to immediately analyze equipment performance and all problem related events for the past day. Point History files for binary input or output points and analog output points shall include a continuous record of the last ten (10) status changes or commands for each point.
3. Control Loop Performance Trends: Standalone DDC panels shall also provide high resolution sampling capability with an operator-adjustable resolution of 10-300 seconds in one (1) second increments for verification of control loop performance.
4. Extended Sample Period Trends: Measured and calculated analog and binary data shall also be assignable to user-definable trends for the purpose of collecting operator-specified performance data over extended periods of time. Sample intervals of one (1) minute to two (2) hours, in one (1) minute intervals, shall be provided. Each standalone DDC panel shall have a dedicated buffer for trend data, and shall be capable of storing a minimum of 500 data samples.
5. Trend viewing/downloading capability-multiple user selected parameters and time period.
6. Data Storage and Archiving: Trend data shall be stored at the standalone DDC panels, and uploaded the operator workstation to hard disk storage when archival is desired. Uploads shall occur based upon either user-defined interval, manual command, or when the trend buffers become full. All trend data shall be available in disk file form for use in third party person computer applications.
    a. Provide an external hard drive with capacity to store 20 years of trend logging data. Configure existing workstation accordingly.

G. Runtime Totalization: Standalone DDC panels shall automatically accumulate and store runtime hours for binary input and output points as specified in the EXECUTION portion of this specification.
1. The Totalization routine shall have a sampling resolution of one (1) minute or less.
2. The user shall have the ability to define a warning limit for Runtime Totalization. Unique, user-specified messages shall be generated when the limit is reached.

H. Analog/Pulse Totalization: Standalone DDC panels shall automatically sample, calculate, and store consumption totals on a daily, weekly, or monthly basis for user-selected analog and binary pulse input-type points.
1. Totalization shall provide calculation and storage of accumulations of up to 99,999.9 units (e.g. KWH, gallons, KBTU, tons, etc.).
2. The Totalization routine shall have a sampling resolution of one (1) minute or less.
3. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.

I. Event Totalization: Standalone DDC panels shall have the ability to count events such as the number of times a pump or fan system is cycled ON and OFF. Event totalization shall be performed on a daily, weekly, or monthly basis.
   1. The Event Totalization feature shall be able to store the records associated with a minimum of 9,999,999 events before reset.
   2. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.

2.6 APPLICATION SPECIFIC CONTROLLERS - HVAC APPLICATIONS

A. Each Standalone DDC Controller shall be able to extend its performance and capacity through the use of remote Application Specific Controllers (ASCs).

B. Each ASC shall operate as a standalone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor. Points shall not be shared between controllers.

C. Each ASC shall have sufficient memory to support its own operating system and data base including:
   1. Control Processes
   2. Energy Management Applications
   3. Operator I/O (Portable Service Terminal)

D. The operator interface to any ASC point data or programs shall be through any network-resident PC workstation, or any PC or portable operator's terminal connected to any DDC panel in the network.

E. Application Specific Controllers shall directly support the temporary use of a portable service terminal. The capabilities of the portable service terminal shall include, but not be limited to, the following:
   1. Display temperatures
   2. Display status
   3. Display set points
   4. Display control parameters
   5. Override binary output control
   6. Override analog set points
   7. Modification of gain and offset constants

F. Powerfail Protection: All system set points, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the controller.

2.7 AHU CONTROLLERS

A. AHU Controllers shall support all the necessary point inputs and outputs to perform the specified control sequences in a totally standalone fashion.

B. AHU Controllers shall have a library of control routines and program logic to perform the sequence operation as specified in the EXECUTION portion of this specification.

C. Occupancy-Based Standby/Comfort Mode Control: Each AHU Controller shall have a provision for occupancy sensing overrides. Based upon the contract status of either a manual wall switch or an occupancy sensing device, the AHU Controller shall automatically select either Standby or Comfort mode to minimize the heating and cooling requirements while satisfying comfort conditions.

D. Continuous Zone Temperature Histories: Each AHU Controller shall automatically and continuously maintain a history of the associated zone temperature to allow users to quickly analyze space comfort and equipment performance for the past (twenty-four) 24-hours. A minimum of two (2) samples per hour shall be stored.

E. Alarm Management: Each AHU Controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.

2.8 OPERATOR INTERFACE

A. Basic Interface Description:
   1. Command Entry/Menu Selection Process: Operator Workstation interface software shall minimize operator training through the use of English language prompting, English language point identification, and industry standard PC application software.
      The operator interface shall minimize the use of a typewriter style keyboard through the use of a mouse or similar pointing device, and "point and click" approach to menu selection. Users shall be able to start and stop equipment or change set points from graphical displays through the use of a mouse or similar pointing device.
   2. Graphical and Text-Based Displays: At the option of the user, operator workstations shall provide consistent graphical or text-based displays of all system point and applications data described in this specification. Point identification, engineering units, status indication, and application naming conventions shall be the same at all workstations.
   3. Multiple, Concurrent Displays: The Operator Interface shall provide the ability to simultaneously view several different types of system displays in overlapping windows to speed building analysis. For example, the interface shall provide the ability to simultaneously display a graphic depicting an air handling unit, while displaying the trend graph of several associated space temperatures to allow the user to analyze the system performance. If the interface is unable to display several different types of displays at the same time, the BAS Contractor shall provide at least two (2) operator stations.
   4. Password Protection: Multiple-level password access protection shall be provided to allow the user/manager to limit workstation control, display, and data base manipulation capabilities as deemed appropriate for each user, based upon an assigned password.
      a. Passwords shall be exactly the same for all operator devices, including portable or panel-mounted network terminals. Any additions or changes made to password definition shall automatically cause passwords at all DDC panels on a network to be updated and downloaded to minimize the task of maintaining system security. Users shall not be required to update passwords for DDC panels individually.
      b. A minimum of five (5) levels of access shall be supported:
         1) Level 1 = Data Access and Display

2) Level 2 = Level 1 + Operator Overrides
3) Level 3 = level 2 + Database Modification
4) Level 4 = Level 3 + Database Generation
5) Level 5 = Level 4 + Password Add/Modification

c. A minimum of fifty (50) passwords shall be supported at each DDC panel.
d. Operators will be able to perform only those commands available for their respective passwords. Menu selections displayed at any operator device, including portable or panel mounted devices, shall be limited to only those items defined for the access level of the password used to Log-On.
e. User-definable, automatic Log-Off timers from one (1) to sixty (60) minutes shall be provided to prevent operators from inadvertently leaving devices on-line.

5. Operator Commands: The operator interface shall allow the operator to perform commands including, but not limited to, the following:
   a. Start-up or shutdown selected equipment
   b. Adjust set points
   c. Add/Modify/Delete time programming
   d. Enable/Disable process execution
   e. Lock/Unlock alarm reporting for each point
   f. Enable/Disable Totalization for each point
   g. Enable/Disable Trending for each point
   h. Override PID loop set points
   i. Enter temporary override schedules
   j. Define Holiday Schedules
   k. Change time/date
   l. Enter/Modify analog alarm limits
   m. Enter/Modify analog warning limits
   n. View limits
   o. Enable/Disable demand limiting for each meter
   p. Enable/Disable duty cycle for each load
6. Logs and Summaries: Reports shall be generated automatically or manually, and directed to either CRT displays, printers, or disk files. As a minimum, the system shall allow the user to easily obtain the following types of reports:
   a. A general listing of all points in the network
   b. List of all points currently in alarm
   c. List of all off-line points
   d. List all points currently in override status
   e. List of all disabled points
   f. List all points currently locked out
   g. List of all items defined in "Follow-Up" file
   h. List all weekly Schedules
   i. List all Holiday Programming
   j. List of limits and deadbands

   Summaries shall be provided for specific points, for a logical point group, for a user-selected group of groups, or for the entire facility without restriction due to the hardware configuration of the facility management system. Under no conditions shall the operator need to specify the address of hardware controller to obtain system information.

B. Dynamic Color Graphic Displays: Color graphic floor plan displays, and system schematics for each piece of mechanical equipment, including air handling units, chilled water systems, and

hot water boiler systems, shall be provided as specified in the EXECUTION portion of this specification to optimize system performance analysis and speed alarm recognition.

1. System Selection/Penetration: The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection, or text-based commands.
2. Dynamic Data Displays: Dynamic temperature values, humidity values, flow values, and status indication shall be shown in their actual respective locations, and shall automatically update to represent current conditions without operator intervention.
3. Windowing: The windowing environment of the PC Operator Workstation shall allow the user to simultaneously view several graphics at the same time to analyze total building operation, or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.
4. Graphics Definition Package: Graphic generation software shall be provided to allow the user to add, modify, or delete system graphic displays.
    a. The BAS Contractor shall provide libraries of pre-engineered screens and symbols depicting standard air handling unit components (i.e. fans, cooling coils, filters, dampers, etc.), complete mechanical systems (i.e. constant volume-terminal reheat, VAV, etc.) and electrical symbols.
    b. The graphic development package shall use a mouse or similar pointing device in conjunction with a drawings program to allow the user to perform the following:
        1) Define symbols
        2) Position and size symbols
        3) Define background screens
        4) Define connecting lines and curves
        5) Locate, orient, and size descriptive text
        6) Define and display colors for all elements
        7) Establish correlation between symbols or text and associated system points or other displays.
    c. Graphical displays can be created to represent any logical grouping of system points or calculated data based upon building function, mechanical system, building layout, or any other logical grouping of points which aid the operator in the analysis of the facility.
5. To accomplish this, the user shall be able to build graphic displays that include point data from multiple DDC panels, including application specific controllers used for DDC unitary or VAV terminal unit control.

C. System Configuration and Definition: All temperature and equipment control strategies and energy management routines shall be definable by the Operator. System definition and modification procedures shall not interface with normal system operation and control.

1. The system shall be provided complete with all equipment and documentation necessary to allow an operator to independently perform the following functions:
    a. Add/Delete/Modify Standalone DDC Panels
    b. Add/Delete/Modify Operator Workstations
    c. Add/Delete/Modify Application Specific Controllers
    d. Add/Delete/Modify points of any type, and all associated point parameters, and tuning constants
    e. Add/Delete/Modify alarm reporting definition for each point
    f. Add/Delete/Modify control loops
    g. Add/Delete/Modify energy management applications
    h. Add/Delete/Modify time and calendar-based programming
    i. Add/Delete/Modify Totalization for every point

j. Add/Delete/Modify Historical Data Trending for every point
k. Add/Delete/Modify custom control processes
l. Add/Delete/Modify any and all graphic displays, symbols, and cross-references to point data
m. Add/Delete/Modify dial-up telecommunication definition
n. Add/Delete/Modify all operator passwords
o. Add/Delete/Modify Alarm Messages

2. Programming Description: Definition of operator device characteristics, DDC panels, individual points, applications and control sequences shall be performed through fill-in-the-blank templates and graphical programming approach.
   Graphical programming shall allow the user to define the software configuration of DDC control logic for HVAC system control sequences, fan interlocks, pump interlocks, PID control loops, and other control relationships through the creation of graphical logic flow diagrams.
   a. Graphical Programming: Control sequences are created by using a mouse input device to draw interconnecting (comparisons and mathematical calculations), and outputs of a control sequence. As a minimum, graphic symbols shall be used to represent:
      1) Process Inputs, such as temperature, humidity, or pressure values, status, time, date, or any other measured or calculated system data.
      2) Mathematical Process Operators, such as addition, subtraction, multiplication, or greater than, equal to, less than, etc.
      3) Logical Process Operators such as AND, OR, Exclusive OR, NOT, etc.
      4) Time Delays.
      5) Process Control Outputs such as start/stop control points, analog adjust points, etc.
      6) Process Calculation Outputs.
      7) Text file Outputs and Advisories.
   b. Network-Wide Strategy Development: Inputs and outputs for any process shall not be restricted to a single DDC panel, but shall be able to allow the development of all other DDC panels to allow the development of network-wide control strategies. Processes shall also allow the operator to use the results of one (1) process as the input to any number of other processes (cascading).
   c. Sequencing, Testing, and Simulation: A software tool shall be provided, which allows a user to simulate Control Sequence Execution to test strategies before they are actually applied to mechanical systems. Users shall be able to enter hypothetical input data, and verify desired control response and calculation results via graphical displays and hardcopy printouts.
3. System Definition/Control Sequence Documentation: All portions of system definition shall be self-documenting to provide hardcopy printouts of all configuration and application data. Control process and DDC control loop documentation shall be provided in logical, graphical flow diagram format to allow control sequences to be easily interpreted and modified at any time in the future.
4. Database Save/Restore/Back-Up: Back-up copies of all standalone DDC panel databases shall be stored in at least one (1) personal computer operator workstation.
   Continuous supervision of the integrity of all DDC panel databases shall be provided. In the event that any DDC panel on the network experiences a loss of its data base for any reason, the system shall automatically download a new copy of the respective database to restore proper operation. Database back-up/Download shall occur over the local area network without operator intervention. Users shall also have the ability to manually execute downloads of any or all portions of a DDC panel's database.

D. Personal Computer Operator Workstation Description: Update Denver Public Library's existing computer located at the Central Branch.

E. Standalone DDC Panel Local or Portable Operator's Terminals: Each DDC panel shall be capable of supporting an operator's terminal for local command entry, instantaneous and historical data display, and program additions and modifications.
   1. The DDC panel Operator Terminal shall provide access to all real or calculated points in the controller to which it is connected, or any other controller in the network. This capability shall not be restricted to a subset of predefined "global points," but shall provide totally open exchange of data between the operator terminal and any DDC panel in the network.

2.9 MATERIALS AND EQUIPMENT

A. General: The Contractor shall provide control products in the sizes and capacities indicated. Additional controllers, sensors, and devices which are required to make a complete control system shall be the responsibility of the Controls Contractor.

B. Electric Dampers Operators:
   1. All damper operators shall be of the synthetic elastomer diaphragm piston-type and shall be fully proportioning unless otherwise specified. Dampers operators shall have metal bodies. The operators shall have ample power to overcome friction of damper linkage and air pressure acting on the damper blades. The damper operator mounting arrangement shall be outside the airstream wherever possible. The operators shall have external adjustable stops to limit the stroke. The operator linkage arrangement shall permit normally-open or normally-closed positions of the damper as required by the Sequence of Operation.
   2. Damper operators on modulating dampers that are sequenced with other control devices shall have a pilot positioner of the full relay type with an interconnecting linkage to provide mechanical feedback so as to accurately position and control the damper.
   3. Electric Type Damper: Size each actuator to operate dampers with sufficient reserve power to provide smooth modulating action or 2-position action as specified.

2.10 AIR MEASURING STATIONS

A. Provide on the indicated fans, airflow traverse probes mounted in the fan inlets capable of continuously measuring the air handling capacity (air volume) of the respective centrifugal fan(s).

B. The fan inlet airflow traverse probes shall contain multiple total and static pressure sensors placed at concentric area centers along the exterior surface of the cylindrical probe and internally connected to their respective averaging manifolds. Sensors shall not protrude beyond the surface of the probe, nor be adversely affected by particle contamination normally present in building system airflows.

C. The fan inlet airflow traverse probes (two (2) per inlet) shall have dual end support swivel brackets suitable for mounting in the fan inlet bell and symmetrical averaging signal takeoffs and fittings, and shall be of aluminum construction.

D. The fan inlet airflow traverse probes shall not induce a measurable pressure drop, nor shall the sound level within the system be amplified by its presence in the fan inlet bell. The probes shall be capable of producing steady, non-pulsating signals of standard total and static pressure, without need for flow corrections or factors, with an accuracy of 3 percent of actual flow over a fan operating range of 6 to 1 capacity turndown. Air measuring station shall be Air Monitor Model Voluprobe FI.

E. Provide electronic flow (air volume, velocity) indicating transmitter for RTU-1 capable of receiving signals of total and static pressures from the air measuring station, amplifying, extracting the square root and scaling to produce a dual 4-20 milliamp DC, output signal linear and scaled air volume or velocity. The flow indicating transmitter shall contain an integral digital display capable of continuous indication of air volume and velocity, percent of span, electronic signal units within the following performance application criteria:

1. Calibrated Spans:
   150 FPM to 2000 FPM
   Ten (10) adjustable spans
   Operating static pressures up to negative 10-inch S.P. W.C.
   Integral 2x20 digit, high LED display
2. Response Time: .5 second for 98 percent span step.
3. Accuracy: +/- 0.1% of Natural Span, including non-linearity, hysteresis, deadband, and non-repeatability.
4. Operating temperature -20 to 180 degree F.
5. Humidity Limits: 0-90% RH, non-condensing.
6. The indicating transmitter output shall not be affected by overpressure up to 200 times greater than span and shall be furnished with a factory calibrated span and automatic zeroing circuit. Transmitter shall be housed in a NEMA 1 enclosure with RFI shielding and separate power and output signal connection ports. Transmitter shall be Air Monitor Veltron II.
7. Acceptable Manufacturer:
   a. Air Monitor Corporation
   b. Ultratech Industries

F. Provide electronic outside air monitoring station (air volume, velocity) with indicating transmitter for RTU-2 capable of receiving signals of total and static pressures from the air measuring station, amplifying, extracting the square root and scaling to produce a dual 4-20 milliamp DC, output signal linear and scaled air volume or velocity. The flow indicating transmitter shall contain an integral digital display capable of continuous indication of air volume and velocity, percent of span, electronic signal units within the following performance application criteria:

1. Monitor Station:
   - 150 FPM to 2000 FPM
   - Outside Reference Sensor
   - Inlet Airflow Sensor
   - Temperature Sensor
   - 14 ga. Galvanized sheetmetal intermittently welded, sealed with metal caulking, galvanized expanded metal screen with 63% free area; .05” SWD x 1.25” LWD x .096” strand width.
2. Transmitter
   - Integral 2x20 digit, high LED display.
   - Accuracy: +/- 0.1% of Natural Span.

- Operating temperature of -20 to 180 degree F.
- The indicating transmitter output shall not be affected by overpressure up to 200 times greater than span and shall be furnished with a factory calibrated span and automatic zeroing circuit. Transmitter shall be housed in a NEMA 1 enclosure with RFI shielding and separate power and output signal connection ports. Transmitter shall be Air Monitor VOLU-flo.

3. Acceptable Manufacturer:
   a. Air Monitor Corporation
   b. Ultratech Industries

2.11 INPUTS AND OUTPUTS

A. All input accuracies required by this section shall be end-to-end (from sensing point to BAS display). End-to-end accuracy includes all errors due to the sensor, transmitter, wiring and BAS signal measurement and A/D conversion.

B. Thermistors or solid state sensors shall be provided for temperature sensing applications except where accuracies or ranges required cannot be met by these devices, RTD's shall be used. The sensors shall be powered by the BAS Panel or Dedicated Controller. The solid state sensors shall be accurate to within +/- 0.5 degree F over the following ranges and meet the following requirements:
   1. Room Type Instruments: 50 degree F to 100 degree F. For room space applications: Sensor shall be surface mounted in a plastic aluminum cover with an insulated baseplate and vandalproof screws.
      a. Each thermostat have the following features:
         1) Exposed set point adjustment dial with temperature graduation indication.
   2. Duct and Plenum Applications: -30 degree F to 240 degree F. Supply, return, exhaust or mixed air averaging type, which shall have an extended element of sufficient length to cover the entire duct cross-section with a minimum of three (3) passes. If a single averaging thermistor of sufficient length to meet the preceding are not available, then two (2) or more sensors and AIs shall be used and averaged in software.

C. Where RTD's are required, they shall be 1,000 OHM platinum type and be supplied with a 4-20 mA DC transmitter. The sensor and transmitter shall be a single unit. They shall be accurate to within +/- 1.0 degree F over the range of 32 degree F to 600 degree F.

D. Where thermocouples are required, they shall be Type J and be supplied with a 4-20 mA DC transmitter. They shall be accurate to within +/- 2.0 degree F over the range of 32 degree F to 1,300 degree F.

E. Provide matched temperature sensors for applications which require both inlet and outlet temperatures of any device.

F. Outdoor Air Temperature and Humidity Transmitter:
   1. Provide Vaisala HMP35D relative humidity and temperature probe with membrane filters and UV stabilized solar radiation shield 2212HM. Probe shall have a temperature measuring range of -40 degree F to +120 degree F with an accuracy of +/- .54 degree F at 68 degree F and relative humidity measuring range of 0 to 100 percent RH with an accuracy of 2 percent, 0 to 90 percent RH with a repeatability better than 1 percent RH per year. RH and temperature probe shall be capable of a continuous temperature

operating range of -40 degree F to +120 degree F. Provide necessary transmitter for output signals.

G. Humidity Transmitter:
   1. Wall Mounted Humidity Transmitter: Wall mounted humidity transmitter shall be Vaisala Model HMW20UB. Transmitter shall measure relative humidity from 0 to 100 percent RH, +/- 2 percent accuracy, wall mounted ABS plastic box, with a long range RH stability better than 1 percent RH/year and temperature compensated over the entire range. Sensor shall utilize the registered HUMICAP H-sensor. Sensor filter shall be membrane Type 18.5 mm and a 4-20 mA output signal.

H. Pressure Sensors, Transmitters and Differential Switches:
   1. Air Differential Pressure Transmitters shall be Modus Model T30 or T40 (as required) with an accuracy of +/- 1 percent of range (including non-linearity and hysteresis), solid state circuitry, no moving parts, capacitance principle capable of sensing positive, negative and differential pressures. Transmitter shall have 4-20 mA output signal and be powered by the control system or dedicated controller and capable of withstanding momentary overpressure of eight (8) times the pressure range.
   2. Differential air pressure switches for filter or proof of airflow status shall be Dwyer Series 1910, with automatic reset, SPDT.
   3. Air and Vacuum Pressure Transmitter: Kele and Associates Model P100GTE, solid state, 4-20 mA signal, with a full scale accuracy of 1 percent.

I. Output Devices:
   1. Control Relays: Control relay contacts shall be rated for the application, with a minimum of two (2) sets of Form C contacts enclosed in a dustproof enclosure. Relays shall be rated for a minimum life of one million (1,000,000) operations. Operating time shall be 20 milliseconds or less, with release time of 10 milliseconds or less. Relays shall be equipped with coil transient suppression devices to limit transients to 150 percent of rated coil voltage. Provide with LED to indicate status.
   2. Analog output transducers shall be of positioning type with position feedback and control internal to the transducer. As an option, position feedback may also be input to the BAS.
   3. Analog output transducers shall meet the following requirements:
      a. 4-20 mA DC output.
      b. Two-pipe electro-mechanical design or microprocessor-based design.
      c. 3-15 psi output range adjustable to a 0-20 psi range minimum.
      d. Linearity, repeatability and hysteresis no greater than 2 percent of full scale.
      e. Air capacity of 1,000 SCIM minimum.
      f. Air consumption of no more than 100 SCIM.
      g. Pressure gauges shall be installed on the branch and supply lines.
      h. Acceptable transducers are the Bellofram T1000, Fairchild T5700, Johnson N6810, Mamac EP-310 or an equivalent.
   4. Electronic analog output transducers shall output a signal to match the controlled device. The Contractor shall be responsible for verifying the required signals for all controlled devices. Transducers shall be completely solid-state with no mechanical parts.
   5. Time Delay Relays: Time delay relay contacts shall be rated for the application with a minimum of two (2) sets of Form C contacts enclosed in a dustproof enclosure. Relays shall be rated for a minimum life of one million (1,000,000) operations. Relays shall be equipped with coil transient suppression, devices to limit transients to 150 percent of rated coil voltage. Delayed contact openings or closing shall be adjustable from one (1) to sixty (60) seconds with a minimum accuracy of +/- 2 percent of setting.

6. Latching Relays: Latching Relay contacts shall be rated for the application with a minimum of two (2) sets of Form C contacts enclosed in a dustproof enclosure. Relays shall be rated for a minimum life of one million (1,000,000) operations. Operating time shall be 20 milliseconds or less, with release time of 10 milliseconds of less. Relays shall be equipped with coil transient suppression devices to limit transients to 150 percent of rated coil voltage.

J. Control Valves: Provide factory-fabricated electrical control valves of type, body material and pressure class indicated or implied. Where type or body material is not indicated, provide selection as determined by manufacturer for installation requirements and pressure class, based on maximum pressure and temperature rating of piping system. Except as otherwise indicated, provide valves with mate and match material of connection piping. Equipment control valves with control valve motors, and with proper shutoff ratings for each individual application.
   1. Water Service Valves: Equal percentage characteristics with rangeability of 50 to 1, and maximum full flow pressure drop of 5 psig.
   2. Single-Seated Valves: Cage type trim, providing seating and guiding surfaces for plug on "top and bottom" guided plugs.
   3. Double-Seated Valves: Balanced plug-type, with cage type trim providing seating and guiding surfaces for plugs on "top and bottom" guided plugs.
   4. Valve Trim and Stems: Polished stainless steel.
   5. Packing: Spring-loaded Teflon, self-adjusting.
   6. Terminal Unit Control Valves: Provide control valves for control of terminal units including, but not necessarily limited to, convectors, finned tube radiation, and fan-coil units that are of integral motor type. Provide modulating type valves, electrically actuated by line voltage of 120V.
   7. Select valves fail safe in normally open or closed position as dictated by freeze, humidity, fire or temperature protection.
   8. Valves ½- Inch thru 2-Inch: Valves shall be constructed with cast brass body and screwed ends. For 1-1 ½ inch and 2- inch special duty, valves may be selected by control manufacturer to have either bronze or cast iron bodies with screwed or flanged ends.
   9. Valves 2-2 ½ Inch and Above: Valves shall be constructed with a cast iron body and have flanged connections.

K. Wall/Duct Mount CO_2 Transmitter:
   1. Description; Measure and transmit CO_2 levels ranging from 0 to 2,000 parts per million [ppm]. Silicone-based CARBOCAP® sensor delivers high accuracy and long-term measurement stability ($\pm$100 ppm) over a five-year period without calibration. It shall consist of an infrared (IR) source, a sample cell, and IR detector, and a tunable interference filter that enables measurements at two wave lengths. Reference measurements made using a tunable interference filter.
   2. Model;
      a. Wall Model; CD-Wxx-00-0 Wall Mount CO_2 transmitter.
      b. Duct Model; CD-Pxx-00-0 Series Duct Mount CO_2 transmitter.
   3. Specifications;
      a. Measuring Range: 0 to-2000ppm CO_2.
      b. Accuracy at 77°: $<\pm$ 30m ppm+ 2.0% of reading, includes manufacturing deviation and drift.
      c. Non-Linearity: <0.5% of Full Scale.
      d. Temperature Dependence of Output: <0.056% of Full Scale/F°.
      e. Response Time (0 to 63%): 1 Minute.
      f. Operating Temperature Range: 23 to 113°F

g. Humidity Range: 0 to 85% RH (non-condensing)
h. Power Supply Range: 20 to 30 VAC (18 to 30 VDC), Class 2.
i. Power Consumption: <2.5 W Average, 4.1 VA.
j. Air Flow Range: 0 to 7,500 ft/minute
k. Duct Probe Material: Duct probe meets plenum rating requirements of UL 1995, Heating and Cooling Equipment.
l. Agency Listings: UL Listed, CCN XAPX

L. Valve Actuators:

1. General: Valve actuators shall be electric with end switches. Provide integral overstroke protection.
2. Actuators for valves shall have spring return. Heating valves shall fail open to flow through coil or other heat transfer device. Spring return is not required on VAV box coils, Duct Heating Coils, cabinet heaters, and unit heaters.
3. All valve actuators shall be sized, to be able to close valve tight, against 130% of maximum available pumping head.
4. Acceptable Manufacturers:
   a. Belimo
   b. Andover Controls

M. Damper Actuators:

1. Damper actuators shall be 24V electronic with end switch. Provide integral overstroke protection.
2. Actuators shall not have spring return. Damper actuators on outside air dampers and relief air shall be normally closed, return air shall be normally open.
3. Acceptable Manufacturers:
   a. Belimo
   b. Andover Controls

2.12 TERMINAL CONTROLLERS (FAN COIL, VAV BOX, MODULATING CONTROL DAMPER)

A. Modulate the fan coil fan speed, VAV box damper, heating or cooling control valve (two-position valves are not permitted).

B. Control each VAV box and/or heating control valve locally and centrally controlled by a single controller mounted accessible and near the heating coil.

C. Readable and adjustable at each controller or space sensor, the central DDC controller or from a remote computer via telephone modem:

D. Room Heating Setpoint Temperature, Occupied/Unoccupied

E. Actual Room Temperature (Read Only)

F. VAV box damper commanded percent open

G. Control Valve commanded percent open

H. Fan coil fan speed commended percent.

I. Furnish Fan coil unit controls, VAV Box controls and actuators to the equipment manufacturers for factory installation.

2.13 LEAK DETECTION SYSTEM REQUIREMENTS

A. Provide a Liebert underfloor leak detection system. The design basis is a Liqui-Tect Monitoring System with LT500Y leak detection cable. The monitoring system shall be a minimum of two zones of up to 5000 feet of cable per zone, 10,000 feet total. Points along the cable shall have a mapped to allow a leak to be pinpointed. The system shall report the distance from the panel, along the cable, in feet. The system shall also include four digital alarm outputs, two per zone, to allow monitoring by the building automation system, without any additional interface device. The alarm outputs shall include one output per zone for leak detection, and one output per zone for cable fault. The system shall continuously monitor operation, signaling system normal, leak detected, and cable fault.

B. The leak detection cable design basis is Liebert model LT500Y leak detection system cable. Leak Detection System Cable shall be constructed as a four-conductor cable with two conductors being jacketed with CL2P rated covering. The two remaining conductors shall be covered with porous non- conductive polymers. The overall cable shall be UL-listed with a CL2P rating. To ensure that the cable will not present an alarm condition when pressure is exerted downward on the cable from a large cable or conduit placed on the top of the cable, Conductive Polymers shall not be used. The diameter of the cable shall not exceed 1/4". The end of the cable shall be terminated in matching male and female connectors for easy connection of cables from end to end. The accuracy of the Leak Detection System Cable shall be linear and within 1% of the length of the cable.

C. Environmental Operating Characteristics:

Humidity: 5 to 90% RH
Temperature: 0 to 55^{o} C
Altitude: 0 to 10,000 ft.

D. The leak detection system monitoring panel and cable shall be fully compatible as a system. Alternative manufacturers will be considered during the pricing period only upon receipt of a request along with appropriate product data.

2.14 POWER MONITORING

A. General: Provide current switches, current transducers, voltage transducers, current transformers as required to meet the specified Sequence of Operation and indicated below.

B. Current Operated Switches: AC current switch, Neilsen - Kuljian Model PD50AC, or PD75, solid state, five (5) year warranty, three (3) selectable ranges for optimum adjustability and resolution. Provide external current transformer where required.

C. Current Transducers: AC current to DC current output, +/- .5 percent accuracy, 4-20 mA output signal, Kele and Associates Model 4CMA. Provide external current transformer where required.

D. Voltage Transducers: Kele and Associates Model PVM or LVM as required for each application, +/- 1/2 percent accuracy, 4-20 mA DC output.

2.15 TEMPERATURE CONTROL CABINETS

A. General: All controllers and field interface devices shall be installed in control panel cabinet/enclosure as described below.

B. Cabinets shall be UL listed, 14 gauge furniture grade steel, finished with baked enamel painted finish inside and out, cabinet doors shall have piano hinge and standard key cylinder locking latch.

C. All devices installed in or on the control cabinet shall be labeled with a fixed mounted, color contrasted, engraved laminated plastic tags, including describing the function of the device, similar to the following example:

ΔP TRANSMITTER DEVICE

Label

DSP-1, AHU-1 SUPPLY DUCT STATIC PRESSURE TRANSMITTER

D. All electrical devices within the panel shall be prewired to terminal strips with all inter-device wiring within the panel completed prior to installation of the system.

E. Mount control panels adjacent to associated equipment on vibration free walls or free standing steel angle supports or "Unistrut" support stand.

2.16 VARIABLE FREQUENCY DRIVES

A. Variable frequency drives shall be arranged so that it can be operated in an open circuit mode, disconnected from the motors, for start-up adjustments and trouble shooting.

B. Automatic operation shall be from a 4-20 milliamp signal follower, which shall follow a transducer signal. The signal follower shall contain the following design features.
   1. Shall accept a transducer output signal and condition it to produce a speed reference signal for the invertor.
   2. Minimum speed adjustment (Zero (0) to Maximum RPM).

C. Wire all safeties to operate both in hand and auto positions as well as drive and by-pass sections.

D. Provide communication cabling and interface necessary to forward VFD computer communication information to and from the BAS/VFD. See Division 23.

2.17 HIGH AND LOW TEMPERATURE LIMIT CONTROL DEVICES

A. Provide PENN A70 series or equal, DPST, manual reset, two (2) isolated sets of contacts. Control responds to temperature along any one (1) foot of entire element.

B. Vapor charged sensing element shall be calibrated for altitude of project site.

C. Provide multiple limit control devices as required to provide complete and full coverage of the entire coil face area and/or duct cross section area.

2.18 ELECTRICAL MATERIALS

A. Conduit and Conductors: Types as indicated in Division 26 sized per Division 26 except for low-voltage twisted pair or single jacketed cable (1/2-inch minimum). All low voltage conductors shall be stranded 22 gauge copper minimum; twisted pair.

B. Fittings per Division 26: Bushings or nylon insulated throats are not required for jacketed cables.

C. All J-boxes shall be identified and labeled per Division 26.

D. All conductors and cables shall be labeled per Division 26.

E. Conduit and box supports shall be per Division 26.

F. Junction boxes shall be of types and sizes as indicated in Division 26.

G. Conduits shall not exceed 40 percent maximum fill for single conductor and jacketed cables.

2.19 END SWITCHES

A. All end switches shall be NEMA rated contacts and NEMA 4X enclosure, either SPDT, DPDT DPST as required to meet the Sequence of Operation, complete the Points List and necessary interlocks or safeties control wiring. End switches shall be as manufactured by Cutler-Hammer or Allen-Bradley.

B. All end switches shall be designed and configured to provide positive indication of a control device (i.e. damper or valve) position for the service intended.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Contractor shall install all equipment, control air piping/tubing, conduit and wiring parallel to building lines.

B. All automatic control valves and control dampers furnished by the Temperature Control Contractor shall be installed under his supervision by the Mechanical Contractor.

C. Install Air Measuring Stations per the manufacturer's requirements.

D. GENERAL INSTALLATION REQUIREMENTS:
1. Spare conductor capacity, equal to a minimum of two (2) additional sensors shall be provided to each underfloor sensor and pendant type sensors.
2. Run wiring and conduit parallel and perpendicular to building lines.
3. Horizontal runs of conduit, trays, tubing or wiring shall be hung from structural members using new supports, or where feasible, utilizing existing temperature control conduit and piping. The Contractor shall verify adequacy of existing systems and warrant these systems as if they were new. Single runs of conduit, tubing or wire shall be by clevis ring and all thread rod. Multiple runs shall be by "Trapeze" or "Unistrut" supports. "Plumber's Strap" shall not be allowed. Maximum distance between supports shall be per the NEC. Existing supports shall only be used upon written concurrence by the Architect, Engineer or Owner.
4. All vertical runs of conduit or tubing shall be through new core drills. Existing core drills may be used if approved by the Owner. The installation shall be supported above each floor penetration using clamps to "Unistrut".
5. All wire that enters or leaves a building structure shall be installed with lightning protection per NEC.
6. All wire terminations shall be with compression type round hole spade lugs under a pan head screw landing; Stay-Kon or equivalent. All wire splices shall be with compression type insulated splice connectors or properly sized "wire-nut" connectors. Hand twisted, soldered and/or taped terminations or splices are not acceptable.
7. Where tubing, wiring or conduit penetrate floors or walls, sleeves with bushings shall be provided for tubing and wires. The conduit or sleeve opening shall be sealed with fire proof packing so the smoke and fire rating of the wall or floor is maintained.
8. Under no circumstances shall wire, tubing, tray, J-boxes or any BAS equipment be run in, mounted on, or suspended from any of the telephone system's equipment, cable trays or support structure (Grey Iron).

9. All the material installed under this contract must be mounted on, or supported from the building structure or supports furnished by this Contractor.

E. Control Wiring:
1. Run wiring in metallic conduit, tubing or raceways. Exceptions are as follows:
   a. NEC Class 2 low voltage wiring where not exposed to view such as above suspended ceilings, in shafts, etc., below rated floor, may be run in plenum rated cable (when approved by Code Authority). Provide cable rings.
   b. Wiring enclosed in temperature control panels.
2. Where conduit is used, provide steel fittings.
3. Low Voltage Conductors: 18 Gauge minimum, except 19 gauge may be used for home runs to central panels and 22 gauge minimum for resistance or thermistor sensing element connections.
4. Wire control interlocks and control panels, except one (1) 120V power circuit to each temperature control panel shown on drawings and schedules shall be provided under Division 1.
5. All wiring shall comply with the requirements of Local and National Electrical Codes.
6. Do not interlock alarms with starter switching to bypass alarm when equipment is manually disconnected.
7. Variable Frequency Drives shall be arranged so that it can be operated in an open circuit mode, disconnected from the motors, for start-up adjustments and trouble shooting.
8. All costs of controls, wiring conduit and associated labor shall be included in the Temperature Control Bid. The control wiring shall be installed under the supervision of this Contractor.

3.2 ENCLOSURES

A. The tubing and wiring within all enclosures shall be run in plastic trays. Tubing and wiring within BAS panels may be run using adhesive-backed tie wraps.

B. All plastic tubing shall be connected to enclosures through conduit. All copper tubing shall be connected to enclosures through bulkhead fittings.

C. Mount all enclosures, including those which house BAS Panels, Slaves and Field Device Panels, so that the top of the enclosure does not exceed six feet, six inches (6'-6"); and the center of any keypad/LCD combination does not exceed five foot, six inches (5'-6") from the floor or is less than four feet, zero inches (4'-0") from the floor.

D. Field Device Panels contain related Field Devices such as relays, control power (24V) transformers, output transducers, etc., that are outboard of the BAS Panels or Dedicated Controllers. Each Field Device Panel shall be mounted within an enclosure. The enclosures shall be provided with lockable latches that will accept a single key common to all Field Device Panels, BAS Panels and Slaves.

3.3 INSTALLATION PRACTICES

A. The Contractor shall install and calibrate all Field Devices, Sensors and Transducers necessary for the complete operation of the I/O Points described herein.

B. Sensors shall be removable without shutting down the system in which they are installed.

C. All immersion sensors shall be installed in new, welded thermowells supplied by the Contractor. Existing thermowells may be reused with concurrence from the Owner. Coordinate any required shutdown with Owner.

D. Thermistor wire leads shall be permanently terminated at panels or controllers with wire clamps.

E. Where none exist, furnish and install pressure/temperature gauges adjacent to each immersion type sensor.

F. Sensors shall be installed with the use of a wet or hot tap without draining the system if required.

3.4 IDENTIFICATION

A. All control J-boxes, conduit and wiring shall be labeled.

B. Electrical devices, wiring, conduit and J-boxes shall be labeled and identified as required by Division 26.
   1. As a minimum regardless of Division 26 requirements, all temperature control J-box covers shall be painted Blue in color on both sides of cover.

C. Identification shall be provided for all enclosures, panels, junction boxes, controllers or field devices. Laminated, bakelite nameplates shall be used. The nameplates shall be 1/16-inch thick and a minimum of 1-inch by 2-inches. The lettering shall be White on a Blue background with minimum 1/4-inch high engraved letters. The nameplates shall be installed with pop rivets.
   1. All new devices will be tagged. Color code to differentiate between new devices.

D. Thoroughly clean the surface to which the label shall be applied with a solvent before applying the identification. Use an epoxy to affix the identification in addition to any adhesive backing on the identification.

E. The Plan Code Designation shown on all shop drawing identification shall be consistent with the Contract Documents.

F. All I/O Field Devices that are not mounted within Field Device Panel enclosures shall be identified with engraved plastic laminated nameplates installed so that they are visible from ground level.

G. The identification shall show the designation used on the Record Documents and identify the function such as "Mixed Air Temperature Sensor" and "Fan Status DP Switch".

H. Calibration settings shall be marked with paint or indelible ink.

3.5 LOCATIONS

A. All sensing devices and locations shall be located by the Contractor as shown on the submittal shop drawings with final review by the Engineer.

B. Wall mount space sensors shall be mounted 5-feet above finished floor. Pendant mount space sensors shall be mounted 8-feet above finished floor.

C. Enclosures housing Field Devices shall be located immediately adjacent horizontally to the BAS Panels or Slaves which are being interfaced to.

3.6 TEMPERATURE SENSORS & OVERRIDE SWITCHES

A. Temperature controls trades shall verify all wall mounted temperature sensors locations with the Architect/Engineer/Owner in order to avoid interference with wall mounted and space furnishings.
   1. Where interferences require moving the temperature sensor more than two (2) feet, consult with the Architect/Engineer for relocation.

B. Temperature sensors shall be mounted on suitable insulated base and secured to the wall in such a way as to be easily removed from wall without damage to the sensor.

C. Check and verify location of thermostats and other exposed control sensors with plans and room details before installation. Locate center of thermostat sensors at 60-inches above finished floor.

D. Locate center of override switches at 48-inches above finished floor.

3.7 CLEANUP

A. At the completion of the work, all equipment pertinent to this contract shall be checked and thoroughly cleaned and all other areas shall be cleaned around equipment provided under this contract. Clean the exposed surfaces of tubing, hangers, and other exposed metal of all grease, plaster, dust, or other foreign materials.

B. Upon final completion of work in an area, vacuum and/or damp wipe all finished room surfaces and furnishings. Use extreme care in cleaning around telephone switching and computer equipment and under no circumstances shall water or solvents be used around this equipment.

C. At the completion of the Work and at the end of each work day, remove from the building, the premises, and surrounding streets, etc., all rubbish and debris resulting from the operations and leave all equipment spaces absolutely clean and ready for use.

3.8 SOFTWARE, DATABASE AND GRAPHICS

A. Software Installation: The Contractor shall provide all labor necessary to install, initialize, start-up and debug all system software as described in this section. This includes any operating system software or other third party software necessary for successful operation of the system.

B. Database Configuration: The Contractor will provide all labor to configure those portions of the database that are required by the Points List and Sequence of Operation.

C. Color Graphics: Unless otherwise directed by the Owner, the Contractor will provide color graphic displays for all systems which are specified with a Sequence of Operation, depicted in

the Mechanical Drawings for each system and floor plan. For each system or floor plan, the display shall contain the associated points identified in the Point List and allow for set point changes as required by the Owner.

3.9 TEMPERATURE CONTROL DRAWINGS

A. Upon completion of project and after record drawings of the temperature controls have been prepared and reviewed, the Contractor shall provide one (1) complete set of Temperature Controls Drawings at each Temperature Control Panel. Each set of drawings shall be laminated in a plastic coating. The drawings shall consist of only those control functions associated with the specific control panel and any relevant or pertinent network interface information.
   1. The laminated drawings shall have a grommet connection attached to a metal cable or chain which is mechanically fastened to the Temperature Control Cabinet.

3.10 START-UP AND TESTING

A. Prior to Beneficial Use of the BAS, the Contractor shall supply to Architect/Engineer two (2) debugged printouts of all software entered into the BAS. Also supply all user's programming and engineering manuals required to interpret the software. Included in the printouts, though not limited to, shall be the following:
   1. Point data base.
   2. All custom control programs written in the BAS control language.
   3. All parameters required for proper operation of BAS control and utility firmware such as start-stop routines, etc.
   4. Printouts or plotted detailed copies of the complete interactive system graphics.

B. The software printout shall be fully documented for ease of interpretation by the Architect/Engineer and Owner, without assistance from the Contractor. English language descriptions shall be either integrated with or attached to the BAS printout. Specifically, the following shall be documented:
   1. All point (I/O and virtual) names.
   2. All BAS Programming Language commands, functions, syntax, operators, and reserved variables.
   3. Use of all BAS firmware.
   4. The intended actions, decisions, and calculations of each line or logical group of lines in the custom control program(s). Sequences of operation are not acceptable for use in this documentation requirement.
   5. Complete descriptions of and theories explaining all software and firmware algorithms. The algorithms to be described include, but are not limited to, PID, optimum start/stop, demand limiting, etc.

C. Documentation that was supplied as part of the submittals need not be submitted at this time.

D. Upon review of software, a Point-To-Point Test of the BAS installation shall commence. The Contractor shall provide two (2) men equipped with two-way communication and shall test actual field operation of each control and sensing point. This procedure shall occur during off-hour periods. The purpose is to test the calibration, response, and action of every point. Any test equipment required to prove the proper operation of the BAS shall be provided by and

operated by the Contractor. The Engineer and Owner will be present to oversee, observe, and review the test. Demonstrate compliance that system functions per the Sequence of Operation.

1. Upon review of the Point-To-Point demonstration, the Contractor shall start up the BAS by putting all controlled equipment in automatic and enabling software. Contractor shall commence final software and overall BAS hardware/software debugging.
2. The Point-To-Point demonstration shall include any existing BAS equipment if it affects the operation of the equipment included under this contract.
3. As a minimum, existing conditions shall be maintained during system changeover.

E. Final acceptance of the BAS is contingent upon a hardware/software system test. All groups of points that yield a system of control shall be tested for compliance with the sequences of operation. Included in the test, but not limited to, shall be:

1. BAS Loop Response. The Contractor shall supply a trend data output in graphical form showing the step response of each BAS loop. The test shall show the loop's response to a change in set point which represents a change in the actuator position of at least 25 percent of its full range. The sampling rate of the trend shall be from one (1) to three (3) minutes depending on the speed of the loop. The trend data shall show for each sample the set point, actuator position, and controlled variable values. Any loop that does not yield temperature control of + 0.2 degree F or humidity control of + 3 percent RH shall require further tuning by the Contractor.
2. Interlocks and other sequences.
3. BAS Control under HVAC equipment failure.
4. HVAC Operation under BAS equipment failure.
5. Battery backup.
6. BAS Control under power failure/restart.
7. Reset schedules.
8. BAS Alarm reporting capability.

F. A detailed test report as defined under Submittals shall be provided indicating its completion and proper system operation.

G. The BAS will not be accepted as meeting the requirements of Beneficial Use until all tests described in this section have been performed to the satisfaction of both the Architect/Engineer and Owner. Any tests that cannot be performed due to circumstances beyond the control of the Contractor shall be exempt from the Beneficial Use requirements if requested in writing by the Contractor and concurred by the Owner and Architect/Engineer. Such tests shall be performed as part of the BAS Warranty.

1. A typed written document stating that the system has been fully checked out on a point by point basis shall be submitted to the Architect/Engineer. All documentation associated with the check out shall be included.
2. Trend data should be organized by HVAC equipment and the system should automatically generate trend plots of the performance of each system showing all appropriate inputs and outputs over user-selected time periods. In addition, add a plot feature to each BAS system graphic which allows the user to enter a date click a “plot” button to automatically generate a 24 hour trend plot for the applicable system or equipment.

3.11 PROJECT RECORD DOCUMENTS

A. The Contractor shall be responsible for updating all existing Project Record Documents associated with the Scope of Work outlined in the Drawings and Specifications.

B. Prior to final completion of the installation, prepare a complete set of Record Drawings on a clear and legible set of ANSI size 'B' (11" x 17") mylar reproducible prints. The content, format and procedure of the submittal shall be as described by the General Conditions.

C. Provide one (1) laminated and framed set of Control Drawings for each new BAS Control Panel and one (1) for the Facility Control Room, locate as directed by the Engineer.

D. Prior to final completion of the installation, prepare three (3) Operation and Maintenance Manuals. The information is to be or provided in a tabbed and index, three (3) screw and post binder. The information shall include:
   1. Operator's Manual with step-by-step procedures for logging On/Off, interrogating the system, producing reports, acknowledging alarms, overriding computer control, and changing firmware parameters.
   2. Programmer's manual with complete description of the custom control language and associated editor, including sample written programs. Provide complete sets of all programming forms, applications memorandums, and addenda to the programmer's manual. All software or firmware algorithms shall be completely described and documented.
   3. Maintenance, Installation, and Engineering Manual(s) that clearly explains how to debug hardware problems, how to repair or replace hardware, preventive maintenance guidelines and schedules, calibration procedures, and how to engineer and install new points, panels, and operator interfaces.
   4. Documentation of all software. List separately all software parameters that will need updating by the Owner such as, though not limited to, holiday, seasonal and start/stop schedules, comfort and duty cycling schedules.
   5. All programs, code, databases, graphic files, CADD drawings and symbol libraries generated for operation of the system shall be included as a part of the system documentation. This information shall be submitted both in hard copy bound format and magnetic media format.
   6. Input/Output schedules, data sheets, and all other items required under Submittals. Describe all regular maintenance that will need to be performed on the BAS hardware. List replacement parts with part numbers.
   7. Complete original issue documentation and software diskettes for all third party software furnished and installed as a part of the system or required for the operation of the system including text editors, control language program and compiler, database managers, graphics and CADD packages, operating systems and communications software.
   8. Complete original issue documentation, installation and operational manuals and supporting software for all third party hardware furnished and installed as a part of the system or required for the operation of the system including remote terminals, user's computer workstation, monitors, graphics and memory boards, printers and modems.
   9. During the warranty period, all copies of the drawings and manuals shall be updated to include all hardware and software changes.

E. All of the above documentation shall record both the equipment installed under this contract and the exact termination to all other existing control or BAS equipment.

F. The Record Drawings shall document the complete existing control system. This includes all mechanical equipment in work area which has automatic control.

3.12 WARRANTY

A. The Warranty period shall begin on the date of Beneficial Use Completion as authorized by the Architect/Engineer and Owner in writing. Beneficial use shall not occur before the Contractor has performed the tests required. With these requirements met, beneficial use shall not occur until, in the opinion of the Architect/Engineer, the BAS is sufficiently complete to be utilized for the purposes for which it is intended.
   1. The warranty start date shall not begin until all phases of the Project are complete, i.e., the Project shall have a single warranty start date.

B. The BAS System shall be guaranteed to be free from defects in material and workmanship and in software design and operation for a period of the warranty after completion of the contract. The Contractor shall provide the necessary skills, labor, and parts to assure the proper operation of, and to provide all required current and preventive maintenance. This warranty shall become effective starting the date of Beneficial Use completion.
   1. The hardware warranty shall include all equipment which has been purchased by the Contractor. The existing hardware is not subject to the warranty requirements.
   2. All software work completed by the Contractor, associated with existing hardware, is subject to the warranty requirements outlined herein.
   3. The Contractor shall respond to all calls during the warranty period for all problems or questions experienced in the operation of the installed equipment and shall take steps to correct any deficiencies that may exist.
   4. The response time to any problems shall be four (4) hours maximum (twenty-four) 24-hours per day, seven (7) days per week. Corrective action, temporary or permanent, shall be made within one (1) business day.

C. The Contractor shall maintain a backup of all BAS software installed in the system. The backup shall be updated monthly or whenever a change to the software is made. A reload of backup software into the system shall be performed by the Contractor immediately upon notification by the Owner. The reload shall be free of charge unless it is due to a power failure of a duration longer than the battery backup.

D. The Contractor shall optimize all control software to assure acceptable operating and space conditions, and peak energy efficiency.

3.13 TRAINING

A. The Contractor shall provide six (6) hours of training for the building operators. The training sessions shall be broken into two (2) 3-hour sessions. The training session shall be made available to the Owner prior to the end of the warranty period, but after final completion of the contract. The session shall be given at the Owner's facility. Scheduling shall be approved by the Owner. The training shall focus on general design, operation, and maintenance procedures of the products installed, though not necessarily the specific system designed, and shall cover:
   1. Hardware configuration including PC boards, switches, communication and point wiring, and location and installation of all sensors and control devices.
   2. Hardware maintenance, calibration, troubleshooting, diagnostics, and repair instructions.
   3. Operation of man-machine interface including logging On/Off, interrogating the system, producing reports, acknowledging alarms, overriding computer control, and changing firmware/software parameters.
   4. Programming the BAS using the editor and the design of custom control software.

5. Recovery procedures from both BAS and HVAC failures.

B. The Instructor for the above session shall be an employee of the Contractor, who is qualified to provide customer training and applications support.

END OF SECTION 230900

SECTION 231123 - NATURAL GAS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes Distribution Piping Systems for natural gas within the building and extending from the point of delivery to the connections with gas utilization devices. Piping materials and equipment specified in this section include:
   1. Pipes, Fittings, and Specialties
   2. Special Duty Valves

B. Gas pressures for systems specified in this section are limited to 5 psig.

C. Products installed but not furnished under this section include gas meters, which will be provided by Xcel Energy to the site ready for installation. Coordinate work with Xcel Energy:

1.2 DEFINITIONS

A. Pipe sizes used in this specification are Nominal Pipe Size (NPS).

B. Gas Distribution Piping: A pipe within the building, which conveys gas from the point of delivery to the points of usage.

C. Gas Service Piping: The pipe from the gas main or other source of supply including the meter, regulating valve, or service valve to the gas distribution system of the building served.

D. Point of Delivery is the outlet of the service meter assembly, or the outlet of the service regulator (service shutoff valve when no meter is provided).

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of natural gas systems products, of types, materials, sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer Qualifications: Installation and replacement of gas piping, gas utilization equipment or accessories, and repair and servicing of equipment shall be performed only by a qualified installer. The term qualified is defined as experienced in such work (experienced shall mean having a minimum of five (5) previous projects similar in size and scope to this project), familiar with precautions required, and has complied with the requirements of the Authority Having Jurisdiction. Upon request, submit evidence of such qualifications to the Architect.

C. Qualifications for Welding Processes and Operators: Comply with the requirements of ASME Boiler and Pressure Vessel Code, "Welding and Brazing Qualification".

D. Regulatory Requirements: Comply with the requirements of the following codes:

1. NFPA 54 - National Fuel Gas Code, for gas piping materials and components, gas piping installations, and inspection, testing, and purging of gas piping systems.
2. Local Building Code.
3. Utility Compliance: Fabricate and install natural gas systems in accordance with Local Gas Utility Company.
4. UMC Compliance: Fabricate and install natural gas systems in accordance with IAPMO "Uniform Mechanical Code".

1.4 SUBMITTALS

A. Submit in accordance with Division 1.

B. Welders' qualification certificates, certifying that welders comply with the quality requirements specified under "Quality Assurance" below.

1.5 CLOSEOUT SUBMITTALS

A. Submit in accordance with Division 1.

B. Spare Parts: Furnish to Owner, with receipt, two (2) valve wrenches for each type of gas valve installed.

C. Test Reports specified in PART 3 below.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and legally dispose of liquid from drips in existing gas piping and handle cautiously to avoid spillage or ignition. Notify the gas supplier. Handle flammable liquids used by the installer with proper precautions, and do not leave on the premises from the end of one (1) working day to the beginning of the next.

1.7 SEQUENCING AND SCHEDULING

A. Notification of Interruption of Service: Except in the case of an emergency, notify all affected users when the gas supply is to be turned off.

B. Work Interruptions: When interruptions in work occur while repairs or alterations are being made to an existing piping system, leave the system in safe condition.

C. Coordinate the installation of pipe sleeves for foundation wall penetrations.

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

A. Above Grade Exposed Locations:
   1. Pipe 2-Inches and Smaller: ASTM A 53, Grade B, Type E, Schedule 40 black steel pipe, electric resistance welded.
      a. Fittings:
         1) Malleable Iron Threaded Fittings: ANSI B16.3; (Class 125 and 300).
         2) Malleable Iron Threaded Unions: ANSI B16.30, Class 150, 250 or 300; selected by Installer for proper piping fabrication and service requirements, including style, end connections, and metal-to-metal seats (iron, bronze or brass).
         3) Forged Steel Socket-Welded and Threaded Fittings: ANSI B16.11, except MSS SP-79 for threaded reducer inserts; rated to match schedule of connected pipe (up to 4-inch pipe size).
   2. Pipe 2-1/2 Inch and Larger: ASTM A 53, Grade B, Type S, Schedule 40 seamless black steel pipe.
      a. Fittings:
         1) Steel Flanges/Fittings: ANSI B16.5, including bolting and gasketing of the following material group, end connection and facing, except as otherwise indicated.
            a) Material Group: Group 1.1
            b) End Connections: Butt-weld
            c) Facings: Raised-face
         2) Forged Steel Socket-Welded and Threaded Fittings: ANSI B16.11, except MSS SP-79 for threaded reducer inserts; rated to match schedule of connected pipe (up to 4-inch pipe size).
         3) Wrought Steel Butt-Welded Fittings: ANSI B16.9, except ANSI B16.28 for short-radius elbows and returns; rated to match connected pipe.

B. Above Grade Concealed Locations:
   1. Piping all sizes: ASTM A 53, Grade B, Type S, Schedule 40 seamless black steel pipe.
      a. Fittings:
         1) Steel Flanges/Fittings: ANSI B16.5, including bolting and gasketing of the following material group, end connection and facing, except as otherwise indicated.
            a) Material Group: Group 1.1
            b) End Connections: Butt weld
            c) Facings: Raised-face
         2) Wrought Steel Butt-Welded Fittings: ANSI B16.9, except ANSI B16.28 for short-radius elbows and returns; rated to match connected pipe.

C. Below Grade:
   1. Piping all sizes: ASTM A 53, Grade B, Type S, Schedule 40 seamless black steel pipe.
      a. Fittings:
         1) Steel Flanges/Fittings: ANSI B16.5, including bolting and gasketing of the following material group, end connection and facing, except as otherwise indicated.
            a) Material Group: Group 1.1

b) End Connections: Butt-weld
c) Facings: Raised-face

2. Wrought Steel Butt-Welded Fittings: ANSI B16.9, except ANSI B16.28 for short-radius elbows and returns; rated to match connected pipe.
   a. Corrosion Protection:
      1) Provide factory applied polyethylene tape, having the following properties:
         a) Overall thickness; 20 mils
         b) Synthetic adhesive
         c) Water vapor transmission rate less than 0.10 Gal./100 sq in
         d) Water absorption less than 0.02 percent
         e) Prime pipe and fittings with a compatible primer prior to application of tape
         f) Pipe wrapping shall conform to the following schedule:

Pipe Size	TapeWidth	Scotchwrap No.	
		Standard	Cold
1/4 - 3/4 Inch	1-inch	50	40
1 - 1-1/2 Inch	2 or 4-inch	50	40
2-Inch and Larger	4-inch	50	40
Color backing		Black	Green

         g) During application of wrap, if the ambient temperature is 40 degree F or less, use only Scotchwrap No. 40 tape. If ambient temperature is 40 degree F or more, use only Scotchwrap No. 50.
   b. Cathodic Protection.

2.2 NATURAL GAS PIPING SPECIALTIES

A. Gas Meters: Diaphragm-type, positive displacement gas meters with aluminum cases, temperature compensated, with internal corrosion-resistant components; threaded ends for 2-inch and smaller, flanged ends for 2-1/2 inch and larger; for gas working pressures, specific gravity, and volume flow indicated.

2.3 VALVES

A. Special Duty Valves are specified in this section by their generic name. Refer to PART 3, "VALVE APPLICATION", for specific uses and applications for valve specified.

B. Gas Cocks 2-Inch and Smaller: 150 psi WOG, bronze body, straightaway pattern, square head, threaded ends. Acceptable Manufacturers: Lunkenheimer, Nibco, Powell, Stockham.

C. Gas Cocks 2-1/2 Inch and Larger: MSS SP-78; 175 psi, lubricated plug type, semi-steel body, single gland, wrench operated, flanged ends. Acceptable Manufacturers: Lunkenheimer, Nibco, Powell, Stockham.

D. Gas Line Pressure Regulators: Single-stage, steel jacketed, corrosion-resistant gas pressure regulators; with atmospheric vent, elevation compensator; with threaded ends for 2-inch and smaller, flanged ends for 2-1/2 inch and larger; for inlet and outlet gas pressures, specific gravity, and volume flow indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Precautions: Before turning off the gas to the premises, or section of piping, turn off all equipment valves. Perform a leakage test as specified in "FIELD QUALITY CONTROL" below, to determine that all equipment is turned off in the piping section to be affected.

B. Conform to the requirements in NFPA 54, for the prevention of accidental ignition.

3.2 PIPING INSTALLATION

A. Conform to the requirements of NFPA 54 - National Fuel Gas Code.

B. Locations and Arrangements: Drawings indicate the general location and arrangement of piping systems. Design locations and arrangements of piping take into consideration pipe sizing, flow direction, slope of pipe, expansion, and other design considerations. So far as practical, install piping as indicated.

C. Concealed Locations: Except as specified below, install concealed gas piping in an airtight conduit constructed of Schedule 40, seamless Black steel with welded joints. Vent conduit to the outside and terminate with a screened vent cap.
   1. Above-Ceiling Locations: Gas piping may be installed in accessible above-ceiling spaces (subject to the approval of the Authority Having Jurisdiction), whether or not such spaces are used as a plenum. Valves shall not be located in such spaces.
   2. Piping In Partitions: Concealed piping shall not be located in solid partitions. Tubing shall not be run inside hollow walls or partitions unless protected against physical damage. This does not apply to tubing passing through walls or partitions.
   3. Prohibited Locations: Do not install gas piping in or through a circulating air duct or plenum, clothes chute, chimney or gas vent, ventilating duct, dumb waiter or elevator shaft. This does not apply to accessible above-ceiling space specified above. Piping shall not be installed beneath slab on grade floors or in floor plenum.

D. Install pipe sleeve and seals at foundation and basement wall penetrations.

E. Seal pipe penetrations of fire barriers using fire barrier penetration sealers.

F. Drips and Sediment Traps: Install a drip leg at points where condensate may collect, at the outlet of the gas meter, and in a location readily accessible to permit cleaning and emptying. Do not install drips where condensate is likely to freeze.
   1. Construct drips and sediment traps using a tee fitting with the bottom outlet plugged or capped. Use a minimum of three (3) pipe diameters in length for the drip leg. Use same size pipe for drip leg as the connected pipe.

G. Use fittings for all changes in direction and all branch connections.

H. Install gas piping at a uniform grade upward to risers, and from the risers to the meter, or service regulator when meter is not provided, or the equipment.

I. Connect branch outlet pipes from the top of horizontal lines, not from the bottom or sides.

3.3 NATURAL GAS PIPING SPECIALTIES

A. Gas Meters:
   1. Prepare for installation of gas meter in accordance with local Utility Company's installation instructions, and comply with requirements.
   2. Set meter on concrete pad.
   3. SubMeters: Provide a contracting head type gas submeter with remote readout interface with the BAS System. Coordinate with Section 23 09 00 – Direct Digital Control Systems.

B. Protective Coating:
   1. Provide protective coating on piping and fittings that will be in contact with material or atmosphere exerting a corrosive action, or piping buried in floors. Protective coating shall be applied at the factory.

C. Gas Regulators shall be vented throughout the roof to outdoors.

3.4 VALVE APPLICATIONS

A. General: The Drawings indicate valve, locations, and arrangements.

B. Shutoff Duty: Use gas cocks or gas-rated ball valves.

3.5 VALVE INSTALLATIONS

A. Install valves in accessible locations, protected from physical damage.

B. Install a gas cock upstream of each gas pressure regulator. Where two (2) gas pressure regulators are installed in series in a single gas line, a manual valve is not required at the second regulator.

C. Install pressure relief or pressure limiting devices so they can be readily operated to determine if the valve is free; so they can be tested to determine the pressure at which they will operate; and examined for leakage when in the closed position. Pipe atmospheric vent to outdoors.

D. Valves shall be installed with unions or other means to facilitate removal or repair without disassembly of connecting piping.

3.6 TERMINAL EQUIPMENT CONNECTIONS

A. Install gas cock upstream and within 6-feet of gas appliance. Install a union or flanged connection downstream from the gas cock to permit removal of controls.

B. Sediment Traps: Install a tee fitting with the bottom outlet plugged or capped as close to the inlet of the gas appliance as practical. Drip leg shall be a minimum of three (3) pipe diameters in length.

3.7 ELECTRICAL BONDING AND GROUNDING

A. Install above ground portions of gas piping systems, upstream from equipment shutoff valves electrically continuous and bonded to a grounding electrode in accordance with NFPA 70 - "National Electrical Code".

B. Do not use gas piping as a grounding electrode.

C. Conform to NFPA 70 - "National Electrical Code," for electrical connections between wiring and electrically operated control devices.

3.8 FIELD QUALITY CONTROL

A. Piping Tests: Inspect, test, and purge natural gas systems in accordance with NFPA 54, and Local Utility requirements.

B. Test system before covering underground lines.

C. Submit written results of tests to Architect/Engineer.

END OF SECTION 231123

SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This section consists of furnishing and installing piping systems associated with heating, chilled, and condenser water systems.

1.2 QUALITY ASSURANCE

A. Comply with ASME B31.9 (Building Service Piping Code) for materials, products, installation, and testing.

B. Pipe and Fitting Manufacturer's Qualifications: Firms regularly engaged in manufacture of pipes and pipe fittings of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

C. Welder's Qualifications: All welders shall be qualified in accordance with ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.

D. Before any welding is performed, the Contractor shall submit to the Architect/Engineer, a copy of the Manufacturer's Record of Welder or Welding Operator Qualification Tests and his Welding Procedure Specification together with the Procedure Qualification Record as required by Section IX of ASME Boiler and Pressure Vessel Code.

E. Each manufacturer or contractor shall be responsible for the quality of welding done by his organization and shall repair or replace any work not in accordance with these specifications.

F. Soldering and Brazing Procedures shall conform to ANSI B9.1 Standard Safety Code for Mechanical Refrigeration.

1.3 SUBMITTALS

A. Submit under provisions of Division 1.

B. Welding Certifications: Submit reports as required for piping work.

C. Brazing Certifications: Submit reports as required for piping work.

1.4 CLOSEOUT SUBMITTALS

A. Submit under provisions of Division 1. Additionally, submit the following information:
   1. Valve Schedule for all Valves. For each valve, list valve designation number, valve type, size, location, and function.
   2. Written report certifying leak testing.

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

A. General: Working pressure and temperature maximums, 125 psi and 250 degrees F; water service.

B. Copper Pipe: ASTM B88, hard-drawn copper tube, Type K for below ground lines and Type L for above ground lines.
   1. Fittings:
      a. Wrought copper solder joint fittings, ASME B16.22
      b. Bronze pipe flanges/fittings, ANSI B16.24 (Class 150 and 300)
      c. Mechanical Pressure-Seal Fittings as manufactured by Viega or Nibco.
   2. Joining Material:
      a. Solder:
         1) ASTM B32, 95-5 tin-antimony, Grade 95TA
         2) ASTM B32 (NSF), Silver-Tin-Copper Alloy
      b. Brazing: AWS A5.8, for underground lines and where copper pipe is connected to brass.
         1) Copper phosphorus-Bcup
         2) Silver-BAg
      c. Pro Press: ASME B16.18/ASME B 16.22, performance criteria of IAPMO PS 117; sealing element shall be EPDM.
   3. Unions: ASME B16.22-95. Wrought copper solder joint, ground seat.

C. Steel Pipe:
   1. ASTM A53, Schedule 40, black steel pipe. (Grade B, Type E, electric resistance welded) (Grade B, Type S or A106 high temperature; seamless)
   2. Fittings:
      a. Threaded: ASME B16.4, Class 125, cast iron, or ASME B16.3, Class 150, malleable-iron. Standard pattern for threaded joints. Threads shall conform to ASME B1.20.1-83.
      b. Flanged: ASME B16.1, Class 125, cast iron, raised ground face, bolt holes spot faced.
         1) Gaskets: ANSI B16.21, full-faced for cast iron flanges, raised face for steel flanges.
      c. Welded: ASTM A234, standard weight, seamless black steel, butt weld.
   3. Unions: ASME B16.39-86, malleable-iron, Class 150, hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces; female threaded ends.

2.2 VALVES

A. General:
   1. Comply with MSS-92 1980 "Valve Users Manual".
   2. Sizes: Provide valves of same size as upstream pipe size. Size control valves for required flow.

B. Extended Stems: Where insulation is indicated or specified, provide extended stems to allow full operation of the valve without interference by the insulation.

C. Bypass and Drain Connections: Comply with MSS SP-45.

D. End Connections: As specified in the individual valves specifications.
   1. Threads: Comply with ANSI B2.1.
   2. Flanges: Comply with ANSI B16.1 for cast iron, ANSI B16.5 for steel, and ANSI B16.24 for bronze.
   3. Solder-Joint: Comply with ANSI B16.18. Where soldered end connections are used, use solder having a melting point below 840 degree F for gate, globe, and check valves and below 421 degree F for ball valves.

E. Ball Valves:
   1. 3-Inch and Smaller: MSS-SP-110, 150 psi SWP, 600 psi BOG, two-piece ASTM B584 cast bronze body, full port, chrome plated brass/bronze ball, TFE seats, anti-blowout stem separate packnut with adjustable stem packing, extended stem, and vinyl covered steel handle. Threaded or soldered end connections.
   2. Acceptable Manufacturers:
      a. Nibco T/S 585-70
      b. Milwaukee
      c. Apollo (Conbraco)
      d. Watts
      e. Grinnell

F. Globe Valves:
   1. 2-1/2 Inch and Smaller: MSS SP-80, Class 150, ASTM B62 bronze body and bonnet, TFE seat disc and malleable iron or ductile iron hand wheel, union bonnet, non-asbestos packing, silicon bronze ASTM B371 or low-zinc alloy B-99 stem. Threaded or soldered end connections.
      a. Acceptable Manufacturers:
         1) Nibco T/S 235-4
         2) Milwaukee
         3) Hammond
         4) Stockham
         5) Grinnell
   2. 3-Inch and Larger: MSS SP-85, Class 125, ASTM A126, Class B cast iron body and bolted bonnet, cast bronze or cast iron disc and cast iron or malleable iron hand wheel, non-asbestos packing, bronze trimmed, OS&Y. Flanged end connection
      a. Acceptable Manufacturers:
         1) Nibco F718-B
         2) Milwaukee
         3) Hammond
         4) Stockham
         5) Grinnell

G. Butterfly Valves:
   1. 4-Inch and Larger: MSS-SP-67, ASTM A126, Class B fully lugged cast iron body, ASTM B148 aluminum bronze disc, ASTM A582 416 stainless steel stem, EPDM liner, bronze bearings, non-metallic bushing and NBR stem seals. Rated for 250 psi bi-directional shutoff and 250 psi dead-end service with downstream piping removed. Provide extended neck for insulation. Sizes 4"–6" shall be lever operated with 10-position throttling plate; sizes 8-inch and larger shall have weatherproof gear operators.
      a. Acceptable Manufacturers

1) Keystone Figure 222
2) Nibco
3) Milwaukee
4) Stockham
5) Centerline
6) Watts
7) Grinnell
8) Apollo
9) Victaulic
10) DeZurik

H. Check Valves:
1. Swing Check Valve:
a. 2-1/2 Inch and Smaller: MSS SP-80; Class 150 SWP, ASTM B62 bronze body and bonnet, horizontal swing design, Y-pattern, with TFE seat disc. Threaded or soldered end connections.
1) Acceptable Manufacturers:
a) Nibco T/S 433-Y
b) Milwaukee
c) Grinnell
d) Stockham
b. 3-Inch and Larger: MSS SP-71; Class 125, ASTM A126 Class B cast iron body with bronze trim, non-asbestos gasket, horizontal swing, and flanged ends
1) Acceptable Manufacturers:
a) Nibco F918-B
b) Milwaukee
c) Stockham
d) Hammond
e) Grinnell

I. Drain Valve: Ball valve with threaded hose end and cap with chain. Apollo Fig. 78-100/78-200 Series

2.3 PIPING ACCESSORIES

A. Test Taps:
1. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
a. Fairfax Company
b. Peterson Engineering Company
c. Universal Lancaster
d. Sisco
e. MG Piping Products Company
2. Combination pressure and temperature test taps consisting of 1/4-inch or 1/2-inch nickel plated brass body, MPT fitting designed to receive either temperature or pressure probe, and gasketed and threaded cap with retention chain.

B. Drain Pans: Minimum 18 gauge stainless steel, reinforced to support weight of drain pan and water. Provide not less than 2-inch deep, with a 3/4-inch drain connection.

2.4 EXPANSION TANKS

A. Manufacturer: Subject to compliance with requirements, provide products by the manufacturers listed:
   1. Amtrol, Inc.
   2. Armstrong Pumps, Inc.
   3. Bell & Gossett ITT; Fluid Handling Division
   4. Taco, Inc.
   5. John Wood Company

B. Diaphragm Type: Welded steel tank suitable for 125 psig working pressure, 350 degrees maximum operating temperature; constructed, tested, and labeled in accordance with ASME Pressure Vessel Code. Flexible diaphragm separates air charge from system water. Include taps for pressure gauge, air charge fitting, and drain.

PART 3 - EXECUTION

3.1 PIPE APPLICATIONS

A. 2-Inches and Smaller:
   1. Black Steel: Install steel pipe with threaded joints and fittings.
   2. Copper Pipe:
      a. Install Type L copper pipe with wrought copper fittings and solder joints, above ground, within building.
      b. Install Type K copper pipe with wrought copper fittings and brazed alloy joints below ground.
      c. Contractor Option: Pro-Press Pressure-Seal Fittings with Type 2 pipe above ground within the Building.

B. 2-1/2 Inches and Larger: Install black steel pipe.
   1. Welded and Flanged Joints: Install welded fittings on pipe 2-1/2 inches and larger.
   2. Grooved Couplings and Mechanical Fittings: Install mechanical grooved end pipe on condenser water piping.

3.2 PIPING INSTALLATION, GENERAL

A. Arrange piping in horizontal groups, each group to be in one plane. Maintain indicated slope.

B. Conceal pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors.

C. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Install piping parallel to permanent elements of building. Provide space to permit insulation applications, with 1-inch clearance outside insulation. Provide 2-inch space above removable ceiling panels to allow for panel removal.

D. Fire and Smoke Wall Penetrations: Maintain the fire and smoke rated integrity where pipes pass through fire and smoke rated walls, partitions, ceilings, and floors. Refer to Section 230500.

E. Sloping, Air Venting, and Draining:
   1. Install piping true to line and grade, and free of traps and air pockets. Install piping level except for gravity flow systems such as condenser water and condensate drain piping.
   2. Connect branch piping to bottom of mains, except for up-feed risers, which shall have take-off out top of main.
   3. Install manual air vents at high points in hydronic piping systems and at all coils. Provide 1/4-inch copper, 180 degree bend pipe to discharge vented water into can.
   4. Install automatic air vent on air separator and where shown. Provide valved inlet and route discharge pipe to floor drain.
   5. Install drain valves with hose adapters at low points in mains, risers, and branch lines. Drain consists of a tee fitting, 3/4-inch ball valve, and short 3/4-inch threaded nipple and cap.

F. Fittings: Standard manufactured fittings. Field fabricated fittings and bushings are prohibited on all piping.

G. Make reductions in pipe sizes using eccentric reducer fitting installed with the level side up.

H. Unions: Install unions in pipes 2-inch and smaller, adjacent to each valve, at final connections of each piece of equipment and elsewhere to permit alterations and repairs. Install dielectric waterway fittings to join dissimilar metals. Unions are not required on flanged devices. DO NOT USE DIELECTRIC UNIONS.

I. Flanges: Install flanges on valves and equipment having 2-1/2 inch and larger connections.

J. Joints:
   1. Threaded Joints: Apply Teflon tape to male equipment threads. Do not use pipe with threads that are corroded or damaged.
   2. Soldered Joints: Comply with AWS Soldering Manual-98.

K. Keep openings in piping closed during construction to prevent entrance of foreign matter.

L. Install flexible connectors at inlet and discharge connections to base-mounted pumps and other vibration producing equipment.

M. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical spaces.

N. Pro-Press Pressure-Seal Fittings shall have EPDM seal material compatible with glycol, chemical treatment, corrosion inhibiters, etc. Comply with manufacturer's printed instructions.

3.3 VALVES

A. Field check valves for packing and lubricant. Replace leaking packing. Service valves with lubricant for smooth and proper operation before placing in service.

B. Install valves accessible from floor level, located for easy access.

C. Install valves in horizontal piping with stem at or above center of pipe. Install valves in position to allow full stem movement. Provide operating handles for valves and cocks without integral operators.

D. Provide extended valve stems where insulation is specified.

E. Provide separate support where necessary.

F. Where soldered end connections are used for valves, use solder having a melting point below 840 degrees F for gate, globe, and check valves; below 421 degrees F for ball valves.

G. Provide valves same size as line size.

H. Provide drain valves and hose adapters at strainers for blowoff; same size as strainer blowoff connection.

I. Check Valves:
   1. Install check valves for proper direction of flow as follows:
      a. Swing Check Valve: Horizontal position with hinge pin level.

J. Valve End Selection: Select valves with the following ends or types of pipe/tube connections:
   1. Copper Tube Size 2-Inch and Smaller: Threaded of solder ends.
   2. Steel Pipe Sizes 2-Inch and Smaller: Threaded or grooved-end.
   3. Steel Pipe Sizes 2-1/2 Inch and Larger: Flanged or grooved end.

K. Valve Application: Install valves in accordance with the following table.

SERVICE	**VALVE TYPE**
Hydronic Isolation; 2" and Smaller	Ball Valve
Hydronic Isolation; 2-1/2" and Larger	Butterfly Valve
Hydronic Throttling or Bypass Valve; All Sizes	Globe Valve
Hydronic Balancing Valve; 2" and Smaller	Calibrated Balancing Valve
Hydronic Balancing Valve; 2-1/2" and Larger	Calibrated Balancing Valve
Hydronic Pump Discharge Check Valves; 2" & Smaller	Swing Check
Hydronic Pump Discharge Check Valve; 2-1/2" & Larger	Wafer Check Valve

3.4 EQUIPMENT PIPING

A. Provide combination balancing and shutoff valves to regulate water flow through piping, coils, and at other equipment and piping where shown or required for proportioning flow.

3.5 DRAIN PANS

A. Install drain pan under the entire length of any piping, including valves, joints, and fittings installed over motor, motor starter, switch gear, transformer, or other electrical equipment and under all piping located anywhere in any transformer vault, electrical switchboard room, and telephone equipment room. Pipe drain connection to discharge where shown or at nearest floor drain.

3.6 TESTING

A. General: Provide temporary equipment for testing including pump and gauges. Test before insulation is installed. Test piping to be concealed prior to permanent enclosure.

B. Provide the Engineer a minimum of twenty-four hours notice of dates when acceptance test will be conducted. Conduct tests in presence of representative of agency having jurisdiction.

C. Test piping systems using ambient temperature water, except where there is risk of damage due to freezing. Engineer approval is required prior to testing if other than hydrostatic tests are used.

D. Use vents installed at high points in the direction of flow, in the system to release trapped air while filling the system. Use drains installed at low points for complete removal of the liquid.

E. Examine system to see that equipment and parts that cannot withstand test pressures are properly isolated.

F. System Tests:
   1. Hydrostatic Test: Pressurize the system to 100 psig or 1.5 times the design pressure, whichever is greater. Maintain pressure until the entire system has been inspected for leaks, but in no case for a time period of less than four (4) hours.
   2. Maintain test pressure until the entire system has been inspected for leaks, but in no case less than four hours. Examine all piping, joints, and connections for leakage.

G. Repair failed piping sections by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

H. Drain test water after testing and repair work has been completed.

I. Prepare written report of testing, indicating locations of leaks corrected, method used to correct leaks, number of tests required, and certification that system is leak free. Provide three (3) copies of test results.

3.7 ADJUSTING AND CLEANING

A. Flush system with clean water. Remove, clean, and replace strainer screens.

B. After cleaning and flushing but before balancing, remove disposable fine mesh strainers in pump suction diffusers.

3.8 TRAINING

A. Provide two (2) hours of instruction on hydronic systems. Include following items as a minimum:
   1. Location of automatic and manual air vents.
   2. Location of strainers and blow down valves.
   3. Location of safety and relief valves.
   4. System drain valves.
   5. System fill and associated devices.

END OF SECTION 232113

SECTION 232123 - HVAC PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of HVAC Pumps Work required by this section is indicated on drawings and schedules, and by requirements of this section.

B. Types of Pumps specified in this section include the following:
   1. In-Line Circulator
   2. Vertical In-Line

C. Pumps furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 23 sections.

D. Refer to other Division 23 sections for other work; not work of this section.

E. Refer to Division 26 sections for the following work; not work of this section.
   1. Power supply wiring from power source to power connection on pumps. This Contractor shall include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.
   2. Interlock wiring between pumps; and between pumps and field-installed control devices.
      a. Interlock wiring specified as factory-installed is work of this section.

F. Provide the following Electrical Work as work of this section, complying with requirements of Division 26 sections:
   1. Control Wiring between field-installed controls, indicating devices, and pump control panels.
      a. Control Wiring specified as work of Division 23 for Automatic Temperature Controls is work of that section.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of general-use centrifugal pumps with characteristics, sizes and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:
   1. HI Compliance: Design, manufacture, and install HVAC pumps in accordance with HI "Hydraulic Institute Standards".
   2. UL Compliance: Design, manufacture, and install HVAC pumps in accordance with UL 778 "Motor Operated Water Pumps".
   3. UL and NEMA Compliance: Provide electric motors and components which are listed and labeled by Underwriters Laboratories and comply with NEMA Standards.

C. Certification, Pump Performance: Provide pumps whose performances, under specified operating conditions, are certified by manufacturer.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's pump specifications, installation and start-up instructions, and current accurate pump characteristic performance curves with selection points clearly indicated.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to HVAC pumps. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

D. Record Drawings: At project closeout, submit record drawings of installed systems products in accordance with requirements of Division 1.

E. Maintenance Data: Submit maintenance data and parts lists for each type of pump, control, and accessory; including "trouble-shooting" maintenance guide. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual; in accordance with requirements of Division 1.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Handle HVAC pumps and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged HVAC pumps or components; replace with new.

B. Store HVAC pumps and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

C. Comply with Manufacturer's rigging and installation instructions for unloading HVAC pumps, and moving them to final location.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. In-Line Circulator Pumps:
      a. Armstrong Pumps, Inc.
      b. Bell & Gossett ITT; Fluid Handling Division
      c. Taco
   2. Vertical In-line Pumps:
      a. Armstrong Pumps, Inc.
      b. Bell & Gossett ITT; Fluid Handling Division
      c. Taco

2.2 PUMPS

A. General: Provide factory-tested pumps, thoroughly cleaned, and painted with one (1) coat of machinery enamel prior to shipment. Type, size, and capacity of each pump is listed in pump schedule. Provide pumps of same type by same manufacturer.

B. Pump motor shall be sized so as not to be overloaded at any point along impeller curve for specified performance.

C. All pump couplers shall be suitable for both constant speed and variable speed operation.

2.3 IN-LINE CIRCULATOR PUMPS

A. General: Provide bronze fitted in-line circulator pumps where indicated, and of capacities as scheduled.

B. Type: Horizontal mount, vertical split case, oil-lubricated, designed for 125 psi working pressure, and 225 degree F (107 degree C) continuous water temperature.

C. Body: Cast iron, with flanged suction and discharge and gauge tappings.

D. Shaft: Hardened alloy steel.

E. Bearings: Oil-lubricated bronze journal bearings.

F. Seal: Mechanical, with carbon seal ring and ceramic seat.

G. Motor: Pump motor shall be non-overloading at any point on pump curve and meet requirements of Section 230513.

H. Coupling: Self-aligning, flexible coupling.

I. Impeller: Brass or Bronze enclosed type, hydraulically and dynamically balanced, and keyed to shaft.

2.4 VERTICAL IN-LINE PUMPS

A. General: Provide bronze fitted vertical in-line pumps where indicated, and of capacities as scheduled.

B. Type: Vertical mount, in-line, close-coupled, single stage, designed for 175 psi working pressure.

C. Body: Cast iron, 125 psi ANSI flanges of equal size, tappings for gauge and drain fittings.

D. Shaft: Steel with replaceable shaft sleeve.

E. Seal: Mechanical seal with ceramic seal seat.

F. Motor: Pump motor shall be non-overloading at any point on pump curve, open and meet requirements of Section 230513.

G. Impeller: Bronze enclosed type, hydraulically and dynamically balanced, keyed to shaft and secured with locking screw. Assembly components shall be 304 stainless steel.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which HVAC pumps are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF PUMPS

A. General: Install HVAC pumps where indicated, in accordance with manufacturer's published installation instructions, complying with recognized industry practices to ensure that HVAC pumps comply with requirements and serve intended purposes.

B. Access: Provide access space around HVAC pumps for service as indicated, but in no case less than that recommended by manufacturer.

C. Support: Install in-line pumps, supported from piping system.

D. Support: Refer to Division 23 section "Vibration Control" for support and mounting requirements of HVAC pumps.

E. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment Installer.

F. Piping Connections: Provide system return connection to inlet strainer with valved bypass to drain. Provide pump discharge connections with check valve, shutoff valve, and balancing valve for each pump.

3.3 ADJUSTING AND CLEANING

A. Alignment: Adjust shafts of all motors and pumps within recommended tolerances by manufacturer, and in presence of manufacturer's service representative.

B. Start-Up: Lubricate pumps before start-up. Start-up in accordance with manufacturer's instructions.

C. Refer to Division 23, Section 230593, for pump system balancing; not work of this section.

D. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 232123

SECTION 232500 - WATER TREATMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of Water Treatment System Work required by this section includes necessary equipment, chemicals, and service for the following systems:
   1. Closed Hot Water Systems

B. Provide chemicals and service program for a period of one (1) year from start-up date of equipment, including the following:
   1. Initial water analysis and recommendations.
   2. Systems start-up assistance.
   3. Training of operating personnel.
   4. Periodic field service and consultation.
   5. Customer report charts and log sheets.
   6. Laboratory technical assistance.

1.2 QUALITY ASSURANCE

A. Manufacturer's and Representative Qualifications. Firms regularly engaged in manufacture of water treatment equipment, chemical and service shall have been active in the field of industrial water treatment and whose products have been in satisfactory use in similar service for not less than five (5) years, and shall have full-time service personnel located within the trading area of job site.

B. Codes and Standards:
   1. ASME Compliance: Construct softener tanks in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, provide stamp and certification.
   2. UL Labels: Provide water conditioners ancillary electrical components which have been listed and labeled by UL.
   3. NEMA Standards: Provide electrical controls and enclosures conforming to applicable standards of NEMA for environment where water conditioners are indicated.
   4. NSF Compliance: Construct and install water conditioners in accordance with NSF Standard 44 "Cation Exchange Water Softeners Relating to Supplementary Treatment of Potable Water".
   5. Chemical Standards: Provide only chemical products which are acceptable under state and local public health and pollution control regulations.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product including rated capacities of selected equipment clearly indicating water pressure drops, weights, installation and start-up instructions, and furnished specialties and accessories.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to water treatment equipment. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

D. Record Drawings: At project closeout, submit record drawings of installed systems products in accordance with requirements of Divisions 1 and 23.

E. Maintenance Data: Submit maintenance data and parts list for each item of equipment, control, and accessory; including "trouble-shooting" maintenance guide. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual, in accordance with requirements of Division 23.

1.4 DELIVERY, STORAGE AND HANDLING

A. Handle water treatment materials and components carefully to prevent damage, breaking, denting and scoring to materials and equipment. Deliver packaged units in original crates. Do not install damaged water treatment materials and components; remove from site and replace with new.

B. Store water treatment materials and components in an environment satisfactory to prevent their damage by the elements.

1.5 EXTENDED MAINTENANCE SERVICES

A. Agreement to Maintain: Prior to time of final acceptance, submit four (4) copies of "Agreement for Continued Service and Maintenance" for water treatment system, for Owner's possible acceptance. Offer terms and conditions for furnishing chemicals and providing continued testing and servicing, and including replacement of materials and equipment, for one (1) year period with option for renewal of Agreement by Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. Water Treatment System:
      a. Calgon Corporation
      b. Dearborn Chemical Division
      c. Garrett Callahan Co.
      d. H-O-H Chemical Inc.
      e. Mogul Division
      f. Sage Industry Inc.

g. International Chemtex
2. Water Conditioners and Filtering Equipment:
   a. Columbia Water Conditioning Co.
   b. Permuitt
   c. Culligan
3. Filter Feeder:
   a. Bruner

2.2 CLOSED SYSTEMS

A. Provide a closed system chemical feed and control system sized and equipped to treat the raw makeup water available at the project site.

B. Except as otherwise indicated, provide closed water treatment system of manufacturer's standard materials and components as indicated by published product information, and as recommended by manufacturer for application indicated.

C. BY-PASS FEEDER:
   1. Provide a By-Pass Feeder for adding chemical to the closed water system. The Feeder shall have two (2) 3/4-inch NPT female pipe connections, and a 3-1/2 inch quick top opening cap, with 0-ring seat. Capacity of the Feeder shall be 5 gallons, capable of operating at 250 psig and at a temperature up to 212 degree F. The By-Pass feeder shall be mounted no higher from the floor than 48-inches.

PART 3 - EXECUTION

3.1 CLEANING OF PIPE LINES AND BOILERS

A. The Water Treatment Contractor shall be responsible for furnishing the cleaning material and supervising the chemical cleaning of the chilled and/or heating piping.

B. The system to be cleaned shall be filled with a solution of 10 percent by weight of a heavy duty alkaline liquid cleaner. The cleaner shall be capable for wetting and penetrating heavy soil deposits of oil or grease, and keeping these products in suspension, for removal through a strainer.

C. The cleaning solution shall be circulated for a minimum of eight (8) hours. Clean all strainers.

D. At the end of the cleaning period, the alkalinity in the system shall be reduced to the pH of the incoming raw water. The system shall then be chemically treated as specified. In no case shall the system being cleaned be left in an untreated condition for more than eight (8) hours.

E. At the conclusion of the cleaning operation, the Water Treatment Contractor shall certify in writing that the system was cleaned as specified.

3.2 TESTING

A. Closed Systems:
   1. Provide a Nitrite "Drop Test" kit for determining the level of Nitrite or Molybdate in the closed system.

3.3 INSTALLATION

A. Coordination where installation of Water Treatment equipment in piping systems is required with the other work (plumbing and heating piping) as necessary to interface components of water treatment equipment. Provide installation instructions to those firms providing installation.

B. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
   1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to Equipment Installer.
   2. Install pressure gauges, valves, and controls furnished by manufacturer, in accordance with manufacturer's instructions.

3.4 INSPECTION

A. Examine areas and conditions under which water treatment systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.5 FIELD QUALITY CONTROL

A. Sample water softener effluent at one (1) week intervals after start-up for period of three (3) weeks and prepare test report on the conditions of the water.

3.6 SYSTEM START-UP

A. The Water Treatment Supplier shall put the system into operation, and make adjustments necessary for proper operation.

B. The Water Treatment Supplier shall provide a written report to the Division 23 Contractor indicating that the start-up has been completed and that all Water Treatment Equipment is operating properly.

3.7 TESTING AND CLEANING

A. Sample all treated water systems at one (1) week intervals after start-up for period of four (4) weeks and prepare certified test report for each system being treated.

B. Start-up test, and adjust water conditioners in presence of manufacturer's authorized representative. Operate units including regeneration, back washing, rinsing and flushing. Adjust unit to maintain required steady state effluent water quality.

C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.8 CLOSEOUT PROCEDURES

A. Provide services of manufacturer's technical representative for one (1) 8-hour day to instruct Owner's personnel in operation and maintenance of water treatment systems.
   1. Schedule training with Owner, provide at least seven (7) day notice to Contractor and Engineer of training date.

END OF SECTION 232500

SECTION 232505 - GLYCOL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Automatic glycol feed systems and inhibited propylene glycol solutions.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of glycol systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards: Provide glycol system components and materials to meet all Local and National Codes and Standards.

C. Provide one (1) year manufacturer's warranty.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions and dimensioned drawings.

B. Maintenance Data: Submit maintenance data and spare parts lists. Include this data, product data, and shop drawings in maintenance manual in accordance with requirements of Division 1.

1.4 CLOSEOUT SUBMITTALS

A. Submit glycol solution strength test results.

PART 2 - PRODUCTS

2.1 AUTOMATIC GLYCOL MAKE-UP SYSTEM

A. General: Provide factory assembled and leak tested glycol feed system with the following components.

B. Tank: 50 Gallon polyethylene, removable cover, and required system connections. Support with four-leg steel stand with four (4) bolt pads painted with oxide primer and enamel finish.

C. Pump: Bronze positive displacement rotary gear or turbine type, 1.5 GPM minimum flow rate at 100 psi TDH, 1/3 HP ODP motor, 120/1/60.

D. Control: System automatically injects a glycol/water solution into hydronic loop based on a drop in pressure in the loop. System shall be either pressure switch and pump, or pressure regulating valve in combination with diaphragm tank pressure switch and pump. Low level cut-off interlocked with pump.

E. Pressure Switch: Field adjustable, 10-20 psi pressure range, factory set at 12 psi.

F. Pressure Relief Valve: Prevents over-pressure and relieves back to tank.

G. Pressure Gauge with isolation valve on discharge piping.

H. Low Level Switch: Mounted on solution tank.

I. Suction Piping: 1/2-Inch rubber hose or copper piping with ball valve and Y strainer.

J. Discharge Piping: 1/2-Inch steel piping with MI fittings or rigid copper piping with brass fittings. Provide pressure switch, ball valve, check valve, and relief valve on the pump discharge.

K. Control Panel: Minimum NEMA 12 enclosure, HOA with running light and magnetic starter for feed pump, alarm light and audible alarm and dry contacts for BAS connection for low level, 8-foot power cord with grounded plug, all wiring routed in conduit.

L. Acceptable Manufacturers:
1. John Woods Company
2. Calcium Control
3. Sage Industries, Inc.

2.2 GLYCOL SOLUTION

A. Provide glycol solutions for the systems specified in the following table.

B.

System	Percent Volume of Propylene Glycol	Burst Protection (degree F)	Freeze Protection (degree F)
Heating Water	30%	-35	-7

C. Glycol Fluid: 95.5 Percent propylene glycol and 4.5 percent inhibitors and water, water white in color, operating temperature range –50 degree F to 250 degree F.

D. Acceptable Manufacturer:
1. DOW DOWFROST

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide necessary piping for a complete installation of glycol make-up system.

B. Thoroughly clean and flush hydronic system before adding propylene glycol solution.

C. Field adjust pressure switch to match system fill pressure.

D. Once the hydronic system has been filled, refill the storage tank on the automatic glycol make-up system with the appropriate concentration of glycol and water.

E. Perform glycol solution test and provide report to Owner.

F. Provide one (1) year service agreement to refill the storage tank on the automatic glycol make-up system during the first year and perform glycol concentration test at the end of the first year of operation.

END OF SECTION 232505

SECTION 233113 - METAL DUCTWORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of Metal Ductwork is indicated on the drawings, schedules, and by requirements of this section.

Ductwork Construction Table

Service	Type	Pressure Class	Insulation	Seal Class
Exterior Supply and Return	Galvanized steel round or rectangular	3"	Lined	B
Supply Air between Air Handling Unit and Terminal Air Box or damper	Galvanized steel, round or rectangular	+3"	Lined	B
Supply Air between Terminal Unit and Air Devices (concealed in ceiling/floor)	Galvanized steel, round or rectangular	+1"	Lined	C
Supply Air between Terminal Unit and Air Devices (exposed)	Spiral seam round galvanized steel suitable for painted finish	+1"	None	C
Underfloor Supply Plenum	Galvanized steel, rectangular	+1	Lined	C
Underfloor Distribution Duct	Galvanized steel, round	+1	None	C
Return Air	Galvanized steel, round or rectangular	-3"	Lined	B
General Building Exhaust	Galvanized steel round or rectangular	-3"	None	B
Transfer Duct	Rectangular galvanized steel	+1"	Lined	C
Return Grille Sound Boot	Rectangular galvanized steel	+1"	Lined	C

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of metal ductwork products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Installer's Qualifications: Firm with at least three (3) years of successful installation experience on projects with metal ductwork systems similar to that required for project.

C. References to SMACNA, ASHRAE and NFPA are minimum requirements, the Contractor shall fabricate, construct, install, seal all ductwork as described in this specification and as shown on the drawings, in addition to these minimum standard references.

D. Codes and Standards:
   1. SMACNA "HVAC Duct Construction Standards, Metal and Flexible".
   2. SMACNA "HVAC Air Duct Leakage Test Manual".
   3. ASHRAE "Systems and Equipment Handbook", Chapter 16, Duct Construction.
   4. NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions.
   1. Include compliance with LEED requirements.

B. Record Drawings: At project closeout, submit record drawings of installed systems, in accordance with requirements of Divisions 1 and 23.

C. Maintenance Data: Submit maintenance data and parts lists for metal ductwork materials and products. Include maintenance data and shop drawings in maintenance manual.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protection: Protect ductwork and accessories from damage during shipping, storage, and handling. Prevent dirt and moisture from entering ducts and fittings.

B. Storage: Where possible, store ductwork inside. Where necessary to store outside, enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Rectangular Duct Liner:
      a. CertainTeed Corp.
      b. Johns-Manville Products Corp.
      c. Knauf Fiberglass
      d. Manson
      e. Owens-Corning Fiberglas Corp.
   2. Round Duct Liner:
      a. Johns-Manville Products Corp.
   3. Flexible Ducts:
      a. Flexmaster
      b. Thermaflex

c. Genflex
d. Ominair
e. Hercules Industries

4. Spin-In Fittings:
   a. Flexmaster
   b. Thermaflex
   c. Genflex
   d. Ominair
   e. Hercules Industries
5. Factory-Fabricated Round Ductwork
   a. Semco Mfg., Inc.
   b. United Sheet Metal Division, United McGill Corp.
   c. Sheet Metal Products Co.
   d. Spiral Pipe of Texas, Inc.
   e. AccuDuct
   f. Metco, Inc.

2.2 DUCTWORK MATERIALS

A. Exposed Ductwork: Where ductwork is exposed to view in occupied spaces, provide mill phosphatized finish that is free from visual imperfections, including pitting, seam marks, roller marks, stains, dents, discolorations, and other imperfections, including those that would impair painting.

B. Galvanized Steel Sheet: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A 527, lockforming quality; with G60 zinc coating in accordance with ASTM A 525.

2.3 MISCELLANEOUS DUCTWORK MATERIALS

A. General: Provide materials of types and sizes required to comply with ductwork system requirements.

B. Fittings: Provide radius type fittings fabricated of multiple sections with maximum 15-degree change of direction per section. Unless specifically detailed otherwise, use 45-degree laterals and 45-degree elbows for branch takeoff connections. Where 90-degree branches are indicated, provide conical type tees.

C. Rectangular Duct Liner: ASTM C1071 fiberglass duct liner with UL approved 25/50 flame/ smoke development. Factory applied edge and air surface coating of acrylic treated with EPA registered ASTM G21 and G22 anti-microbial agent.
   1. K Value: ASTM C 518, 0.25 at 75 degree F mean temperature.
   2. Noise Reduction Coefficient: ASTM C 423, 0.70 based on Type A Mounting.
   3. Maximum Velocity: 5000 fpm.
   4. Adhesive: Meeting ASTM C919.
   5. Fasteners: Duct liner galvanized steel pins, welded or mechanically fastened.
   6. Interior Ductwork: 1-Inch thick.
   7. Exterior Ductwork: 2-Inch thick.
   8. Underfloor Ductwork: ½-Inch thick.

D. Round Duct Liner: 1-Inch thick rigid preformed round liner with air surface coated with acrylic coating treated with EPA registered ASTM G 21 and G22anti-microbial agent and UL approved 25/50 flame/smoke development.
   1. K Value: ASTM C 518, 0.23 at 75 degree F mean temperature.
   2. Noise Reduction Coefficient: ASTM C 423, 0.70 based on Type A mounting.
   3. Maximum Velocity: 500 fpm.

E. Duct Sealant: UL Listed, Class 1, flame spread 0, fuel contributed 0, smoke developed 0, water-based sealer, non-toxic, non-combustible, and non-flammable. Non-hardening, non-migrating mastic or liquid elastic sealant, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.

F. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.
   1. For exposed stainless steel ductwork, provide matching stainless steel support materials.
   2. For aluminum ductwork, provide aluminum support materials except where materials are electrolytically separated from ductwork.

G. Flexible Ducts: Flexible air ducts shall be listed under UL-181 standards as Class I Air Duct Material and shall comply with NFPA Standards 90A and 90B. Minimum operating pressure rating shall be 6-inch w.c. through a temperature range of -20 degree to 150 degree F; minimum working velocity rating shall be 400 fpm. Contractor shall assume responsibility for supplying material approved by the Authority Having Jurisdiction.
   1. All insulated flexible ducts shall be constructed on an all metal or aluminum laminate inner core, 1-inch thick, 3/4 lb. density fiberglass insulation with minimum "C" factor of 0.23 or less and an outer jacket made exclusively of fire retardant reinforced aluminum material.
   2. Non-insulated flexible ducts shall be constructed from dead soft aluminum sheet, spiral corrugated, or aluminum construction over a steel spring helix.

H. Spin-in Fittings: Provide spin-in fittings between flexible and round sheet metal duct takeoffs and air devices from main ducts. Spin-in fittings shall include butterfly type manual volume damper with regulator and locking device.

I. All fasteners and hardware for stainless steel ductwork shall be made of stainless steel.

2.4 FABRICATION

A. Fabricate ductwork of gauges and reinforcement complying with SMACNA "HVAC Duct Construction Standards" and ASHRAE "Systems and Equipment Handbook", Chapter 16, Duct Construction.

B. Provide smooth radius elbows with 1.0 radius. Limit angular tapers to 30 degree for contracting tapers and 20 degree for expanding tapers.

C. Refer to Division 23, Section 233300 "Ductwork Accessories" for accessory requirements.

2.5 FACTORY-FABRICATED ROUND DUCTWORK (2-Inch Pressure Class and Less)

A. Material: Galvanized sheet steel complying with ASTM A 527, lockforming quality, with ASTM A 525, G90 zinc coating, mill phosphatized.

B. Gauge: 28 Gauge minimum for round and oval ducts and fittings, 4-inch through 24-inch diameter.

C. Elbows: One-piece construction for 90 degree and 45 degree elbows 14-inch and smaller. Provide multiple gore construction for larger diameters with standing seam circumferential joint.

D. Divided Flow Fittings: 90 Degree tees, constructed with saddle tap spot welded and bonded to duct fitting body.

2.6 FACTORY-FABRICATED ROUND DUCTWORK (3-Inch Pressure Class and Above)

A. General: Provide factory-fabricated duct and fittings.

B. Round Ductwork: Construct of galvanized sheet steel complying with ASTM A 527 by the following methods and in minimum gauges listed.

Diameter	Minimum Gauge	Method of Manufacture
3" to 14"	26	Spiral Lockseam
15" to 26"	24	Spiral Lockseam
27" to 36"	22	Spiral Lockseam
37" to 50"	20	Spiral Lockseam
51" to 60"	18	Spiral Lockseam
Over 60"	16	Longitudinal Seam

1. Provide locked seams for spiral duct; fusion-welded butt seam for longitudinal seam duct. Provide internal stiffener rings and external reinforcement as required to meet operating static pressures scheduled on drawings.
2. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous welds along seams.

Diameter	Minimum Gauge
3" to 36"	20
38" to 50"	18
Over 50"	16

C. Internally Insulated Duct and Fittings: Construct with outer pressure shell, 1-inch thick insulation layer, and perforated inner liner. Construct shell and liner of galvanized sheet steel complying with ASTM A 527, of spiral lockseam construction, use longitudinal seam for over 59-inches, in minimum gauges listed.

Nominal Duct Diameter	Outer Shell	Inner Liner

Nominal Duct Diameter	Outer Shell	Inner Liner
3" to 12"	26 gauge	24 gauge
13" to 24"	24 gauge	24 gauge
25" to 34"	22 gauge	24 gauge
35" to 48"	20 gauge	24 gauge
49" to 58"	18 gauge	24 gauge
Over 59"	16 gauge	20 gauge

1. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous weld along seams of outer shell.

Nominal Duct Diameter	Outer Shell	Inner Liner
3" to 34"	20 gauge	20 gauge
36" to 48"	18 gauge	20 gauge
Over 48"	16 gauge	20 gauge

2. Inner Liner: Perforate with 3/32-inch holes for 22 percent open area. Provide metal spacers welded in position to maintain spacing and concentricity.

PART 3 - EXECUTION

3.1 INSPECTION

A. General: Examine areas and conditions under which metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF METAL DUCTWORK

A. General: Assemble and install ductwork in accordance with recognized industry practices that will achieve airtight and noiseless (no objectionable noise) systems. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8-inch misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers, and anchors of type that will hold ducts true-to-shape and prevent buckling, popping or compressing. Support vertical ducts at every floor.

B. Inserts: Install concrete inserts for support of ductwork in coordination with formwork, as required to avoid delays in work.

C. Routing: Locate ductwork runs vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by drawings, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction,

columns, and other structural and permanent enclosure elements of building. Limit clearance to 1/2-inch where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1-inch clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

D. Electrical Equipment Spaces: Do not route ductwork through transformer vaults and electrical equipment spaces and enclosures.

E. Slope high moisture ductwork down to air device. Do not provide joints on bottom of duct in longitudinal direction.

F. Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gauge as duct. Overlap opening on all four (4) sides by at least 1-1/2 inch. Fasten to duct only.

G. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

H. Installation: Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards.

I. Temporary Closure: At ends of ducts that are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering that will prevent entrance of dust and debris until time connections are to be completed.

3.3 INSTALLATION OF DUCT LINER

A. Install duct liner in accordance with SMACNA HVAC Duct Construction Standards.

B. Adhere insulation to sheet metal with full coverage of adhesive.

C. Mechanical fasteners should be of length sufficient to limit compression of liner.

D. All exposed edges of the liner must be factory or field coated.

E. Repair liner surface penetrations with adhesive.

3.4 INSTALLATION OF FLEXIBLE DUCTS

A. Do not exceed 6'-0" for any flexible duct run.

B. Install in accordance with Chapter 3 of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".

3.5 ADJUSTING AND CLEANING

A. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances. Where ductwork is to be painted, clean and prepare surface for painting.

B. Balancing: Seal any leaks in ductwork that become apparent in balancing process.

END OF SECTION 233113

SECTION 233300 - DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Types of Ductwork Accessories required for project include the following:
   1. Manual Volume Dampers
   2. Control Dampers
   3. Turning Vanes
   4. Duct Hardware
   5. Duct Access Doors
   6. Flexible Connections

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of ductwork accessories, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Industry Standards: Comply with ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.

C. UL Compliance: Construct, test, and label fire dampers in accordance with UL Standard 555 "Fire Dampers and Ceiling Dampers" 6th Edition and UL Standard 555S "Motor-Driven Fire/Smoke Dampers" 4th Edition.

D. NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of ductwork accessories.

E. SMACNA Compliance: Comply with "Fire Damper and Heat Stop Guide" for the installation of fire, smoke, and fire/smoke dampers.

F. All fire dampers, smoke dampers, fire/smoke dampers and radiation dampers shall meet the latest local building code requirements.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction, and installation instructions.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of ductwork accessory showing interfacing requirements with ductwork, method of fastening or support, and methods of assembly of components. Include details of construction equipment and accessories being provided.

C. Submittals for all damper types specified in this section shall include a schedule for each damper indicating net free area, actual face velocity and pressure drop (at sea level) based on net free area and the maximum air quantity which will be passing through the damper. Submittals without this information will be rejected.

D. Record Drawings: At project closeout, submit record drawings of installed systems products, in accordance with requirements of Division 1.

E. Maintenance Data: Submit manufacturer's maintenance data including parts lists for each type of duct accessory. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. Dampers:
      a. American Warming and Ventilating
      b. Air Balance, Inc.
      c. Arrow Louver & Damper; Division of Arrow United Industries, Inc.
      d. Louvers & Dampers, Inc.
      e. Penn Ventilator Co.
      f. Dowco Corp.
      g. Air Stream
      h. Cesco-Advanced Air
      i. Ruskin
      j. Vent Products Inc.
      k. Greenheck
   2. Turning Vanes:
      a. Aero Dyne Co.
      b. Airsan Corp.
      c. Barb-Aire
      d. Duro Dyne Corp.
      e. Environmental Elements Corp.; Subs. Koppers Co., Inc.
      f. Hart & Cooley Mfg. Co.
      g. Hercules
   3. Duct Hardware:
      a. Ventfabrics, Inc.
      b. Young Regulator Co.
   4. Duct Access Doors:
      a. Flexmaster (Inspector Series)
      b. Cesco-Advanced Air
      c. Duro Dyne Corp.
      d. Ventfabrics, Inc.
   5. Flexible Connections:
      a. Duro Dyne Corp.
      b. Ventfabrics, Inc.

2.2 MANUAL BALANCING DAMPERS

A. Low Pressure Rectangular Dampers (Less than 2,000 FPM and Under 4-Inch W.C. S.P. Differential):
   1. For 12-inch in height or larger, use multiple opposed blade type and close fitted to ducts. 16 Gauge galvanized steel frame and blades with carbon steel shaft mounted with oil impregnated bronze bearings, stainless steel jamb seals and silicone blade edge seals. Linkage shall be in-jamb fixed type located outside the airstream made of plated steel tie bar and crank plates, with stainless steel pivots. Maximum damper panel width is 48-inch. Provide jack shafting when duct size required is greater than 48-inch wide. Provide notched shaft end indicating damper position, locking quadrant to fix damper position and handle. For flat oval and round ductwork, provide Type C housing.
   2. For ducts less than 12-inch in height, use 16 gauge frame and 20 gauge blade galvanized steel, steel axle with nylon bearings, locking quadrant handle and notched shaft end indicating damper position.
      a. Design Basis: Greenheck MBD

B. Low Pressure Round Dampers (Less than 1,500 FPM and Under 1-Inch W.C. S.P. Differential):
   1. For Dampers 4-inch diameter through 18-inch diameter use 18 gauge galvanized steel frame and the following blade construction:

4-Inch thru 12-inch diameter	22 gauge galvanized steel
13-Inch thru 18-inch diameter	20 gauge galvanized steel

   2. Carbon steel axle shaft with retainers mounted on nylon bearings with notched end shaft indicating damper position, locking quadrant and handle.
      a. Design Basis: Greenheck MBDR

2.3 VOLUME CONTROL DAMPERS

A. Provide opposed blade dampers for volume control and parallel blade for isolation/shutoff service. 12 Gauge galvanized steel frame with welded corners. Double skin galvanized steel blades with single-lock seam, airfoil shape with a strength greater than 14 gauge.
AWV Model VC-422

B. Double durometer vinyl blade edge seals and metallic compression seals at the jambs. Leakage shall not exceed 11.5 CFM/square foot at 4-inch W.C. S.P.

C. Solid carbon steel axles mounted on bronze oilite bearings. In-jamb linkage located outside the airstream.

D. 48-Inch wide and 72-inch high maximum damper size.

E. For automatic volume control dampers, provide factory supplied electric 24v motor operators with quantities, voltage and sizes suitable for proper operation at the velocity and pressures the dampers will be operating at.

2.4 TURNING VANES

A. Fabricated Turning Vanes: Provide fabricated 22 gauge, single blade or 4-1/2 inch radius, 3-1/4 inch spacing turning vanes and Type 2, 4-1/2 inch wide runners, constructed in accordance with SMACNA "HVAC Duct Construction Standards" Fig 2.3.

B. Manufactured Turning Vanes: Provide single blade 2-inch radius turning vanes constructed of 1-1/2 inch wide curved blades set at 1 1/2-inch O.C., supported with bars perpendicular to blades set at 2-inch O.C., and set into side strips suitable for mounting in ductwork.

C. Do not use trailing edge turning vanes.

2.5 DUCT HARDWARE

A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:
   1. Test Holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.
   2. Quadrant Locks: Provide for each manual volume damper, quadrant lock device on one (1) end of shaft; and end bearing plate on other end for damper lengths over 12-inch. Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

2.6 DUCT ACCESS DOORS

A. General: Provide access doors, whether shown or not, at all fire dampers, smoke dampers, temperature control dampers, branch balancing dampers, outside air plenums, inlet of fans, upstream of all duct smoke detectors and all other equipment requiring service and/or access.

B. Construction: Construct of same or greater gauge as ductwork served, provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. All access doors shall have gasket and will be air-tight. Provide one (1) side hinged, other side with one (1) handle-type latch for doors 12-inch high and smaller, two (2) handle-type latches for larger doors. For spiral ductwork, use United McGill combination access section type ARF-SD for non-insulated duct systems and type ARF-ID double wall insulated door for insulated ducted systems (all supply ductwork).

C. General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make air-tight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment. Shelf life shall be verified to not exceed six (6) months. Any sign of cracking on interior or exterior shall be cause for replacement immediately.

D. Use the following product types for each application accordingly:
   1. Indoor Equipment Non-Corrosive Air Systems: Heavy glass fabric, double-coated with DuPont's NEOPRENE, non-combustible fabric, fire retardant coating with good resistance to abrasion and flexing. Fabric shall be 30 ounce per square yard, capable of

operating at –10 degree F to 200 degree F, waterproof, air tight, 6-inches wide, complies with NFPA 90 and UL Standard #214. "Ventglas" Model as manufactured by VentFabric, Inc.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to the Engineer.

3.2 INSTALLATION OF DUCTWORK ACCESSORIES

A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.

B. Install turning vanes in square or rectangular 90 degree elbows in supply, return and exhaust air systems, and elsewhere as indicated.

C. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.

D. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

E. Provide duct access doors whether shown or not for inspection and cleaning before and after all filters, coils, fans, automatic dampers, at fire dampers (minimum 16-inch x 24-inch in ducts larger than 18-inch), fire/smoke dampers, upstream side of airturns in all return and exhaust air ductwork, upstream of duct smoke detectors and elsewhere as indicated. Review locations prior to fabrication. Provide multiple access doors for large ductwork to provide adequate reach to equipment.

F. Provide 4-inch x 4-inch (104 x 104 mm) quick opening access doors for inspection at balancing dampers. Install fire dampers and smoke dampers in accordance with manufacturers instructions.

G. Provide balancing dampers at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts and as required for air balancing.

H. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and equipment subject to forced vibration. Provide matching flanged backing frame with flexible connector where flanged fan connections are provided.

3.3 FIELD QUALITY CONTROL

A. Operate installed ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leakproof performance.

B. Test every volume control damper for proper operation, provide letter to the Architect/ Engineer certifying this work is complete and all dampers are functioning properly.

3.4 ADJUSTING AND CLEANING

A. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.

B. Label access doors in accordance with Division 23 Section "Mechanical Identification".

C. Final positioning of manual dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing".

D. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 233300

SECTION 233413 - AIR HANDLING FANS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of Air Handling Equipment Work required by this section is indicated on drawings and schedules, and by requirements of this section.

B. This Section includes the following types of Air-Handling Equipment:
   1. Inline Centrifugal Fans
   2. Centrifugal Roof Ventilators

C. Refer to other Division 23 sections for vibration control; control system; sequence of operation; testing, adjusting and balancing.

D. Refer to Division 26 section for the following work; not work of this section.
   1. Power supply wiring from power source to power connections at air handling units.

E. Refer to Division 23 section "Mechanical/Electrical Requirements for Mechanical Equipment".

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air handling equipment of types and sizes required, whose products have been in satisfactory use in similar service for not less than three (3) years.

B. Codes and Standards:
   1. Fans Performance Ratings: Establish flow rate, pressure, power air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA Standard 210/ASHRAE Standard 51 - Laboratory Methods of Testing Fans for Rating.
   2. UL Compliance: Provide air handling equipment which are listed by UL and have UL label affixed.
   3. UL Compliance: Provide air handling equipment which are designed, manufactured, and tested in accordance with UL 805 "Power Ventilators".
   4. NEMA Compliance: Provide motors and electrical accessories complying with NEMA Standards.
   5. Sound Power Level Ratings: Comply with AMCA Standard 301 "Method for Calculating Fan Sound Ratings from Laboratory Test Data". Test fans in accordance with AMCA Standard 300 "Test Code for Sound Rating". Fans shall be licensed to bear the AMCA Certified Sound Ratings Seal.
   6. Nationally Recognized Testing Laboratory and NEMA Compliance (NRTL): Fans and components shall be NRTL listed and labeled. The term "NRTL" shall be defined in OSHA Regulation 1910.7.
   7. Electrical Component Standards: Components and installation shall comply with NFPA 70 "National Electrical Code".

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for air handling equipment including specifications, capacity ratings, sound data, dimensions, weights, materials, operating and service/access clearance accessories furnished, and installation instructions.

B. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, construction details, methods of assembly of components, and field connection details.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to air-handling units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are manufacturer-installed and portions to be field-installed.

D. Record Drawings: At project closeout, submit record drawings of installed systems products; in accordance with requirements of Division 1.

E. Maintenance Data: Submit maintenance data and parts list for each type of power and gravity ventilator, accessory, and control. Include this data, product data, shop drawings, and wiring diagrams in maintenance manuals in accordance with requirements of Division 1.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Lift and support units with the manufacturer's designated lifting or supporting points.

B. Disassemble and reassemble units as required for movement into the final location following manufacturer's written instructions.

C. Deliver fan units as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate the installation of roof curbs, equipment supports, and roof penetrations.

B. Coordinate the size and location of structural steel support members.

1.6 EXTRA MATERIALS

A. Furnish one (1) additional complete set of belts for each belt-driven fan.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Inline Centrifugal Fans:
      a. Greenheck

b. Acme Engineering & Manufacturing Corp.
c. Buffalo
d. Loren Cook Co.
e. Penn Ventilator Co.
f. Jenn Industries Inc.
g. New York Blower Co.

2. Centrifugal Roof Ventilators:
   a. Greenheck
   b. Acme Engineering & Manufacturing Corp.
   c. Aerovent, Inc.
   d. Briedert Co., C.G.
   e. Carnes Company, Inc.
   f. Loren Cook Co.
   g. Jenn Industries, Inc.
   h. Penn Ventilator Co., Inc.
3. Prefabricated Roof Curbs:
   a. Louvers & Dampers
   b. Custom Curb, Inc.
   c. Pate Co.
   d. S & L Manufacturing Co.
   e. ThyCurb Division; Thybar Corp.

2.2 FANS, GENERAL

A. General: Provide fans that are factory fabricated and assembled, factory tested, and factory finished, with indicated capacities and characteristics.

B. Fans and Shafts: Statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower.
   1. Fan Shaft: Turned, ground, and polished steel designed to operate at no more than 70 percent of the first critical speed at the top of the speed range of the fan's class.

C. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.
   1. Service Factor: 1.4.

D. Belts: Oil-resistant, non-sparking, and non-static.

E. Motors and Fan Wheel Pulleys: Adjustable pitch for use with motors through 15 HP; fixed pitch for use with motors larger than 15 HP. Select pulley so that pitch adjustment is at the middle of the adjustment range at fan design conditions. Provide energy efficient motor.
   1. Belt Guards: Provide steel belt guards for motors mounted on the outside of the fan cabinet.

F. Shaft Bearings: Provide type indicated, having a median life "Rating Life" AFBMA L10 of 60,000 calculated in accordance with AFBMA Standard 9 for ball bearings and AFBMA Standard 11 for roller bearings.

G. Factory Finish: The following finishes are required:
   1. Sheet Metal Parts: Prime coating prior to final assembly.
   2. Exterior Surfaces: Baked-enamel finish coat after assembly.

H. Vibration: Provide vibration isolators as scheduled and specified in other Division 23 sections.

2.3 INLINE CENTRIFUGAL FANS

A. General Description: Inline centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, drive assembly, motor and disconnect switch, mounting brackets, and accessories.

B. Housing: Split, spun-aluminum housing, with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Direct-Drive Units: Motor encased in housing out of air stream, factory-wired to disconnect located on outside of fan housing.

D. Belt-Drive Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

E. Wheel: Aluminum, airfoil blades welded to aluminum hub.

F. Bearings: Grease lubricated ball or roller anti-friction type with extended lubrication lines to outside fan housing.

G. Accessories: The following accessories are required as indicated:
   1. Gravity Backdraft Damper:
   2. Companion Flanges: For inlet and outlet duct connections.
   3. Fan Guards: Expanded metal in removable frame.
   4. Speed Control: Variable speed switch with On-Off control and speed control for 100 to 50 percent of fan air delivery.

2.4 CENTRIFUGAL ROOF VENTILATORS

A. General Description: Belt-driven or direct-drive as indicated, centrifugal consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

B. Housing: Heavy-gauge, removable, spun-aluminum, dome top and outlet baffle; square, one-piece, hinged, aluminum base with venturi inlet cone.

C. Fan Wheel: Aluminum hub and wheel with backward-inclined blades.

D. Belt-Driven Drive Assembly: Resiliently mounted to the housing, with the following features:
   1. Pulleys: Cast iron, adjustable-pitch.
   2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
   3. Fan Shaft: Turned, ground, and polished steel drive shaft keyed to wheel hub.
   4. Fan and motor isolated from exhaust air stream.

E. Accessories: The following items are required as indicated:
   1. Disconnect Switch: Non-fusible type, with thermal overload protection mounted inside fan housing, factory-wired through an internal aluminum conduit.
   2. Bird Screens: Removable 1/2-inch mesh, 16 gauge, aluminum or brass wire.
   3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base, factory set to close when fan stops.

4. Roof Curbs: Prefabricated, heavy-gauge, galvanized steel; mitered and welded corners; 2-inch thick, rigid, fiberglass insulation adhered to inside walls; built-in cant and mounting flange for flat roof decks; and 2-inch wood nailer. Size as required to suit roof opening and fan base.
    a. Overall Height: 12-Inches from top of roof insulation to top of curb; contractor to coordinate actual curb height to account for thickness of roof insulation at curb.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, housekeeping pads, and other conditions affecting performance of fans.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install fans level and plumb, in accordance with manufacturer's written instructions. Support units using vibration control devices as indicated. Vibration control devices are specified in Division 23 Section "Vibration Controls".
1. Secure roof-mounted fans to roof curbs with cadmium-plated hardware.
    a. Installation of roof curbs is specified in Division 7.
2. Suspended Units: Suspend units from structural steel support frame using threaded steel rods and vibration isolation springs.

B. Arrange installation of units to provide access space around air-handling units for service and maintenance.

3.3 CONNECTIONS

A. Duct installations and connections are specified in other Division 23 sections. Make final duct connections on inlet and outlet duct connections with flexible connections.

B. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Ensure that rotation is in direction indicated and intended for proper performance. Do not proceed with centrifugal fan start-up until wiring installation is acceptable to Centrifugal Fan Installer.
2. Temperature control wiring and interlock wiring are specified in Division 23.
3. Grounding: Connect unit components to ground in accordance with the National Electrical Code.

3.4 FIELD QUALITY CONTROL

A. Upon completion of installation of air handling equipment, and after motor has been energized with normal power source, test equipment to demonstrate compliance with requirements. Where possible, field correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment which cannot be satisfactorily corrected.

B. Manufacturer's Field Inspection: Arrange and pay for a factory-authorized service representative to perform the following:
   1. Inspect the field assembly of components and installation of fans including ductwork and electrical connections.
   2. Prepare a written report on findings and recommended corrective actions.

3.5 ADJUSTING, CLEANING, AND PROTECTING

A. Start-up, test and adjust air handling equipment in presence of manufacturer's authorized representative.

B. Adjust damper linkages for proper damper operation.

C. Clean unit cabinet interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheel and cabinet.

3.6 SPARE PARTS

A. General: Furnish to Owner with receipt one (1) spare set of belts for each belt driven air handling equipment.

3.7 PRE-STARTUP CHECK

A. Final Checks Before Start-Up: Perform the following operations and checks before start-up:
   1. Remove shipping blocking and bracing.
   2. Verify unit is secure on mountings and supporting devices and that connections for piping, ductwork, and electrical are complete. Verify proper thermal overload protection is installed in motors, starters, and disconnects.
   3. Perform cleaning and adjusting specified in this Section.
   4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearings operations. Reconnect fan drive system, align belts, and install belt guards.
   5. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
   6. Verify manual and automatic volume control and that fire and smoke dampers in connected ductwork systems are in the full-open position.
   7. Disable automatic temperature control operators.

B. Starting Procedures for Fans:
   1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.
   2. Replace fan and motor pulleys as required to achieve design conditions.
   3. Measure and record motor electrical values for voltage and amperage.

C. Shut unit down and reconnect automatic temperature control operators.

D. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for procedures for air-handling-system testing, adjusting, and balancing.

3.8 DEMONSTRATION

A. Demonstration Services: Arrange and pay for a factory-authorized service representative to train Owner's maintenance personnel on the following:
   1. Procedures and schedules related to start-up and shutdown, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
   2. Familiarization with contents of Operating and Maintenance Manuals specified in Division 1 Section "Project Closeout" and Division 23 Section "Basic Mechanical Requirements".

B. Schedule training with at least seven (7) days' advance notice.

END OF SECTION 233413

SECTION 233600 - AIR TERMINALS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of Air Terminals Work required by this section is indicated on drawings and schedules, and by requirements of this section.

B. Types of Air Terminals specified in this section include the following:
   1. Variable Volume Air Terminals
      a. Shutoff Single Duct
      b. Reheat

C. Refer to other Division 23 sections for external insulation of air terminals; testing, adjusting and balancing of air terminals; temperature controls which are to be furnished by others but installed as work of this section.

D. Refer to Division 26 sections for the following work; not work of this section.
   1. Power supply wiring from power source to power connection on air terminals. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

E. Provide the following electrical work as work of this section, complying with requirements of Division 26 sections:
   1. Control wiring between field-installed controls and air terminals.
      a. Control wiring specified as work of Division 23 for Automatic Temperature Controls is work of that section.

F. Controllers shall be factory installed and comply with Section 23 09 00, Direct Digital Control Systems. Coordinate with work of this section.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of air terminals with characteristics, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:
   1. ADC Compliance: Provide air terminals which have been tested and rated in accordance with ADC standards, and bear ADC Seal.
   2. ARI Compliance: Provide air terminals which have been tested and rated in accordance with ARI 880 "Industry Standard for Air Terminals" and bear ARI certification seal.
   3. NFPA Compliance: Construct air terminals using acoustical and thermal insulations complying with NFPA 90A "Air Conditioning and Ventilating Systems".

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including performance and sound data for each size and type of air terminal furnished; schedule showing drawing designation, room location, number furnished, model number, size, and accessories furnished; and installation and start-up instructions.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.

C. Wiring Diagrams: Submit ladder-type wiring diagrams for electric power and control components, clearly indicating required field electrical connections.

D. Record Drawings: At project closeout, submit record drawings of installed systems products, in accordance with requirements of Division 23.

E. Maintenance Data: Submit maintenance data and parts list for each type of air terminal; including "trouble-shooting" maintenance guide. Include this data, product data, shop drawings, and maintenance data in maintenance manual; in accordance with requirements of Division 23.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver air terminals wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of air terminal and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in boxes.

B. Store air terminals in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. Air Terminals:
      a. Price
      b. Carrier Corp.
      c. Trane (The) Co.

2.2 AIR TERMINALS

A. General: Provide factory-fabricated and tested air terminals as indicated, selected with performance characteristics which match or exceed those indicated on schedule.

B. Air terminal units shall be low pressure drop, single duct throttling type pressure independent and suitable for use in medium pressure variable volume air distribution systems.

C. Casing shall be 22 gauge galvanized steel construction with internal acoustical coated 1-inch thick, 1-1/2 lb. density fiberglass insulation, inlet and outlet duct connection and discharge sound attenuator, where scheduled.

D. Internal damper blade shall be extruded aluminum or 18 gauge steel with keyed fit shaft and nylon bushing. Damper shall seal against gasketed stops maximum 2 percent leakage at 3.0-inch S.P. All mechanical parts shall be galvanized or non-ferrous.

E. Hot water heating coils shall be designed for 200 psig maximum working pressure and 200 degree F maximum operating temperature. Coil shall be serpentine-type, 2-row minimum, constructed of 1/2-inch O.D. copper tubes mechanically bonded to aluminum fins; galvanized steel casing.

F. Provide factory-installed framed duct access door complete with quarter-turn quick release fasteners in terminal box casing upstream of reheat coil.

G. Provide label on each air terminal unit, indicating plan designation, unit size, CFM range and settings and calibration curve.

H. Controls shall include wall mounted sensor, modulating damper, damper operator furnished by the Temperature Control Contractor, and factory installed by the equipment manufacturer, pressure independent pneumatic cross-shaped flow sensor with amplifying total pressure pickup points connected in parallel to a central averaging chamber (an inlet velocity sensor with pickup points connected in series shall not be accepted), for measuring inlet volume. The sensor shall amplify duct velocity pressure by a factor of 1.75 and shall maintain control accuracy with the same size inlet duct in any configuration. Specific control component requirements are specified in Division 23 Section Direct Digital Control Systems.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which air terminals are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF AIR TERMINALS

A. General: Install air terminals as indicated, and in accordance with manufacturer's installation instructions.

B. Location: Install each unit level and accurately in position indicated in relation to other work; and maintain sufficient clearance for normal service and maintenance, but in no case less than that recommended by manufacturer.

C. Duct Connections: Connect ductwork to air terminals in accordance with Division 23 ductwork sections.

3.3 FIELD QUALITY CONTROL

A. Upon completion of installation and prior to initial operation, test and demonstrate that air terminals, and duct connections to air terminals, are leak-tight.

B. Repair or replace air terminals and duct connections as required to eliminate leaks, and retest to demonstrate compliance.

3.4 CLEANING

A. Clean exposed factory-finished surfaces. Repair any marred or scratched surfaces with manufacturers touch-up paint.

END OF SECTION 233600

SECTION 233713 - AIR OUTLETS & INLETS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of Air Outlets and Inlets Work is indicated by drawings and schedules, and by requirements of this section.

B. Types of Air Outlets and Inlets required for project include the following:
   1. Ceiling Air Diffusers
   2. Wall Registers and Grilles
   3. Displacement Diffusers
   4. Floor Diffusers
   5. Louvers

C. Refer to other Division 23 sections for ductwork, duct accessories; testing and balancing; not work of this section.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:
   1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
   2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".
   3. ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual".
   4. ADC Seal: Provide air outlets and inlets bearing ADC Certified Rating Seal.
   5. AMCA Compliance: Test and rate louvers in accordance with AMCA 500L-99 "Laboratory Method of Testing Louvers for Rating".
   6. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:
   1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
   2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.

3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses, throw and drop, and noise criteria ratings. Indicate selections on data.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.

C. Record Drawings: At project closeout, submit record drawings of installed systems products, in accordance with requirements of Division 1.

D. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 1.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. Diffusers, Registers and Grilles:
      a. Anemostat Products Division; Dynamics Corp. of America
      b. Carnes Co.; Division of Wehr Corp.
      c. Krueger; Division of Philips Industries, Inc.
      d. Titus Products Division; Philips Industries, Inc.
      e. Metal-Aire
      f. E.H. Price.
   2. Louvers:
      a. Air Balance
      b. American Warming & Ventilating, Inc.
      c. Arrow United Industries, Inc.
      d. Dowco Corp.
      e. Louvers & Dampers, Inc.
      f. Penn Ventilator Co., Inc.
      g. Ruskin
      h. Greenheck

2.2 CEILING AIR DIFFUSERS

A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.

D. Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed on Air Device Schedule.

2.3 REGISTERS AND GRILLES

A. General: Except as otherwise indicated, provide manufacturer's standard registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Wall Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall systems, and that are specifically manufactured to fit into wall construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall construction which will contain each type of wall register and grille.

D. Types: Provide registers and grilles of type, capacity, and with accessories and finishes as listed on air device schedule.

2.4 DISPLACEMENT DIFFUSERS

A. General: Except as otherwise indicated, provide manufacturer’s standard displacement diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide displacement diffusers that have , as minimum, face velocity, pressure loss, airflow, noise criteria ratings for each size device as listed in manufacturer’s current data. Sound data derived from tests in accordance with ASHRAE Standard 70-1991.

C. Construction: Displacement diffuser shall be constructed with an equalization baffle behind the operative diffuser face for uniform, low velocity, distribution of supply air. Both the equalization baffle and face shall be securely retained in the diffuser frames. The diffuser

frames shall be constructed of high strength aluminum extrusion for fasteners on the front or side panels. The operative face shall be constructed of pained high-gauge steel, side and end panels may be provided in painted steel, side and end panels may be provided in painted steel. All perforated materials shall be fastened to the frame with vibration dampening. The frame and internal baffling elements shall be constructed of Aluminum. The paint shall be powder coat polyester. Visible non-metallic components are unacceptable. The diffuser shall be supplied with concealed mounting brackets that do not require puncturing the diffuser to install.

D. Types: Provide displacement diffusers of type, capacity and with accessories and finishes as listed on Air Device Schedule. Provide an integral, continuous diffuser base.

E. Color: Color selected by Architect. Submit color chart.

2.5 FLOOR DIFFUSERS

A. General: Except as otherwise indicated, provide manufacturer's standard floor mounted air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide floor mounted air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Floor Compatibility: Provide diffusers with border styles that are compatible with floor systems, and that are specifically manufactured to fit into a raised floor system with accurate fit and adequate support. Refer to general construction drawings and specifications for floor systems which will contain each type of floor mounted air diffuser.

D. Types: Provide floor mounted air diffusers of type, capacity, and with accessories and finishes as listed on Air Device Schedule.
   1. Provide variable air volume 24 Ga steel basked designed for underfloor air distribution systems as scheduled. Used in combination with the Round Floor Diffusers, the basket shall install from the room side and includes RJ12 jacks for daisy chain connection. Provide a 24 VAC direct drive modulating 24V actuator.

2.6 LOUVERS

A. General: Provide stationary extruded aluminum louvers in sizes and locations indicated on the Drawings.

B. Performance: Provide beginning of water penetration (0.01 oz. per sq.ft.) at a free area velocity of no less than 624 fpm at standard air conditions based on mill finish, 48-inch x 48-inch test size per AMCA Standard 511.

C. Frame: 4-Inch deep channel, 0.81-inch thick 6063-T5 extruded aluminum alloy. Coordinate with wall construction shown on the Architectural Drawings and provide frame and sill style necessary to provide a weatherproof installation.

D. Blades: K-Design, drainable blade design 0.81-inch thick, 6063-T5 extruded aluminum alloy.

E. Louver Screens: On inside face of exhaust air louvers and outside face of outside air louvers, provide removable 1/2-inch expanded mesh framed aluminum bird screen.

F. Finish: Mill with 2-coat Kynar, provide standard color chart for color selection by Architect.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended functions.

B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling modules.

D. Locate displacement air diffusers as indicated on construction plans. Coordinate exact locations of diffusers with chase spaces and architectural elevations.

3.3 SPARE PARTS

A. Furnish to Owner, with receipt, three (3) operating keys for each type of air outlet and inlet that require them.

END OF SECTION 233713

SECTION 233718 - FABRIC AIR DISPERSION FOR UFAD SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes fabric air dispersion systems and components for use in underfloor air distribution systems.

B. Extent of Non-Metal Ductwork is indicated on drawings and in schedules, and by requirements of this section.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:
   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.

1.4 QUALITY ASSURANCE

A. Building Codes and Standards:
   1. Product must be Classified by Underwriter's Laboratories in accordance with the 25/50 flame spread / smoke developed requirements of NFPA 90-A.
   2. All product sections must be labeled with the logo and classification marking of Underwriter's Laboratories.

B. Firms regularly engaged in manufacture of fabric ducts of types and capacities required whose products have been of satisfactory use in similar service for not less than 10 years.

1.5 DELIVERY, STORAGE AND HANDLING

1. Protect fabric air dispersion systems from damage during shipping, storage and handling.
2. Where possible, store products inside and protected from weather. Where necessary to store outside, store above grade and enclose with a vented waterproof wrapping.

1.6 WARRANTY

A. Provide manufacturer's standard 5 year warranty program for those products supplied for the fabric portion of this system.

B. Design and Performance Warranty: Provide manufacturer's standard design and performance warranty stating fabric air dispersion system will perform in accordance with design parameters stipulated in submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. DuctSox, Corporation.
   2. Ke-Fibertec

2.2 FABRIC AIR DISPERSION SYSTEMS

A. Fabric Air Dispersion Systems
   1. Fabric: Woven fire retardant fabric complying with the following physical characteristics.
   2. Air Dispersion Method: Linear vents, size and quantity to be determined based on total airflow.
   3. Temperature Range: 0 degrees F to 180 degrees F
   4. Fire Retardancy: Classified by Underwriters Laboratories in accordance with the requirements of NFPA 90-A.
   5. Supply: Fabric air dispersion system shall be specifically designed for both constant volume and variable-air-volume flows.
   6. Non-Vented Section is modular in lengths which disperse a small amount of airflow and interconnect other components.
   7. Fabric Elbows: Fabric elbows shall be constructed out of three separate gores and shall be constructed using a single radius centerline radius. Elbows shall be fabricated to allow for routing between pedestals for raised floor system.
   8. Dispersion Section: Sections that disperse air and include venting on one or both sides and end.
   9. Operable Endcap: Fabric zip in endcap enables field adjustment of airflow dispersion pattern to best fit needs of the space.
   10. Labeling: Product shall include labels every five feet adjacent to the top seam of the fabric duct sections. Labels shall be permanently bonded to and an integral part of the fabric so as not to fall off or be removed. Labels shall indicate direction of airflow, provide instruction not to route electrical systems above fabric duct system and bear the Underwriters Laboratories (UL) label.
   11. Inlet connection to metal duct via fabric draw band with anchor patches as supplied by manufacturer. Anchor patches to be secured to metal duct via sheet metal screw fastener – supplied by contractor. Inlet connection includes zipper for easy installation / maintenance.
   12. Lengths to include required zippers as specified by manufacturer.
   13. Size and location of linear vents to be specified and approved by manufacturer.
   14. Fabric system shall include connectors to accommodate suspension system.
   15. Any deviation from a straight run shall be made using a gored elbow. Standard 90 degree elbows are 3 gores and the radius of the elbow is 1 times the diameter of the fabric duct.

B. Fabric air diffusers shall be designed from 0.10” water gage minimum to 3.0” maximum, with 0.25” as the standard.

C. Fabric air dispersion system shall be limited to design temperatures between 0 degrees F and 180 degrees F (-17.8 degrees C and 82 degrees C).

D. Design CFM, static pressure and fabric air dispersion length shall be designed or approved by the manufacturer.

E. Do not use fabric air dispersion systems in inaccessible locations.

F. Use fabric air dispersion system only for positive pressure air distribution components of the mechanical ventilation system.

2.3 SUSPENSION SYSTEMS

A. Tension Anchor: Install using a tension cable system including single or multiple pieces of cable. Fabric ducts shall be fitted with cable clips top sewn into the fabric. Straight sections shall be fitted with a cable clip at the exit of the duct. Elbows shall be fitted with cable clips on the exit of the elbow. Straight sections and elbows shall be connected to the pedestals of the raised floor system and held in tension by drawing the cable tight.

B. Component options include (must specify per area if multiple on same project):
   1. Acetyl Cable Clips Top Sewn into Fabric
   2. Galvanized Steel Cable

2.4 DESIGN PARAMETERS:

A. Fabric air diffusers shall be designed from 0.10” water gage minimum to 3.0” maximum, with 0.25” as the standard.

B. Fabric air dispersion system shall be limited to design temperatures between 0 degrees F and 180 degrees F (-17.8 degrees C and 82 degrees C).

C. Design CFM, static pressure and fabric air dispersion length shall be designed or approved by the manufacturer.

D. Do not use fabric air dispersion systems in inaccessible locations.

E. Use fabric air dispersion system only for positive pressure air distribution components of the mechanical ventilation system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas for compliance with requirements for installation tolerances and for appropriate alignment, tension, obstructions and other conditions affecting proper installation of fabric air dispersion system.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 HANGER AND SUSPENSION SYSTEM INSTALLATION

A. Install suspension system in accordance with the requirements of the manufacturer. Instructions for installation shall be provided by the manufacturer with product.

B. Install suspension supporting cables after the raised floor structure is secure. Fabric duct system shall be installed level, run suspension system parallel and perpendicular with raised floor system grid.

3.3 CONNECTIONS

A. Connect fabric duct to supply air plenum using a round sheet metal tap collar (per manufacturer's recommendations). Fabric duct system shall be connected to sheet metal collar using fabric inlet collar.

B. Unless otherwise indicated, install fabric air dispersion systems parallel and perpendicular to the raised access floor grid.

C. Fabric ducts shall not pass through non-fire-rated interior partitions. Provide sheet metal duct or sleeve and appropriate mechanical devices to penetrate wall assembly
   1. Where fabric air dispersion systems pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers. Provide sheet metal extensions from housing of fire damper to connect fabric air dispersion system on either side of fire damper.

3.4 FIELD QUALITY CONTROL

A. Test, adjust and balance air handling equipment, main supply air ductwork and branch supply air ductwork. Replace any damaged or malfunctioning HVAC system components upstream of inlet to fabric air dispersion system.

3.5 CLEANING

A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Apply edge guard to edge of sheet metal ductwork prior to installation of fabric air dispersion system.

B. Clean air handling unit and ductwork upstream of the fabric duct system unit-by-unit as it is installed. Clean external surfaces of foreign substance which may cause corrosive deterioration of facing.

C. If fabric duct systems become soiled during installation, they should be removed and cleaned following the manufacturers standard terms of laundry. Refer to manufacturer's published literature for proper laundering methods.

END OF SECTION 233716

SECTION 235200 - BOILERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes packaged, factory-fabricated and assembled, gas-fired, finned water-tube boilers, trim, and accessories for generating hot water.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights (shipping, installed, and operating), furnished specialties, flue sizing recommendations and accessories; and installation and start-up instructions.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weights, loadings, required clearances, and method of field assembly, components and location and size of each field connection.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power and control wiring. Clearly differentiate between portions of wiring that are factory installed and portions to be field-installed.

D. Record Drawings: At project closeout, submit record drawings of installed systems products in accordance with requirements of Division 15.

E. Maintenance Data: Submit maintenance data and parts list for each boiler, control, and accessory; including "trouble-shooting" maintenance guide. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual; in accordance with requirements of Division 23.

F. Warranty: Special warranty specified in this Section.

G. Other Informational Submittals:
   1. Startup service reports.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.

C. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."

D. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."

E. I=B=R Compliance: Boilers shall be tested and rated according to HI's "Rating Procedure for Heating Boilers" and "Testing Standard for Commercial Boilers," with I=B=R emblem on a nameplate affixed to boiler.

F. UL Compliance: Test boilers for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

1.5 COORDINATION

A. Coordinate size and location of concrete housekeeping pads.

B. Coordinate all electrical and controls requirements.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace heat exchangers damaged by thermal shock and vent dampers of boilers that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Heat Exchangers: 20 years from date of Substantial Completion.
   2. Warranty Period for Vent Dampers: Five years from date of Substantial Completion.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace drums, tubes, headers, cabinets, atmospheric gas burners, and pressure vessels of boilers that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Drums, Tubes, Headers, Cabinets, and Atmospheric Gas Burner: Five years from date of Substantial Completion, pro rata.
   2. Warranty Period for Pressure Vessel: 20 years from date of Substantial Completion, for thermal shock.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle boiler sections and equipment carefully to prevent damage, breaking, and scoring. Do not install damaged sections or components; replace with new.

B. Store boiler sections and equipment in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

C. Comply with manufacturer's rigging and moving instructions for unloading boilers, and moving them to final location.

PART 2 - PRODUCTS

2.1 HIGH EFFICIENCY, NON-CONDENSING BOILERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Patterson-Kelley; no alternates.

C. Contractor is responsible for differences in plumbing, power, piping, venting, and other manufacturer’s installation requirements if the design basis is not provided, at no additional cost to the Owner.

D. Description: Factory-fabricated, -assembled, and -tested boiler with tubes sealed into headers pressure tight, and set on a steel base; including insulated jacket, flue-gas vent, combustion-air intake connections, water supply and return connections, and controls.

E. Heat Exchanger:
   1. Finned copper tubing with stainless-steel baffles.
   2. Bronze headers.
   3. Tubes shall be sealed in header with silicone O-ring gaskets.

F. Combustion Chamber Internal Insulation: Interlocking panels of refractory insulation, high-temperature cements, mineral fiber, and ceramic refractory tile for service temperatures to 2000 deg F (1100 deg C).

G. Casing:

   1. Jacket: Sheet metal, with snap-in or interlocking closures; aluminum access doors.
   2. Control Compartment Enclosure: NEMA 250, Type 1A.
   3. Finish: Powder coated.
   4. Insulation: Minimum 2-inch thick, mineral-fiber insulation surrounding the heat exchanger.
   5. Draft Hood: Integral.
   6. Combustion-Air Connection: Inlet duct collar and sheet metal closure over burner compartment.
   7. Mounting base to secure boiler.
      a. Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler pressure vessel, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" when mounting base is anchored to building structure.

H. Burner:
   1. Burner Tubes and Orifices: Stainless steel, for natural gas.
      a. Sealed Combustion: Factory-mounted centrifugal fan to draw outside air into boiler and discharge into burner compartment.
      b. Direct Vent: Factory-mounted centrifugal fan to draw flue gas out of boiler and discharge into boiler vent.
   2. Burner:
      a. Modulating Burner with min 5 to 1 turn down.
      b. High-temperature stainless steel to fire in a 360-degree pattern.
      c. Burner shall have a viewing port for observation of burner operation and a factory-mounted centrifugal fan to supply outside air to boiler burner.
      d. Fan shall be controlled to pre-purge and post-purge the combustion chamber before firing.
   3. Gas Train: Control devices and full-modulation control sequence shall comply with requirements in CSA (formerly AGA/CGA) and ASME CSD-1. In addition to these requirements, include shutoff cock, pressure regulator, and control valve.
   4. Gas Train: Combination gas valve with manual shutoff, pressure regulator, and pilot adjustment.
   5. Pilot: Intermittent-electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.
   6. Flue-Gas Recirculation Fans: Centrifugal fans on burner assembly to re-circulate flue gas to decrease oxides of nitrogen emissions to less than 30ppm.
      a. Motors: Comply with requirements specified in other Division 15.

I. Trim:
   1. Aquastat Controllers: Operating and high limit.
   2. Safety Relief Valve: ASME rated.
   3. Pressure and Temperature Gage: Minimum 3-1/2-inch- (89-mm-) diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.
   4. Boiler Air Vent: Automatic.
   5. Drain Valve: Minimum NPS 3/4 (DN 20) hose-end gate valve.
   6. Circulation Pump: Non-overloading, in-line pump with split-capacitor motor having thermal-overload protection and lubricated bearings; designed to operate at specified boiler pressures and temperatures.

J. Controls:
   1. Refer to Division 15 Section "Temperature Controls."
   2. Boiler operating controls shall include the following devices and features:
      a. Control transformer.
      b. Motorized Vent Damper: Interlocked with burner to open before burner starts. If damper fails to open, stop burner operation.
      c. Set-Point Adjust: Set points shall be adjustable.
      d. Sequence of Operation: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain system temperature in response to BAS.
      e. Include automatic, alternating-firing sequence for multiple boilers to ensure maximum system efficiency throughout the load range and to provide equal runtime for boilers.
   3. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.

a. High Cutoff: Manual reset stops burner if operating conditions rise above maximum boiler design temperature.
b. Water Flow Switch: Automatic-reset paddle-switch shall prevent burner operation on low water flow.
c. Blocked Vent Safety Switch: Manual-reset switch factory mounted on draft diverter.
d. Rollout Safety Switch: Factory mounted on boiler combustion chamber.
e. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.

4. Building Automation System Interface: Factory install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms.
   a. Monitoring: On/off status, common trouble alarm.
   b. Control: On/off operation, hot water supply temperature set-point adjustment.
   c. A communication interface with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through building automation system.

2.2 VENTING KITS

A. Vent Damper: Motorized, UL listed for use on atmospheric burner boiler equipped with draft hood; motor to open and close damper; stainless-steel vent coupling and damper blade; keyed wiring harness connector plug; and dual-position switches to permit burner operation.

B. Provide category IV venting complete system, ASTM AL 959, Type AL 29-4C stainless steel, pipe, vent terminal, thimble, indoor plate, vent adapter, condensate trap, and sealant. Comply with boiler manufacturer’s requirements for venting materials.
   1. Provide open top termination kit.

C. Combustion-Air Intake: Stainless steel, pipe, vent terminal with screen, inlet air coupling, and sealant.

2.3 SOURCE QUALITY CONTROL

A. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.

B. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.

C. Allow Owner access to source quality-control testing of boilers. Notify Architect 14 days in advance of testing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.
   1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

B. Examine mechanical spaces for suitable conditions where boilers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BOILER INSTALLATION

A. Install boilers level on concrete housekeeping pad.

B. Install gas-fired boilers according to NFPA 54.

C. Install oil-fired boilers according to NFPA 31.

D. Assemble and install boiler trim.

E. Install electrical devices furnished with boiler but not specified to be factory mounted.

F. Install control wiring to field-mounted electrical devices.

G. Install gas regulators as required; install regulator vents one size larger than regulator opening and per manufacturer’s installation requirements.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to boiler to allow service and maintenance.

C. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.

D. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.

E. Install piping from safety relief valves to nearest floor drain.

F. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.

G. Boiler Flue Venting:

1. Install venting kit and combustion-air intake.
2. Connect full size to boiler connections.

H. Connect breeching to full size of boiler outlet.

I. Ground equipment according to Division 16 Section "Grounding and Bonding for Electrical Systems."

J. Connect wiring according to Division 16 Section "Low-Voltage, Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:
1. Perform installation and startup checks according to manufacturer's written instructions.
2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
    a. Burner Test: Adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency.
    b. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature.
    c. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Remove and replace malfunctioning units and retest as specified above.

D. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

E. Performance Tests:
1. Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.
2. Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment in order to comply.
3. Perform field performance tests to determine the capacity and efficiency of the boilers.
    a. Test for full capacity.
    b. Test for boiler efficiency at low fire 20, 40, 60, 80, 100, 80, 60, 40 and 20 percent of full capacity. Determine efficiency at each test point.
4. Repeat tests until results comply with requirements indicated.
5. Provide analysis equipment required to determine performance.
6. Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.

7. Notify Architect in advance of test dates.
8. Document test results in a report and submit to Architect.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain boilers. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 235200

SECTION 237313 - AIR HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Extent of the work required by this section is indicated on drawings and schedules, and by requirements of this section.

B. The equipment specified by this section, is to be included as a part of the Air Handler Pre-Purchase package.

C. Types of Air Handling Units specified in this section include the following:
   1. Custom Outdoor Air Handling Units; Energy Recovery

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of packaged air handling units with characteristics, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:
   1. AMCA Compliance: Test and rate air handling units in accordance with AMCA standards.
   2. ARI Compliance: Test and rate air handling units in accordance with ARI 430 "Standard for Central-Station Air Handling Units", display certification symbol on units of certified models.
   3. ARI Compliance: Capacity ratings for air-to-air energy recovery equipment shall be ARI certified to Standard 1060, “Rating Air-to-Air Energy Recovery Equipment” and bear the ARI certification seal for ARI Air-to-Air Energy Reovery Ventilation Equipment Program based on ARI 1060. Ratings “in accordance with 1060” without certification are unacceptable.
   4. ASHRAE Compliance: Filters shall be tested in accordance to ASHRAE 52.
   5. NFPA Compliance: Provide air handling unit internal insulation having flame spread rating not over twenty-five (25) and smoke developed rating no higher than fifty (50); and complying with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".
   6. UL and NEMA Compliance: Provide electrical components required as part of air handling units, which have been listed and labeled by UL and comply with NEMA Standards.

7. NEC Compliance: Comply with National Electrical Code (NFPA 70) as applicable to installation and electrical connections of ancillary electrical components of air handling units.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for air handling units showing dimensions, weights, capacities, ratings, fan performance with operating point clearly indicated, motor electrical characteristics, gauges and finishes of materials, locations and size of each field connection, and installation instructions.

B. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, weight loadings, required clearances, construction details, and field connection details.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to air handling units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

D. Record Drawings: At project closeout, submit record drawings of installed systems products in accordance with requirements of Division 1.

E. Maintenance Data: Submit maintenance instructions, including instructions for lubrication, filter replacement, motor and drive replacement, and spare parts lists. Include this data, product data, shop drawings, and wiring diagrams in maintenance manuals; in accordance with requirements of Division 1.

1.5 SHIPMENT, DELIVERY, AND HANDLING

A. Air handling units shall be broken down and shipped in components as field conditions require. A factory authorized representative shall inspect the final installation to certify that the unit has been reassembled per factory recommendations and specifications.

B. Deliver air handling units with factory-installed shipping skids and lifting lugs; pack components in factory-fabricated protective containers.

C. Prepare air handling units carefully to avoid damage to components, enclosures, and finish.

D. If required, store air handling units in clean dry place and protect from weather.

E. Insure that Installing Contractor is aware of Manufacturer's rigging and installation instructions for unloading air handling units, and moving them to final location.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide air handling units of one of the following:
   1. Annexair

2. No Alternates

2.2 AIR HANDLING UNITS; ENERGY RECOVERY

A. General: Provide factory-fabricated and factory-tested air handling units as indicated, of sizes and capacities as scheduled, and as specified herein.
   1. Provide variable air volume units consisting of fan sections, coil sections, evaporative cooling sections and drain pans.
   2. Provide reinforced points of support for setting units.
   3. Provide sloped drain pan, located under all coil sections, including future coil sections, and evaporative cooling section, extensive enough to catch condensate leaving coil at highest catalogued face velocity. Provide at least one (1) drain connection at low point in drain pan in piping vestibule.
   4. Cover casing and frame with protective finish on both sides.
   5. Provide lights in accessible sections with wire guards, factory wired to switch mounted on casing exterior. In spray coil or humidifier sections provide marine lights of glass and wire sealed design.

B. Casings: Construct casings, designed to withstand specific operating pressures. Provide casing panels and/or access doors that are easily and quickly removable for inspection and access to internal parts.
   1. The unit housing shall be constructed from a frame, base and panel assembly.
   2. Fully welded extruded aluminum frame with fully welded base structure of formed heavy gauge galvanized steel.
   3. Floor inner liner shall be constructed of no thinner than 16 gauge G-90 steel mechanically fastened to the base structure which shall consist of an anti vibration gasket to diminish the metal to metal contact. An under-floor liner shall be provided. Base structure shall have removable integral lifting lugs.
   4. All roof and wall panels shall be made from G-90 galvanized steel, minimum 18-gauge exterior and 20 gauge interior. All panels and access doors shall be double wall construction with two-inch thick, minimum 3.0 PCF fiberglass insulation. Panels shall be fastened from the interior and gasketed along the frame to reduce thermal transmission. Fixed panels shall be removable without affecting the housing integrity.
   5. The airflow separation wall between the outside air intake and exhaust air outlet shall be 4-inch, fully insulated with the same insulation thickness as the exterior panels.
   6. Access doors shall be of double wall construction and shall be provided to all major components to facilitate quick and easy access. Each access door shall be latched with three (3) Ventlok type latches, heavy duty aluminum butt hinges and designed to open 180 degrees. Doors shall open against air pressure where indicated on drawings. Access doors shall be sealed with a full “U-Shaped” gasket for superior air tightness along the door edge. Bulb type gaskets are not be acceptable.

C. Roof Curbs: Manufacturer's standard construction, insulated and having corrosive protective coating, complete with factory-installed wood nailer and drain nipple. Construction shall be in accordance with NRCA Standards.

D. Coils: Provide heating coils of scheduled capacity, mounted in unit in manner permitting removal.

1. Construct coils with copper tubing primary surface and aluminum secondary surface bonded to tubes by method approved by specified manufacturer. Provide coils with threaded connections. Provide coils with drain and vent connections. Pitch coils in unit casing for drainage.

E. Coil Sections: Provide common or individual casing for heating coils and future cooling coils as required. Design internal structure of coil section to allow for removal of coils, and provide suitable baffles to assure no air bypass around coils. Provide drain pans and drain connections coil sections of sufficient size to contain and remove moisture. Insulate coil section casings and drain pans as specified herein. Coil performance shall be ARI 410 certified.

F. Fan Sections: Provide multiple direct drive plug fans which are specifically designed and suitable for the class of service indicated. Design fan assemblies so as not to pass through first critical speed when unit comes up to rated RPM. Provide grease-lubricated fan bearings with externally accessible fittings for lubrication. Statically and dynamically balance fan assemblies in fan housing after final assembly. Fans shall be AMCA tested and rated.
   1. Individual plug fans shall be provided with backdraft damper assembly to prevent reverse flow when fan is disabled.
   2. Provide inlet air flow straightener for each individual plug fan.
   3. Interlock access door with fans to turn all fans off when door is opened.
   4. Fan bearings shall be rated for a minimum of L5Ø life 200,000 hours.

G. Filter Section: Provide filter section with hinged access doors at each end. Provide racks to receive filters in flat configuration.
   1. Provide magnehelic gauges, one gauge shall be provided for each filter bank.

H. Evaporative Cooling Section:
   1. The sump shall be 16 gauge type, 304 stainless steel with welded seams. The media support shall be 16 gauge stainless steel. Extend sump minimum of 6” upstream of media. Size sump for the “OFF” condition so that water is not lost out the overflow draft.
   2. The media shall be Glasdek made from large glass fibers bound together by inorganic, noncrystallline fillers and UL approved with a UL900 Class 2 rating up to a 12 in depth 1 Media thickness, efficiency and air pressure drop shall be as scheduled.
   3. The manufacturer shall provide an internal copper piping system with a check valve, balancing valve, 0.5 in valved bleed off line piped to overflow drain and priming port for the pump.
   4. Pumps shall be stainless steel centrifugal submersible with a high starting torque motor and sealed bearing. Pumps shall be complete with low water cut off.
   5. The make-up water inlet shall be a 0.75 in float valve assembly with neoprene seat, brass rod, float ball and quick fill hose bib.
   6. The drain shall be 1.25 in valved with integral sump overflow.
   7. The manufacturer shall provide a distribution header, distribution pad, all air blank offs and a media support system as per MUNTERS MEDIA recommended installation procedures.
   8. The manufacturer shall ensure access is provided to both sides of sump for tank cleaning purposes.
   9. Provide an externally located disconnect switch for the pumps.
   10. Each direct evaporative cooling section shall include 2 pumps, piped for 1/3-2/3 distribution.
   11. Each indirect evaporative cooling section (exhaust side) shall include 1 pump.

12. All fasteners and brackets shall be stainless steel. Provide di-electric isolation between all dissimilar materials.

I. Fan Motors: Provide electric motors of size and capacity as required for fan operation as scheduled. Comply with Division 23 Section "Mechanical & Electrical Requirements For Mech Equipment".

J. Variable Frequency Controllers: Provide variable speed drives specifically for air handling fans of the type, and of size and capacity as scheduled. Comply with Division 23 Section "Variable Frequency Controllers".

K. Insulation: Insulate unit casing, throughout, including separation panel between outside air and return air path, and bypass duct if used. Insulate framing angles exposed to air stream. Securely attach insulation, of sufficient thickness and density to prevent condensation from forming on unit casing. Protect insulation against deterioration from air currents.
1. Provide insulation with fire-retarding characteristics, complying with NFPA 90A. Insulate drain pans as required to prevent condensate formation on unit exterior at ambient conditions to be encountered.

L. HEAT WHEELS
1. The sensible recovery wheel shall be provided with the efficiency, pressure drop and motor horsepower as scheduled or shown on the plans. The pressure drop shall not be more than 0.1" WC for every 100 FPM face velocity for the stated and scheduled recovery efficiency.
2. The wheel matrix shall be constructed from epoxy coated corrugated aluminum. Construct media to have wheel fin spacing of 15 FPI maximum allowing an 800 micron particle to pass through and to limit cross contamination between air streams to 0.01 percent by volume of exhaust air and to maintain high heat transfer efficiency. Perimeter seals shall be full contact, low bleed type, made from dual band ultra high molecular weight polyethylene. Non-contact seals and fabric seals are not acceptable.
3. All wheels shall be AHRI 1060 certified. All wheels shall be independently tested in accordance with NFPA 90 smoke flame rating standards and meet 25/50 flame and smoke spread rating.
4. Rotor: Construct of corrugated aluminum strengthened with radial spokes for rigidity. Provide bacteriostatic, non-toxic, non-corrosive desiccant coating. Drive rotor by means of belt around outside or rotor.
    a. The media shall be cleanable with compressed air or low pressure steam or light detergent without degrading the latent recovery.
5. Drive: Provide variable-speed, fractional HP motor, and gear reducer, with speed control.
6. Accessories: Provide the following accessories:
    a. Timer to periodically rotate wheel during prolonged shutdown periods.
7. Frost Control: Frost control shall be accomplished by a variable speed drive and controlling the wheel speed based on differential pressure across the wheel on the exhaust side. Manufacturer shall provide performance data showing compliance with schedule data with specified equipment construction. This shall include heat recover leaving air temperatures and evaporative cooler temperatures. Provide psychrometric analysis showing frost prevention has been accounted for.

M. Outdoor Enclosures: Provide weather resistant, outdoor type enclosures for units exposed to weather. Pitch tops of casings for water run-off. Provide gaskets for assembled joints, calk weather-tight.

N. Air Filters: Provide air filters of the following type:
   1. Disposable Pre-Filter: Provide pleated panel type air filters with the following characteristics:
      a. 2-inch thick, consisting of viscous coated fibers with filtering media encased in fiberboard cell sides having perforated metal grids on each side to provide media support.
      b. 30-35% dust spot efficiency, ASHRAE Standard 52.1.
      c. MERV 8 @ 3-10 micron, ASHRAE Standard 52.2
      d. Clean resistance not exceeding 0.50 inches w.g. at face velocity of 500 fpm
      e. Final resistance 0.9 inches w.g.
      f. UL Standard 900 Class I
      g. Camfil Farr 30/30.
   2. Disposable Post-Filter: Provide extended surface multi-pocket type air filters with the following characteristics:
      a. 12” long filter section, consisting of microfine fiberglass or synthetic media, rigid box-type construction.
      b. 90-95% dust spot efficiency, ASHRAE Standard 52.1.
      c. MERV 13 @ 0.3-1.0 micron, ASHRAE Standard 52.2
      d. Clean resistance not exceeding 0.50 inches w.g. at face velocity of 500 fpm
      e. Final resistance 1.5 inches w.g..
      f. UL Standard 900 Class I
      g. Camfil Farr Riga-Flo.

O. Dampers:
   1. Provide internally mounted minimum outside air, outside air, return air, and exhaust air dampers. Dampers to be Ruskin CD36 or approved equivalent. Dampers shall be of standard interlocking blade design and galvanized construction; they shall be parallel blade type with replaceable extruded vinyl blade edge seals on all blades. Blades shall rotate on synthetic sleeve bearings. Maximum damper blade length shall be 60 inches. Leakage rate shall not exceed 5.4 cfm per square foot at one-inch WG.
   2. Dampers shall be furnished with stainless steel side (jamb) seals.

P. Provide Marine lights with protective metal cage and glass seals complete with duplex receptacles shall be installed on the wall across from the access doors. A switch with an indicator light shall be installed on the unit. Electrical power shall be 120V/1/60. Lights shall be equipped with compact fluorescent bulbs. Wiring for lighting shall be in rigid EMT conduit with rain tight fittings. Comply with NEC.

Q. Sound Power: Provide unit that meets or exceeds the sound power data listed below.

Frequency	63	125	250	500	1000	2000	4000	8000
Return	74	78	85	83	79	77	76	76
Supply	80	81	89	84	88	80	80	80

PART 3 - EXECUTION

3.1 INSPECTION

A. Be familiar with the area and the conditions under which air handling units are to be installed. Advise mechanical contractor and engineer of any adverse conditions, or environmental factors that may affect the installation or performance of the air handling unit.

3.2 INSTALLATION OF AIR HANDLING UNITS

A. General: Install air handling units where indicated, in accordance with equipment manufacturer's published installation instructions, and with recognized industry practices, to ensure that units comply with requirements and serve intended purposes.

B. Coordination: Coordinate with other work, including ductwork, floor construction, roof decking, and piping, as necessary to interface installation of air handling units with other work.

C. Access: Provide access space around air handling units for service as indicated, but in no case less than that recommended by manufacturer.

D. Support: Install roof-mounted air handling units on structural steel. Anchor unit to roof steel as indicated on structural plans.

E. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
   1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to Equipment Installer.

F. Piping Connections: Refer to Division 23 HVAC sections. Provide piping, valves, accessories, gauges, supports, and as indicated.
   1. Provide shutoff valves, balancing valves, unions, thermometers (supply and return), P and T taps (supply and return) and other accessories on all piping connections.

G. Duct Connections: Refer to Division 23 Air Distribution sections. Provide ductwork, accessories as indicated.
   1. Provide flexible connections on all duct connections.

H. Grounding: Provide positive equipment ground for air handling unit components.

3.3 FIELD QUALITY CONTROL

A. Testing: Upon completion of installation of air handling units, provide factory trained start-up support to the installing contractor. Mechanical Contractor shall perform actual start-up and operate equipment to demonstrate capability and compliance with requirements. Field correct malfunctioning units if required, then retest to demonstrate compliance with these specifications.

3.4 EXTRA STOCK

A. Provide one (1) complete extra set of filters for each air handling unit. Install new filters at completion of air handling system work, and prior to testing, adjusting, and balancing work. Obtain receipt from Owner that new filters have been installed.

3.5 TRAINING

A. Schedule a minimum of four (4) hours of training with Owner. The manufacturer's representative, and the Division 23 Contractor shall be present. The training shall be coordinated by the Division 23 Contractor and the Owner in conjunction with the other mechanical equipment on the project.

B. Training:
   1. Train the Owner's maintenance personnel on start-up and shutdown procedures, troubleshooting procedures, and servicing and preventative maintenance schedules and procedures. Review with the Owner's personnel, the contents of the Operating and Maintenance manual.
   2. Schedule training with Owner through the Architect/Engineer with at least seven (7) days prior notice.

END OF SECTION 237313

SECTION 237414 - ROOFTOP HEATING & COOLING UNITS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of Packaged Rooftop Heating and Cooling Units Work required by this section is indicated on drawings and schedules, and by requirements of this section.

B. Refer to other Division 23 sections for metal ductwork, air devices, automatic temperature controls not factory-installed, and required for conjunction with packaged heating and cooling units; not work of this section.

C. Electrical Work: Refer to Division 23 section "Electrical Provisions of Mechanical Work" for requirements.

1.2 REFRIGERANTS

A. All refrigerants used for each condensing unit shall be on the latest EPA list of approved refrigerants and environmentally friendly.

B. No HCFC based refrigerants shall be used.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, dimensions, required clearances, weights, furnished specialties and accessories; and installation and start-up instructions.

B. LEED Submittals:
   1. Product data for Credit EA 4: for refrigerants, documentation including printed statement that refrigerants are free of HCFC’s.

C. Shop Drawings:
   1. Submit shop drawings detailing the manufacturer's electrical requirements for power supply wiring for rooftop heating and cooling units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
   2. Submit shop drawings detailing the mounting, securing, and flashing of the roof curb to the roof structure. Indicate coordinating requirements with roof membrane system.

D. Record Drawings: At project closeout, submit record drawings of installed systems products in accordance with requirements of Division 1.

E. Maintenance Data: Submit maintenance data and parts list for each rooftop heating and cooling unit, control, and accessory, including "trouble-shooting" maintenance guide. Include this data in maintenance manual; in accordance with requirements of Division 1.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of rooftop heating and cooling units, of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:
   1. Testing and rating of rooftop units of 135,000 BTU/Hr capacity or over shall be in accordance with ARI 360 "Standard for Commercial and Industrial Unitary Air-Conditioning Equipment".
   2. Testing and rating of rooftop units under 135,000 BTU/Hr capacity shall be in accordance with ARI 210 "Standard for Unitary Air-Conditioning Equipment", and provide Certified Rating Seal. Sound testing and rating of units shall be in accordance with ARI 270 "Standard for Sound Rating of Outdoor Unitary Equipment". Units shall bear Certified Rating Seal.
   3. Refrigerating system construction of rooftop units shall be in accordance with ASHRAE 15 "Safety Code for Mechanical Refrigeration".
   4. Energy Efficiency Ratio (EER) of rooftop units shall be equal to or greater than prescribed by ASHRAE 90.1 A "Energy Conservation in New Building Design".
   5. Provide rooftop units which are UL listed and labeled.
   6. Rooftop units shall be designed, manufactured, and tested in accordance with UL requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Handle rooftop units and components carefully to prevent damage. Replace damaged rooftop units or components with new.

B. Store rooftop units and components in clean dry place, off the ground, and protect from weather, water, and physical damage.

C. Rig rooftop units to comply with manufacturer's rigging and installation instructions for unloading rooftop units, and moving them to final location.

1.6 SCHEDULING AND SEQUENCING

A. Coordinate installation of roof mounting curb with roof structure.

B. Coordinate roof opening locations and for mechanical and electrical connections.

1.7 SPECIAL WARRANTY

A. Warranty on Compressor: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, compressors with inadequate and defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Replacement is limited to component replacement only, and does not include labor for removal and reinstallation.

1. Warranty Period: Five (5) years from date of substantial completion.

1.8 MAINTENANCE

A. Extra Materials: Furnish to Owner, with receipt, the following spare parts for each rooftop heating and cooling unit:
   1. One (1) set of matched fan belts for each belt-driven fan.
   2. One (1) set of filters for each unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Rooftop Units:
      a. Trane (The) Co; Division of American Standard Inc.
      b. Carrier Air Conditioning; Division of Carrier Corp.

2.2 ROOFTOP UNITS LESS THAN 20 TONS

A. General Description: Units shall be factory-assembled and tested, designed for roof or slab installation, and consisting of compressors, condensers, evaporator coils, condenser and evaporator fans, refrigeration and temperature controls, filters, condenser coil guards and dampers. Capacities and electrical characteristics are scheduled on the Drawings.

B. Casing: Manufacturer's standard casing construction, having corrosion protection coating, and exterior finish. Casings shall have removable panels or access doors for inspection and access to internal parts, a minimum of 1/2-inch thick thermal insulation, knockouts for electrical and piping connections and an exterior condensate drain connection and lifting lugs.

C. Roof Curbs: Manufacturer's standard construction, insulated and having corrosive protective coating, complete with factory-installed wood nailer and drain nipple. Construction shall be in accordance with NRCA Standards.

D. Evaporator Fans: Forward-curved, centrifugal, belt-driven fans with adjustable sheaves or direct-driven fans; and permanently lubricated motor bearings.

E. Condenser Fans: Propeller-type, direct-driven fans with permanently lubricated bearings.

F. Coils shall be constructed with a minimum of two rows.

G. Coils:
   1. General: Aluminum plate fin and seamless copper tube type. Fins shall have collars drawn, belled and firmly bonded to the tubes by means of mechanical expansion of the tubes. No soldering or tinning shall be used in the bonding process. Coils shall have a galvanized steel casing. Coils shall be mounted in the coil casing with same end connections accessible for service. Coils shall be removable from the unit through the roof or through the piping enclosure. Coil section shall be completely insulated.
   2. Refrigerant Cooling Coils: Have an equalizing type vertical distributor to ensure each coil circuit receives the same amount of refrigerant. Coils shall be proof (450 psig) and leak (300 psig) tested with air pressure under water, then cleaned, dehydrated, and sealed with a holding charge of nitrogen.

H. Compressors: Serviceable, semi-hermetic, or fully hermetic compressors, complete with integral vibration isolators and crankcase heaters.

I. Safety Controls: Manual reset type for:
   1. Low pressure cutout;
   2. High pressure cutout;
   3. Compressor motor overload protection.

J. Economizer Control: Return and outside air dampers, outside air filter, fully modulating electric control system with dry bulbs control, and adjustable mixed-air thermostat. System shall have 100 percent outside air capability. Provide automatic changeover through adjustable dry bulbs control device.

K. Variable Air Volume Control: Discharge air step controller, and electric control system with dry bulb control.

L. Accessories: Units shall include the following accessories as indicated or scheduled:
   1. Anti-Recycling Control: Furnish anti-recycling control to automatically prevent compressor restart for five (5) minutes after shutdown.
   2. Modulating power exhaust economizer: Provide a fully programmable, variable speed drive, powered exhaust economizer. Can fab or equal.

M. Sound Power: Provide unit that meets or exceeds the sound power data listed below.

Frequency	63	125	250	500	1000	2000	4000	8000
Return	87	87	77	72	70	65	60	50
Supply	83	84	79	77	72	70	67	60

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which rooftop units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION

A. General: Install rooftop units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

B. Support: Install and secure roof curb to roof structure, in accordance with National Roofing Contractor's Association (NRCA) installation recommendations and shop drawings. Install and secure rooftop units on curbs and coordinate roof penetrations and flashing.

C. Electrical Connections: Refer to Division 26 for final connections to equipment and installation of loose shipped electrical components.

D. Install power exhaust economizer in accordance with manufacturer’s printed instructions.

3.3 DEMONSTRATION

A. Start-Up Services:
   1. Provide the services of a factory-authorized service representative to start-up rooftop units, in accordance with manufacturer's written start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

B. Operating and Maintenance Training:
   1. Provide services of manufacturer's service representative to instruct Owner's personnel in operation and maintenance of rooftop units. Training shall include start-up and shutdown, servicing and preventative maintenance schedule and procedures, and troubleshooting procedures plus procedures for obtaining repair parts and technical assistance. Review operating and maintenance data contained in the Operating and Maintenance Manuals specified in Division 1.
   2. Schedule training with Owner, provide at least seven (7) day prior notice to the Architect/Engineer.

3.4 EXTRA STOCK

A. Provide one (1) complete extra set of filters for each air handling unit. Install new filters at completion of air handling system work, and prior to testing, adjusting, and balancing work. Obtain receipt from Owner that new filters have been installed.

END OF SECTION 237414

SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. LEED Submittals:
   1. Product Data for Credit EA 4: For refrigerants, documentation including printed statement that refrigerants are free of HCFCs.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Wiring Diagrams: For power, signal, and control wiring.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Field quality-control reports.

F. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

G. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:
   1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
   2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-Up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

1.5 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
   1. Warranty Period:
      a. For Compressor: One year(s) from date of Substantial Completion.
      b. For Parts: One year(s) from date of Substantial Completion.
      c. For Labor: One year(s) from date of Substantial Completion.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Filters: One set(s) for each air-handling unit.
   2. Gaskets: One set(s) for each access door.
   3. Fan Belts: One set(s) for each air-handling unit fan.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Mitsubishi Electric & Electronics USA, Inc.; HVAC Advanced Products Division.
   2. SANYO North America Corporation; SANYO Fisher Company.

3. Toshiba Carrier

2.2 INDOOR UNITS 5 TONS OR LESS

A. Wall-Mounted, Evaporator-Fan Components:
   1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
   2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
   3. Fan: Direct drive, centrifugal.
   4. Fan Motors:
      a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
      b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
      c. Enclosure Type: Totally enclosed, fan cooled.
      d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
      e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
      f. Mount unit-mounted disconnect switches on exterior of unit.
   5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
   6. Condensate Drain Pans:
      a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
         1) Length: Extend drain pan downstream from leaving face.
         2) Depth: A minimum of 1 inch deep.
      b. Single-wall, stainless-steel sheet.
      c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
         1) Minimum Connection Size: NPS 1.
      d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
   7. Air Filtration Section:
      a. General Requirements for Air Filtration Section:
         1) Comply with NFPA 90A.
         2) Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
         3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.
      b. Disposable Panel Filters:
         1) Factory-fabricated, viscous-coated, flat-panel type.
         2) Thickness: 1 inch.
         3) Media: Interlaced glass fibers sprayed with nonflammable adhesive.
         4) Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.

2.3 OUTDOOR UNITS (5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:
   1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
   2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
      a. Compressor Type: Scroll.
      b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
      c. Refrigerant Charge: R-410A.
      d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 210/240.
   3. Fan: Aluminum-propeller type, directly connected to motor.
   4. Motor: Permanently lubricated, with integral thermal-overload protection.
   5. Low Ambient Kit: Permits operation down to 45 deg F.
   6. Mounting Base: Polyethylene.

2.4 ACCESSORIES

A. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:
   1. Compressor time delay.
   2. 24-hour time control of system stop and start.
   3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
   4. Fan-speed selection including auto setting.

B. Automatic-reset timer to prevent rapid cycling of compressor.

C. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

D. Drain Hose: For condensate.

E. Integral condensate Pump.

2.5 CAPACITIES AND CHARACTERISTICS

A. See Equipment Schedule on Plans for capacities.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounted, compressor-condenser components on equipment supports specified in Division 07 Section "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

D. Install seismic restraints, per Code.

E. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch.

F. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.4 STARTUP SERVICE

A. Perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126

SECTION 238200 - TERMINAL UNITS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of Terminal Unit Work is indicated on drawings and schedules, and by requirements of this section.

B. Types of Terminal Units required for project include the following:
   1. Baseboard Radiation
   2. Unit Heaters
   3. Cabinet Unit Heaters
   4. Fan-Coil Units
   5. Radiant Ceiling Panels

C. Refer to other Division 23 sections for piping; ductwork; testing, adjusting and balancing of terminal units; not work of this section.

D. Refer to Division 26 section for the following work; not work of this section.
   1. Power supply wiring from power source to power connection on terminal units.
   2. Provide the following electrical work as work of this section, complying with requirements of Division 26 sections:
      a. Control wiring between field-installed controls, indicating devices, and terminal unit control panels.
         1) Control wiring specified as work of Division 23 for Automatic Temperature Controls is work of that section.

E. Refer to other Division 23 sections for automatic temperature controls not factory installed, required in conjunction with terminal units; not work of this section.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of terminal units, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Codes and Standards:
   1. I=B=R Compliance: Test and rate baseboard and finned tube radiation in accordance with I=B=R, provide published ratings bearing emblem of I=B=R.
   2. ARI Compliance: Provide coil ratings in accordance with ARI Standard 410 "Forced-Circulation Air-Cooling and Air-Heating Coils".
   3. ASHRAE Compliance: Test coils in accordance with ASHRAE Standard 33 "Methods of Testing Forced Circulation Air Cooling and Heating Coils".
   4. ARI Compliance: Test and rate fan-coil units in accordance with ARI Standard 440 "Room Fan-Coil Air Conditioners".

5. UL Compliance: Construct and install fan-coil units in compliance with UL 883 "Safety Standards for Fan Coil Units and Room Fan Heater Units".
6. UL Compliance: Provide electrical components for terminal units which have been listed and labeled by UL.
7. ARI Compliance: Test and rate ventilators in accordance with ARI Standard 330 "Unit Ventilators".
8. Electric Heating Equipment: All equipment with a heating coil capacity exceeding a 48 amp rating shall have the heating elements subdivided and protected by an overcurrent protection device rated at not more than 60 amps. Equipment not exceeding 48 amps shall also have overcurrent protection. Overcurrent protection devices shall be factory wired and installed in accordance with the National Electric Code. All equipment shall be factory assembled and wired in accordance with the National Fire Protection Association and shall be listed by Underwriters' Laboratories.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, for terminal units showing dimensions, capacities, ratings, performance characteristics, gauges and finishes of materials, and installation-startup instructions.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating terminal unit dimensions, weight loading, required clearances, construction details, field connection details and methods of assembly of components.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to terminal units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

D. Record Drawings: At project closeout, submit record drawings of installed systems products in accordance with requirements of Division 1.

E. Samples: Submit three (3) color charts of each type of unit.

F. Maintenance Data: Submit maintenance instructions, including lubrication instructions, filter replacement, motor and drive replacement, control, accessories, "trouble-shooting" maintenance guide, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 1.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Handle terminal units and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged terminal units or components; replace with new.

B. Store terminal units and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

C. Comply with Manufacturer's rigging and installation instructions for unloading terminal units, and moving them to final location.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. Baseboard Radiation:
      a. Modine Mfg. Co.
      b. Slant/Fin Corp.
      c. Standard Fin-Pipe Radiator Corp.
      d. Sterling Radiator; Division of Reed National Corp.
      e. Trane (The) Co.
      f. Vulcan Radiator Corp.
   2. Unit Heaters:
      a. Airtherm Mfg. Co.
      b. Buffalo Forge Co.
      c. Dunham-Bush, Inc.
      d. Modine Mfg. Co.
      e. Trane (The) Co.
      f. Wing (The) Co.; Division Wing Industries, Inc.
      g. Young Radiator Co.
      h. Vulcan Radiator Corp.
   3. Cabinet Unit Heaters:
      a. Airtherm Mfg. Co.
      b. Dunham-Bush, Inc.
      c. Modine Mfg. Co.
      d. Trane (The) Co.
      e. Young Radiator Co.
      f. Vulcan Radiator Corp.
   4. Fan Coil Units:
      a. Price
      b. Airtherm Mfg. Co.
      c. Carrier Corp.
      d. Trane (The) Co.
      e. York; Division of York International
      f. International Environmental Corp.
      g. Titus
   5. Radiant Ceiling Panels
      a. Sterling
      b. Airtex
      c. Aero Tech Mfgr Co.

2.2 BASEBOARD RADIATION

A. General: Provide hot water baseboard radiation of lengths, wall-to-wall enclosure, in locations as indicated, of capacities, style, and having accessories as scheduled.

B. Cabinets: Minimum 20 gauge cold-rolled steel, 1-piece back and top panel, front panel with integral damper. Provide steel brackets inserted in back/top panel, to support element and front

panel. Provide custom baked enamel finish on topside and front panel only. Submit color chart for selection by Architect.

C. Elements: Copper tube and aluminum fins, with slide mechanism between element and support brackets to eliminate expansion and contraction noises.

D. Accessories: Provide the following accessories:
1. End panels, inside and outside corners, and enclosure extensions.
2. Removable 18-inch long cover access section in front of valves, balancing cocks, and traps.
3. Factory-mounted dampers.
4. Sill extensions.
5. Mullion channels.
6. Pilaster covers.
7. Pipe Slide Guides glide on support brackets to eliminate expansion and contraction noises.

2.3 UNIT HEATERS

A. General: Provide unit heaters in locations as indicated, and of capacities, style, and having accessories as scheduled.

B. Horizontal Unit Heaters:
1. Casings: Construct of steel, phosphatized inside and out, and finished with standard color baked enamel finish. Provide motor-mounted panel, minimum of 18 gauge steel. Fabricate casing to enclose coil, louvers, and fan blades. Provide louvers for 4-way air diffusion.
2. Fans: Construct of aluminum, and factory-balance. Provide fan inlet orifice, smooth, and drawn into casing back panel.

C. Vertical Unit Heaters:
1. Casings: Construct of steel, phosphatized inside and out, and finished with standard color baked enamel finish. Design casing to enclose fan, motor, and coil, design fan orifice formed into discharge panel. Provide air diffusers as scheduled.
2. Fans: Construct of aluminum and factory-balance. Design so motor and fan assembly is removable through fan outlet panel.

D. Coils: Construct of plate-type aluminum fins, mechanically bonded to copper tubes. Design coil for use in hot water applications.

E. Motors: Provide totally enclosed motors, with built-in overload protection, having electrical characteristics as scheduled.

2.4 CABINET UNIT HEATERS

A. General: Provide hot water cabinet heaters having cabinet sizes and in locations as indicated, and of capacities, style, and having accessories as scheduled. Include in basic unit chassis, coil, fanboard, fan wheels, housings, motor, and insulation.

B. Chassis: Galvanized steel wrap-around structural frame with edges flanged.

C. Insulation: Faced, heavy density glass fiber.

D. Cabinet: 16 Gauge removable front panel, 18 gauge top and side panels. Insulate front panel over entire coil section. Provide access door on coil connection side. Clean cabinet parts, bonderize, phosphatize, and flow-coat with custom color as selected by Architect in baked enamel finish. Submit color chart.

E. Water Coils: Construct of 5/8-inch seamless copper tubes mechanically bonded to configurated aluminum fins. Design for 300 psi and leak test at 300 psi under water. Provide same end connections for supply and return.

F. Fans: Provide centrifugal, forward curved double width fan wheels constructed of non-corrosive, molded, fiberglass-reinforced thermoplastic material. Construct fan scrolls of galvanized steel.

G. Motors: Provide shaded pole motors with integral thermal overload protection, and motor cords for plug-in to junction box in unit.

H. Filters: Provide replaceable "sock" type filters. Provide tack-welded wire frame custom made for CUH to replace factory filters.

I. Accessories: Provide the following accessories as indicated and/or scheduled:
   1. Wall Boxes: Provide aluminum wall boxes with integral eliminators and insect screen.
   2. Recessing Flanges: Provide 18 gauge steel flanges for recessing cabinet heaters into wall or ceiling.
   3. Sub-bases: Provide 18 gauge steel sub-base for vertical units, height as indicated.
   4. Extended Oilers: Provide plastic motor oiler tubes extending to beneath top discharge grille.

2.5 FAN-COIL UNITS

A. General: Provide fan-coil units having cabinet sizes, and in locations indicated, and of capacities, style, and having accessories as scheduled. Include in basic unit chassis, coils, fanboard, fans, housing, motor, filter, and insulation. Fan coil piping connections , filter access, control panel shall be provided on the “Access Side” of the units per the layout in the drawing to allow for maintenance access.
   1. Fan coils for under-floor applications shall fit in floor plenum.

B. Chassis: Construct chassis of galvanized steel with flanged edges.

C. Insulation: Faced, heavy density glass fiber.

D. Cabinet: Construct of 18 gauge steel removable panels, 16 gauge front. Provide insulation over entire coil section. Clean cabinet parts, bonderize, phosphatize, and flow-coat with standard factory baked enamel finish.

E. Coils: Construct of ½-inch seamless copper tubes mechanically bonded to configurated aluminum fins. Design for 250 psi working pressure, and leak tested at 350 psi under water.

F. Fans: Provide centrifugal forward curved double width wheels of reinforced fiberglass, in galvanized steel fan scrolls.

G. Motors: Provide motors with integral thermal overload protection. Run test motors at factory in assembled unit prior to shipping. Provide quickly detachable motor cords.
   1. Provide ECM meters for under floor fan coil units.

H. Filters: Provide MERV 13 filters and custom filter frame.

I. Accessories: Provide the following accessories as indicated and/or scheduled:
   1. Integral backdraft damper.
   2. Filter.

J. Controls: Controls shall be furnished by work of Section 23 09 00, Direct Digital Controls , for factory installation. Coordinate with controls installer.

2.6 RADIANT CEILING PANELS

A. The radiant panels shall be placed into a standard grid system to be provided by the General Contractor in accordance with the Architect's reflected ceiling panels.

B. Provide ½-inch O.D., Type "L" copper loops for interconnection of panels.

C. Radiant panels shall have certified performance data provided by a recognized testing laboratory.

D. Panels shall be finished with standard white paint. Submit color chart for Architect's review.

E. Provide supervision by distributor of panels.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which terminal units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF BASEBOARD RADIATION

A. General: Install baseboard radiation as indicated, and in accordance with manufacturer's installation instructions.

B. Locate baseboard radiation on outside walls as indicated, run cover continuous wall-to-wall unless otherwise indicated.

C. Center elements under windows. Where multiple windows occur over units, divide element into equal segments centered under each window.

D. Install end caps where units butt against walls. Install access panels centered in front of each shutoff valve, balancing cock, or temperature control valve.

3.3 INSTALLATION OF UNIT HEATERS

A. General: Install unit heaters as indicated, and in accordance with manufacturer's installation instructions.

B. Uncrate units and inspect for damage. Verify that nameplate data corresponds with unit designation.

C. Hang units from building substrate, not from piping. Mount as high as possible to maintain greatest headroom possible unless otherwise indicated.

D. Support units with rod-type hangers anchored to building substrate.

E. Install piping as indicated.

F. Protect units with protective covers during balance of construction.

3.4 INSTALLATION OF CABINET HEATERS

A. General: Install cabinet heaters as indicated, and in accordance with manufacturer's installation instructions.

B. Locate cabinet heaters as indicated, coordinate with other trades to assure correct recess size for recessed units.

C. Install piping as indicated.

D. Protect units with protective covers during balance of construction.

3.5 INSTALLATION OF FAN-COIL UNITS

A. General: Install fan-coil units as indicated, and in accordance with manufacturer’s installation instructions.

B. Locate fan-coil units as indicated. Coordinate with other trades to assure unit will fit in locations indicated.

C. Provide piping as detailed on the drawings.

3.6 INSTALLATION OF RADIANT CEILING PANELS

A. General: Install radiant ceiling panels as indicated and in accordance with manufacturer’s installation instructions.

B. Inspect for damage and verify that nameplate data correspondence with panel disignation.

3.7 ELECTRICAL WIRING

A. General: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment Installer.

3.8 ADJUSTING AND CLEANING

A. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean terminal coils and inside of cabinets.

B. Retouch any marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

C. Install new filter units for terminals requiring same.

3.9 START-UP

A. Start-up, test, and adjust terminal units in accordance with manufacturer's published start-up instructions. Adjust for proper air flow where applicable.

END OF SECTION 238200

SECTION 238317 - RADIANT-HEATING SNOWMELT PIPING – ADD ALTERNATE 3

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions or the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Snow and ice melting systems (SIM), where shown on the Drawings and Schedules, shall be hydronic.

B. The work in this Section includes, but is not limited to the following:
   1. Crosslinked polyethylene (PEXa) piping.
   2. Distribution manifold(s) with balancing and flow control valves where required.
   3. Pipe-to-manifold compression nut fittings.
   4. Cold-expansion and compression-sleeve fittings.
   5. Pipe fasteners as approved by the manufacturer of the piping.
   6. Systems Controls and Automation.
   7. Manufacturer supported supervision and field engineering required for the complete and proper function of the system.

1.3 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit manufacturer’s product submittal data and installation instructions.

C. Submit the following shop drawings, calculations and reports.
   1. Submit shop drawings for piping installation in the project. Indicate all valves, pumps and items of equipment that are required to control and operate the hydronic radiant system for heating as shown on the drawings and described in the sequence of operations. Submit a valve and pump schedule listing each number, type, size, model and service. Cross reference to supporting product data.
   2. Submit manufacturer's detailed drawings showing layouts, fixing details and piping details of all areas where hydronic radiant systems are indicated along with product and performance data for each component.
   3. Provide calculations that support the heating performance requirements of the hydronic radiant system. These calculations should show the flow through the system for heating as well as the primary heating connections to the radiant system headers and control circuits. Provide system pressure-drop calculations as well.
   4. Submit drawings showing details of manifolds, including all connections and valves. If manifolds are to be installed on a wall, then the details should include all fixture details.

If the manifolds are to be installed in wall cavities, then provide all fixture and access details.

5. Specify piping materials and temperature/pressure ratings.
6. Provide drawings showing the location of all expansion and penetration sleeves, showing coordination with concrete slab expansion joints. Provide confirmation of concrete slab expansion requirements and the use of any concrete additives.
7. Provide drawings showing piping manifold locations and installation details.
8. Provide control sequences and requirements for control hardware devices. Indicate compliance and coordination with requirements of other specification sections.
9. Provide piping sample with certification of properties.
10. Submit manufacturer's report detailing that the hydronic radiant system has been installed in accordance with this specification and the manufacturer's specified instructions.
11. Submit report indicating that installation was performed according to the manufacturer's instructions. Include pressure testing documentation as required in related specification sections.
12. Submit start-up report demonstrating that system meets required capacity, is fully functional and commissioned to the satisfaction of system manufacturer.
13. Provide installation drawings indicating tubing layout, manifold locations, zoning requirements and manifold schedules with details required for installation of the system. Provide sectional drawing of floor slab demonstrating coordination with other construction trades and showing insulation, if required.

D. Quality Assurance/Control Submittals: Submit test reports. Upon request, submit test reports from recognized testing laboratories.

E. Documentation: Submit the following documentation:
   1. Manufacturer’s certificate indicating products comply with specified requirements.
      a. Submit independent certification results for the piping systems from an accredited independent testing laboratory.
      b. The design shall be approved by a professional appropriately licensed in the jurisdiction where the installation will take place, as being complete and accurate.
      c. Fittings shall be third-party certified to applicable referenced standards as part of the manufacturer’s PEX piping system, with independent listings from NSF, CSA and ICC, as applicable.
      d. Fittings embedded within the thermal mass or encased behind walls or ceilings shall be certified to ASTM F2080.
   2. Manufacturer’s detailed zone-by-zone heat-loss analysis for the structure.
   3. Documentation indicating the installer is trained to install the manufacturer’s products.

F. Close-out Submittals: Submit the following documents.
   1. Warranty documents specified herein
   2. Operation and maintenance data
   3. Manufacturer’s field reports specified herein
   4. Final as-built tubing layout drawing

G. Submit computer-generated SIM system design indicating heat flux, pipe sizing, spacing, flow rates, and temperatures. SIM design calculations shall be performed on pipe manufacturer’s software.

1.4 QUALITY ASSURANCE

A. References
   1. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are cited by issuing authority abbreviation and standard designation.

B. ASTM – American Society for Testing and Materials
   1. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials
   3. ASTM F876 – Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
   4. ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops
   5. ASTM F877 – Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems.
   6. ASTM F2014 – Standard Specification for Non-Reinforced Extruded Tee Connections for Piping Applications.
   7. ASTM F2080 – Standard Specification for Cold-Expansion Fittings With Metal Compression-Sleeves for Cross-Linked Polyethylene (PEX) Pipe.

C. CSA – Canadian Standards Association
   1. CSA B137.5 – Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.
   2. CSA B214 – Installation Code for Hydronic Heating Systems.

D. American National Standards Institute (ANSI)/Underwriters Laboratories, Inc. (UL)
   1. ANSI/UL 263 Standard for Safety for Fire Tests of Building Construction and Materials

E. IAPMO – International Association of Plumbing and Mechanical Officials
   1. Uniform Mechanical Code

F. ICC – International Code Council
   1. International Mechanical Code (IMC)
   2. ICC Evaluation Service (ES) Evaluation Report No ESR-1099

G. ISO – International Organization for Standardization
   1. ISO 9001 – Quality Management Systems – Requirements

H. ULC – Underwriters' Laboratories of Canada
   1. CAN/ULC S102.2 – Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials.

I. PPI – Plastic Pipe Institute
   1. TR-3 / 2007 – Policies and Procedures for Developing Hydrostatic Design Basis (HDB), for thermoplastic piping materials or pipe.
   2. TR-4/2007- Recommended Hydrostatic Pressure Design Basis (PDB), Strength Design Basis (SDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe.

1.5 DEFINITIONS

A. Crosslinked polyethylene, commonly abbreviated PEX, is made from high density polyethylene (HDPE). Crosslinking is accomplished during manufacturing. Crosslinking enhances the physical & mechanical properties of the polymer. The high-temperature properties are improved. Chemical resistance is enhanced by resisting dissolution. Low temperature properties are also improved; its impact and tensile strength, scratch resistance, and resistance to brittle fracture are enhanced. The required degree of crosslinking, according to ASTM Standard F876-07, is between 70 - 89%. This specification requires PEX to be designated as PEXa and be manufactured by the high-pressure peroxide method.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with Division 1, Product Requirements.

B. Deliver and store piping and equipment in shipping containers with labeling in place.
   1. Pipe shall be kept in original shipping boxes until required for installation.

C. Store piping and equipment in a safe place, dry, enclosed, under cover, in a well-ventilated area.
   1. Do not expose pipe to ultraviolet light beyond exposure limits recommended by manufacturer.
   2. Protect piping and manifolds from entry of contaminating materials. Install suitable plugs in open pipe ends until installation.
   3. Where possible, connect pipes to assembled manifolds to eliminate possibility of contaminants and cross-connections.
   4. Piping shall not be dragged across the ground or other surfaces, and shall be stored on a flat surface with no sharp edges.

D. Protect materials from damage by other trades.

E. Pipe shall be protected from oil, grease, paint, direct sunlight and other elements as recommended by manufacturer.

1.7 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer’s Warranty: Submit, for Owner’s acceptance, manufacturer’s standard warranty document executed by authorized company official. Manufacturer’s warranty is in addition to, and not a limitation of, other rights Owner may have under contract documents.
   1. Warranty shall transfer to subsequent owners.
   2. Warranty Period for PEX Tubing: 30-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of substantial completion when installed by a factory-trained contractor
   3. Warranty Period for Manifolds and Fittings: 5-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of substantial completion when installed by a factory-trained contractor
   4. Warranty Period for Controls and Electrical Components: 2-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of substantial completion when installed by a factory-trained contractor

C. If a factory-trained contractor does not install the system, then the most recent limited warranty published by the PEX tubing manufacturer takes precedence.

PART 2 - PRODUCTS

2.1 HYDRONIC RADIANT HEATING AND/OR COOLING SYSTEM

A. Manufacturer:
   1. Tekmar
   2. Wirsbo

2.2 PRODUCT SUBSTITUTIONS

A. All products, components, etc., specified herein are manufactured by and/or available from the PEX tubing manufacturer.

B. Alternative equipment manufacturers must submit required data for all electrical, mechanical, structural, engineering, etc. revisions for an equivalent system for approval 15 days prior to bid.

C. Alternative equipment manufacturers must submit completed hydronic radiant system design layout to the project engineer for review. Plagiarism of another manufacturer's design is unacceptable.

2.3 PIPING

A. Snow and ice melt system pipe shall be high-density crosslinked polyethylene manufactured using the high-pressure peroxide method of crosslinking (PEXa). Pipe shall conform to ASTM F876, ASTM F877 and CSA B137.5.

B. Pipe shall be rated for continuous operation of 100 psi gauge pressure at 180°F temperature (690 kPa @ 82°C), and 80 psi gauge pressure at 200°F temperature (550 kPa @ 93°C).

C. When required, pipe shall have a co-extruded oxygen diffusion barrier capable of limiting oxygen diffusion through the pipe to less than 0.10 mg/l/day at 104°F (40°C) water temperature, in accordance with DIN 4726.

D. Bend Radius:
   1. The minimum bend radius for cold bending of the pipe shall be not less than five (5) times the outside diameter.
   2. Bends with a radius less than this shall require the use of a bending template as supplied by the pipe manufacturer, and/or hot air.

E. Pipe to have a Flame Spread Index of less than 25, and a Smoke Developed Index of less than 50 when tested in accordance with ASTM E84 (in U.S.) or CAN/ULC S102.2 (in Canada). In any case where the pipe does not conform to these standards, appropriate piping insulation shall be installed in order to meet the standard.

2.4 FITTINGS

A. Fittings shall be third-party certified to applicable standards ASTM F877, ASTM F2080 and CSA B137.5 as part of the manufacturer's PEX piping system, with independent listings from NSF, CSA and ICC, as applicable.

B. Compression nut manifold fittings shall be manufactured of brass with a barbed insert and a reusable split compression ring.

C. Compression-sleeve fittings shall be manufactured of brass and shall be supplied by the piping manufacturer as part of a proven cataloged system.

D. Fittings embedded within the thermal mass or encased behind walls or ceilings shall be cold-expansion compression-sleeve fittings certified to ASTM F2080. Where required by the manufacturer, fittings shall be protected from external environmental conditions.

2.5 MANIFOLDS

A. Material: Distribution manifolds shall be manufactured of brass or copper and be supplied by the piping manufacturer as a proven cataloged part of the manufacturer's system.

B. Brass manifolds shall be produced from extruded brass round pipe with tapped holes for connections, and be pre-assembled by the manufacturer. 100% of manifolds used shall have been air tested by the manufacturer with no indication of leaks.

C. Balancing Manifolds:
   1. Where required by design, brass balancing manifolds shall be equipped with integral visual flow gauges, circuit balancing and flow control valves, isolation valves with integral thermometer housings, and air vent/fill ports.
   2. Each circuit valve shall be supplied with a manual actuating handle for filling/purging operation.

D. Copper manifolds
   1. Copper manifolds shall be manufactured from Type L copper.
   2. Copper and/or brass outlets shall be high-temperature brazed (lead-free) into headers.
   3. Outlets in copper headers shall be made using the T-drill process according to ASTM F2014.

2.6 CONTROLS

A. Automatic SIM Detector and Melting Controls
   1. SIM control shall use low-voltage devices to monitor outdoor ambient, slab, fluid supply and/or return temperatures, as well as an automatic snow and ice detector to detect moisture in the SIM zone.
   2. SIM control shall be capable of maintaining a set temperature in a SIM slab or thermal mass, with adjustable settings for Idle and Melting mode.
   3. Connection to output devices shall be as per the recommended installation of the SIM control, as part of a proven cataloged system.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS

A. As a minimum, installation shall be performed by qualified laborers trained by the manufacturer in the procedures of PEX SIM systems and they shall be appropriately licensed for the jurisdiction where the installation will take place for a period of three years.

3.2 EXAMINATION

A. Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of Work.

B. Do not proceed until unsatisfactory conditions are corrected.

C. Beginning of installation means acceptance of existing conditions.

3.3 PREPARATION

A. Coordinate with related trades and manufacturer’s recommendations with regard to installation in conjunction with:
   1. Reinforcing wire mesh or rebar.
   2. Precast or existing concrete sub-grade.
   3. Asphalt or other hot mix.
   4. Patio pavers.
   5. Preparation of space for manifold installation.
   6. Mounting outdoors or in an unheated indoor environment.

3.4 INSTALLATION

A. Install in accordance with manufacturer's published installation manual and/or published guidelines and final shop drawings.

B. Mount manifolds in the locations previously prepared or in previously installed cabinets, if used. Manifolds shall be mounted as level as possible.

C. Route piping in an orderly manner, according to layout and spacing shown in final shop drawings.

D. At connections and fittings, use a plastic pipe cutter to ensure square and clean cuts, and join pipes immediately or cap ends of pipe to seal from contaminants. Where fittings are installed within the thermal mass, they shall be wrapped in chloride-free tape or sealed within a heat-shrink material approved by the manufacturer.

E. Pipe shall be dispensed using a suitable uncoiling device. Remove twists prior to securing pipe. Pipe shall lie flat on an even plane. Finished grade of a thermal mass shall be a minimum of 3/4 inch (19 mm) above the top of PEX heating pipes. Fasten piping at no more than 3 feet (90 cm) intervals, being careful not to twist the pipe. In thin concrete slabs, secure piping every 2 feet (60 cm). Use only fasteners supplied or approved by the manufacturer of the PEX pipe.

F. Piping that shall pass through expansion joints shall be covered in protective polyethylene convoluted sleeving (flexible conduit) extending 15 inches (38 cm) on each side of the joint. Sleeving shall be secured on pipe to prevent movement during installation of thermal mass.

G. Where piping exits the thermal mass, a protective conduit shall be placed around the pipe, with the conduit extending a minimum of 6 inches (15 cm) into the floor and exiting by a minimum of 6 inches (15 cm). For penetrations at manifolds, use rigid PVC bend guides secured in place to prevent movement.

H. At the time of installation of each circuit of pipe, connect the pipe to the correct manifold outlet and record pipe length for balancing. If manifold is not installed, cap the end of the pipe and label the pipe's circuit numbers along with S for supply and R for return. Connect pipes to manifold as soon as possible and record circuit lengths. Circuits shall be labeled to indicate circuit length and serviced area.

I. If the SIM system substrate material (thermal mass) requires curing and/or has other limitations which can be influenced by the SIM system while in operation, then the SIM system shall not be put into operation until such time that the substrate material has fully cured or set according to the material requirements of the substrate manufacturer.

J. The installer shall confirm minimum and maximum exposure temperatures for the substrate material (thermal mass) and shall ensure proper SIM operating temperatures.

3.5 FIELD QUALITY CONTROL

A. Filling, Testing & Balancing: Tests of hydronic heating systems shall comply with authorities having jurisdiction, and, where required, shall be witnessed by the building official.

B. Pressure gauges used shall show pressure increments of 1 psig and shall be located at or near the lowest points in the distribution system.

C. Air Test
1. Charge the completed, yet unconcealed pipes with air at a minimum of 40 psig.
2. Do not exceed 150 psig.
3. Use liquid gas detector or soap solution to check for leakage at manifold connections.

D. Water Test
1. Purge air from pipes.
2. Charge the completed, yet unconcealed pipes with water.
3. Take necessary precautions to prevent water from freezing.
4. Check the system for leakage, especially at pipe joints.

E. Perform a preliminary pressure test pressurizing the system to the greater of 1.5 times the maximum operating pressure or 100 psig for 30 minutes.
1. As the piping expands, restore pressure, first at 10 minutes into the test and again at 20 minutes.
2. At the end of the 30-minute preliminary test, pressure shall not fall by more than 8 psig from the maximum, and there shall be no leakage.

F. After successfully performing the preliminary test, perform the main pressure test immediately.
1. The main pressure test shall last 2 hours.
2. The test pressure shall be restored and shall not fall more than 3 psig after 2 hours.
3. No leakage shall be detected.

G. Pressure shall be maintained and monitored during installation of the thermal mass.

1. If any leak is detected during installation of thermal mass, leak shall be found immediately and the area cleared for repair using manufacturer's approved repair coupling.
2. Retest before covering repair.

H. Complete inspection and furnish test reports supplied by the manufacturer of the system.

3.6 CLEANING

A. Clean exposed surfaces upon completion of installation using clean, damp cloth. No cleaning agents are allowed.

B. Comply with manufacturer's recommendations.

C. Compare or replace damaged installed products.

D. Remove construction debris from project site and legally dispose of debris.

3.7 PROTECTION

A. Protect installation throughout construction process until date of final completion.

B. Replace components that cannot be repaired.

3.8 DEMONSTRATION

A. Demonstrate operation of hydronic radiant heating and/or cooling system to Owner's personnel.

B. Advise the Owner's Representative about the type and concentration of glycol and water solution if used in the hydronic radiant heating and/or cooling system.
1. The Owner monitors the solution effectiveness through an established maintenance program as outlined by the glycol manufacturer.

END OF SECTION 238316

SECTION 260500 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 013329 - Sustainable Design Specification Section applies to this Section.

1.2 SUMMARY

A. Description: Work shall consist of furnishing all labor, equipment, supplies, and materials, unless otherwise specified, necessary for the installation of complete electrical systems as required by the specifications and as shown on the drawings, subject to the terms and conditions of the contract. The Work shall also include the completion of those details of electrical work not mentioned or shown which are necessary for the successful operation of all electrical systems.

B. Certain labor, materials, and equipment may be furnished under other Sections of these specifications, by Utility Companies or by the Owner. When this is the case, the extent, source and description of these items will be as indicated on the drawings or as described in the specifications.

C. Attention is called to the fact that this is a LEED project. Project requirements include compliance with all Division 1 LEED criteria, including, but not limited to:
   1. Construction Indoor Air Quality (IAQ) Management Plan, and construction waste management and disposal requirements.
   2. Product Data for temporary MERV 8 filtration if systems will be used during construction.
   3. Document LEED credit impact for product substitution.
   4. Six photographs at three difference occasions (18 total) during construction of the different SMACNA requirements, along with a brief description of the SMACNA approach employed, documenting implementation of the IAQ management measures, such as protection of ducts, floor mopping/sweeping, cleaning of air handling units, installation of filters, and on-site stored or install absorptive materials.
   5. Low-Emitting Adhesives and Sealants requirements.
   6. Low-Emitting Paints and Coatings requirements.
   7. Coordination with commissioning agent and commissioning requirements.

1.3 RELATED SECTIONS

A. Basic Electrical Requirements specifically applicable to Division 26 Sections, in addition to Division 1 - General Requirements.

1.4 REFERENCE STANDARDS

A. Comply with the requirements of the reference standards noted herein, except where more stringent requirements are listed herein or otherwise required by the Contract Documents. A listing of applicable reference standards is contained in Division 1.

B. Latest editions of the following:
   1. ANSI/NFPA 70 - National Electrical Code (as adopted and amended by the Denver Building Code).
   2. ANSI/IEEE C2 - National Electrical Safety Code.
   3. NECA - Standard of Installation.
   4. Other references as listed elsewhere in these specifications.

1.5 DEFINITIONS

A. "Furnish" or "Provide": To supply, install and connect up complete and ready for safe and regular operation of particular work unless specifically otherwise noted.

B. "Install": To erect, mount and connect complete with related accessories.

C. "Supply": To purchase, procure, acquire and deliver complete with related accessories.

D. "Work": Labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.

E. "Wiring": Raceway, fittings, wire, boxes and related items.

F. "Concealed": Embedded in masonry, concrete or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures.

G. "Exposed": Not installed underground or "concealed" as defined above.

H. "Indicated," "Shown" or "Noted": As indicated, shown or noted on drawings or specifications.

I. "Similar" or "Equal": Equal in materials, weight, size, design, construction, capacity, performance, and efficiency of specified product.

J. "Reviewed," "Satisfactory," "Accepted," or "Directed": As reviewed, satisfactory, accepted, or directed by or to Engineer.

K. "Related Work" includes, but is not necessarily limited to, mentioned work associated with, or affected by, the work specified.

L. Refer to Article 100 of the currently adopted National Electrical Code for other definitions as applicable to this project.

1.6 WORK SEQUENCE

A. Construct Work in sequence under provisions of Division 1 where applicable.

1.7 DRAWINGS AND SPECIFICATIONS

A. The drawings indicate the general arrangement of circuits and outlets, locations of switches, panelboards and other work. Information shown on the drawings is schematic, however, recircuiting will not be permitted without specific acceptance. Drawings and specifications are complementary each to the other. What is called for by one shall be as binding as if called for by both. Data presented on these drawings is as accurate as planning can determine, but accuracy is not guaranteed and field verification of all dimensions, locations, levels, etc., to suit field conditions is directed. Review all Architectural, Structural and Mechanical Drawings and Specifications; adjust all work to conform to all conditions shown therein. The Architectural drawings shall take precedence over all other drawings.

B. Prior to submitting a bid, visit the site of the job and ascertain all conditions affecting the proposed installation and adjust all work accordingly. Make provisions for these costs.

C. Discrepancies between different plans, between plans and specifications, between specifications, or regulations and codes governing this installation shall be brought to the attention of the Engineer in writing before the date of bid opening. In the event such discrepancies exist, and the Engineer is not so notified, the adjudication of responsibility shall be solely at the discretion of the Engineer.

1.8 COORDINATION

A. Prior to fabrication or installation of any electrical work, participate in detailed coordination planning meetings with all other building utilities system trades, under the direction of the General Contractor, so as to completely establish routings, elevations, space requirements, and coordination of access, layout, and suspension requirements in relationship to the building structure and the work of all other trades.

1.9 SUBMITTALS (Refer to Division 1)

A. Submit shop drawings and product data in accordance with provisions of Division 1.

B. Prior to submission, shop drawings, material lists and catalog cuts or manufacturer's printed data shall be thoroughly checked for compliance with contract requirements, compatibility with equipment being furnished by the Contractor or Owner, accuracy of dimensions, coordination with work of other trades, and conformance with sound and safe practice as to erection of installation. Each submittal shall bear Contractor's signed statement evidencing such checking.

C. Clearly mark each shop drawing as follows for purposes of identification:
   1. Shop Drawing
   2. Equipment Identification Used on Contract Drawings
   3. Date
   4. Name of Project
   5. Branch of Work
   6. Engineer's Name
   7. Contractor's Name

D. Clearly mark printed material, catalog cuts, pamphlets or specification sheets, and shop drawings with the same designation shown on the contract document schedules. Identify specific item proposed, showing catalog number, recess openings, dimensions, capacities, electrical characteristics, etc. Submittals which are incomplete will be returned to the Contractor without review.

E. Contractor agrees that submittals processed by the Engineer are not change orders; that the purpose of submittals is to demonstrate to the Engineer that the Contractor understands the design concept; and that the Contractor demonstrates this understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use.

F. Contractor shall be responsible for dimensions (which he shall confirm and correlate at the job site), fabrication processes and techniques of construction, and coordination of his work with that of other trades. The Contractor shall check and verify all measurements and review shop drawings before submitting them. If any deviations from the specified requirements for any item of material or equipment exist, such deviation shall be expressly stated in writing and incorporated with the submittal.

G. Maintain one copy of shop drawings at the project field office until completion of the project, and make this copy available, upon request, to representatives of the Engineer and Owner.

H. No equipment or materials shall be installed or stored at the jobsite until submittals for such equipment or materials have been given review action permitting their use.

I. Shop drawings and manufacturer's published data shall be submitted for:
   1. All switchboards, panelboards
   2. Interior and Exterior Luminaires, including lamp and ballast information (catalog cuts)
   3. Fire alarm system
   4. Lighting Control System
   5. Lighting Control Devices
   6. Wiring Devices
   7. Electrical Sub-Metering

J. Adhesives & Sealants
   1. Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standard.

K. Low-Emitting Paints and Coatings
   1. Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standards.

1.10 RECORD DOCUMENTS

A. Maintain a contract set of electrical drawings at the site. Neatly mark all changes, discoveries and deviations from the original drawings. Use a color which contrasts with the prints. This shall be a separate set of drawings, not used for construction purposes, and shall be kept up to date as the job progresses and shall be made available for inspection by the Engineer at all

times. Upon completion of the contract, this set of record drawings shall be delivered to the Engineer. Record documents to be provided by the Contractor shall clearly and accurately show the following:

1. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.
2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

1.11 REGULATORY REQUIREMENTS

A. Conform to those editions of the following as currently adopted by the local code enforcement authority:
   1. ANSI/NFPA 70.
   2. ANSI/IEEE C2.
   3. Denver Building Code, and applicable requirements of the Fire Prevention Bureau.
   4. Comply with requirements of the utility company furnishing service to this installation.
   5. Other requirements as listed elsewhere in these specifications.

B. Obtain electrical permits, plan review, and inspections from authority having jurisdiction in accordance with Division 1.

C. The drawings and specifications take precedence when they are more stringent than codes, statutes, or ordinances in effect. Applicable codes, ordinances, standards and statutes take precedence when they are more stringent than, or conflict with the drawings and specifications.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and Equipment: Acceptable to the authority having jurisdiction as suitable for the use intended, except where more stringent requirements are indicated by the Contract Documents.

B. Compatibility with Available Space: Equipment layouts shown are based on use of equipment as specified. If the Contractor chooses equipment available from any other manufacturer listed as an acceptable manufacturer, or offers equipment under the provision for substitutions, the Contractor shall be solely responsible for first ascertaining that the offered equipment can be installed in the space available with ample clearances for maintenance. Include coordination drawings, as specified herein, when required.

C. All equipment and materials installed shall be new, unless otherwise specified.

D. Defective or damaged materials shall be replaced or repaired, prior to final acceptance, in a manner acceptable to the Engineer or Owner and at no additional cost to the Owner.

E. All electrical materials shall be acceptable for installation only if labeled or listed by a nationally recognized testing laboratory and if accepted by local authorities.

F. All major equipment components shall have the manufacturer's name, address, model number, and serial number permanently attached in a conspicuous location.

G. Adhesives & Sealants
   1. Adhesives and Sealants applied on site within the weather proofing exterior in this section must comply with South Coast Air Quality Management District Rule 1168 OR Green Seal Standard GS-36. Refer to LEED Specification 01352 for specific VOC requirements.

H. Paints & Coatings
   1. Paints and coatings applied on site within the weather proofing exterior in this section must comply with Green Seal Standard GS-11, Green Seal Standard GC-03, OR South Coast Air Quality Management District Rule 1113. Refer to LEED Specification 01352 for specific VOC requirements.

I. Coordinate with Commissioning Agent for the testing of lighting controls and devices and respond to Commissioning Agent findings.

2.2 STORAGE AND PROTECTION

A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions.

B. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.

C. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged, and are maintained under required conditions.

2.3 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards.

B. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not specifically named.

C. Products Specified by Naming One or More Manufacturers without a Provision for Substitutions: Products of named manufacturers meeting specifications; no options, no substitutions allowed.

2.4 PRODUCTS LIST

A. Within 30 days after date of Owner-Contractor Agreement, submit complete list of major products required for submittal under these specifications, with name of manufacturer, trade name, and model number of each product.

2.5 SUBSTITUTIONS

A. Refer to Division 1.

B. Electrical Contractor to document LEED credit impact for product substitution.

2.6 GUARANTEE

A. The entire electrical system installed under this Contract shall be left in proper working order. Replace, at no additional cost to the Owner, any work, materials, or equipment which evidences defects in design, construction, or workmanship within two years, or as specifically noted elsewhere in these specifications, from date of final acceptance.

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. Install work using procedures defined in NECA Standard of Installation.

B. Workmanship shall conform to highest industry standards for each trade involved in erection of the work.

C. Contractor's personnel and subcontractors selected to perform the work shall be well versed and skilled in the trades involved.

D. Any changes or deviations from the drawings and specifications must be accepted in writing by the Engineer. All errors in installation shall be corrected at the expense of the Contractor. All specialties shall be installed as detailed on the drawings. Where details or specific installation requirements are not provided, manufacturer's recommendations shall be followed.

E. Upon completion of work, all equipment and materials shall be installed complete, thoroughly checked, correctly adjusted, and left ready for intended use or operation. All work shall be thoroughly cleaned and all residue shall be removed from surfaces. Exterior surfaces of all material and equipment shall be delivered in a perfect, unblemished condition.

F. Contractor shall provide a complete installation, including all required labor, material, cartage, insurance, permits, and taxes.

3.2 CHASES, OPENINGS, CUTTING AND PATCHING

A. Carefully lay out all work in advance so as to eliminate where possible, cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings and roofs. Any damage to the building, structure, piping, ducts, equipment or any defaced finish shall be repaired by skilled mechanics of the trades involved at no additional cost to the Owner and to the satisfaction of the Architect/Engineer. Any necessary cutting, channeling, drilling or welding as required for the proper support, concealment, installation or anchoring of raceways, outlets, or other electrical equipment shall be performed in a careful manner, and as approved by the Engineer.

B. All openings made in fire-rated walls, floors, or ceilings shall be patched and made tight in a manner to conform to the fire rating for the surface penetrated.

C. All penetrations required through completed concrete construction shall be core drilled at minimum size required. Precautions shall be taken when drilling to prevent damage to structural concrete. The Contractor shall obtain permission from the Engineer before proceeding with drilling.

3.3 ELECTRICAL INSTALLATIONS

A. Coordinate electrical systems, equipment, and materials installation with other building components. If equipment of a different size is furnished by the Contractor, the Contractor shall furnish and install the proper motor starter, fuses, circuit breaker, disconnect switch, wire and conduit required for the equipment furnished, at no additional cost to the Owner and shall be approved by the Owner.

3.4 PROGRESS OF WORK

A. Order the progress of electrical work to conform to the progress of the work of the other trades. Complete the entire installation as soon as the condition of the building will permit. Any cost resulting from defective or ill-timed work performed under this Section shall be borne by this Contractor.

3.5 TRENCHING AND BACKFILLING

A. Perform all trenching and backfilling required by work performed under this Section in accordance with the excavating and grading specifications and as herein specified.

B. Excavate trenches to the depth required for the utilities involved. The trench bottom shall be graded true and free from stones or soft spots, bottom of trenches must be compacted.

C. After installation of electrical work, backfill, tamp, and compact to insure against the possibility of differential settling, in conformity with Division 2 Specifications. Verify location of existing or new utilities and, if damaged by this Contractor, replace or repair.

3.6 ELECTRICAL COMPLETION

A. Indoctrination of Operating and Maintenance Personnel: Furnish the services of a qualified representative of the supplier of each item or system itemized below who shall instruct specific personnel, as designated by the Owner, in the operation and maintenance of that item or system.

1. Instruction shall be given when the particular system is complete, and shall be of the number of hours indicated and at the time requested by the Owner. A representative of the Contractor shall be present for all demonstrations.

System	Hours Of Instruction
Fire Alarm System	8 (2 4-hour sessions)
Electrical Distribution Equipment (under 600 volts)	12 (4 4-hour sessions)
Emergency System	8 (2 4- hour sessions)
Lighting Control System	8 (2 4- hour sessions)

B. Operating and Maintenance Manuals and Parts Lists: Deliver three (3) complete operating & maintenance manuals and parts lists to the Owner at the time of the above required indoctrination. Fully explain the contents of the manuals as part of required indoctrination and instruct the Owner's personnel in the correct procedure in obtaining service, both during and after the guarantee period.

1. The operating and maintenance manuals and parts lists shall give complete information as to whom the Owner shall contact for service and parts. Include address and phone number. Furnish evidence that an authorized service organization regularly carries a complete stock of repair parts for these items (or systems), and that the organization is available for service. Service shall be furnished within 24 hours after requested.

C. Operating and Acceptance Tests: Provide all labor, instruments, and equipment for the performance of tests as specified below and elsewhere in these specifications. Submit three copies of a typewritten test report to the Engineer for his approval.

1. For a seven-day period after building has been placed into normal service, record the full load current in each phase or line at the main service entrance and submit to the Engineer.
2. Perform a careful inspection of the main switchboard bus structure and cable connections to verify that all connections are torqued to manufacturer's recommendations.

D. Clean-Up: Remove all materials, scrap, etc., relative to the electrical installation, and leave the premises and all equipment, lamps, fixtures, etc. in a clean, orderly condition. Any costs to the Owner for clean-up of the site will be charged against the Contractor.

E. Acceptance Demonstration: Upon completion of the work, at a time to be designated by the Engineer, the Contractor shall demonstrate for the Owner the operation of the entire installation, including all systems provided under this contract.

F. Final acceptance by the Owner will not occur until all operating instructions are received and Owner's personnel have been thoroughly indoctrinated in the maintenance and operation of all equipment.

END OF SECTION 260500

SECTION 260519 - BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.1 SUMMARY

A. Building Wire and Cable.

B. Metal Clad Cable.

C. Wiring Connections and Terminations

1.2 RELATED SECTIONS

A. Section 260532 - Conduit

B. Section 260534 – Electrical Boxes and Fittings.

C. Section 260529 - Supporting Devices and Seals

D. Section 260553- Electrical Identification

1.3 REFERENCE STANDARDS

A. Comply with the requirements of the reference standards noted herein, except where more stringent requirements are listed herein or otherwise required by the Contract Documents. A listing of applicable reference standards is contained in Division 1.

B. NEMA WC 70 – Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

C. NEMA WC 70 – Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

1.4 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Conductor sizes are based on copper.

C. Wire and cable routing shown on Drawings is appropriate unless dimensioned. Route wire and cable as required to meet project conditions.

D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.5 COORDINATION

A. Coordinate Work under provisions of Section 260500.

B. Determine required separation between wiring and other work.

C. Determine routing to avoid interference with other work.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

A. Thermoplastic-Insulated Building Wire: NEMA WC 70.

B. Rubber-Insulated Building Wire: NEMA WC 70.

C. Feeders and Branch Circuits: Copper, stranded conductor, 600 volt, insulation, THHN/THWN, or XHHW.

D. Control Circuits: Copper, stranded conductor 600 volt insulation, THHN/THWN, or XHHW.

2.2 METAL CLAD CABLE

A. Description: ANSI/NFPA 70, Type MC.

B. Conductor: Copper.

C. Insulation Voltage Rating: 600 volts.

D. Insulation Temperature Rating: 75 degrees C.

E. Insulation Material: Thermoplastic and thermosetting.

F. Armor Material: Steel.

G. Armor Design: Interlocked metal tape.

H. Jacket: PVC jacket when installed in damp and wet locations.

I. Cable to be provided with a separate equipment grounding conductor sized per NEC.

2.3 REMOTE CONTROL AND SIGNAL CABLE

A. Control Cable for Class 1 Remote Control and Signal Circuits: Copper conductor, 600 volt insulation, rated 60 degree C, individual conductors twisted together, shielded, and covered with a PVC jacket.

B. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300 volt insulation, rated 60 degrees C, individual conductors twisted together, shielded, and covered with a PVC jacket; UL listed.

C. Plenum Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300 volt insulation, rated 60 degrees C, individual conductors twisted together, shielded, and covered with a non-metallic jacket; UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.

D. Install all remote control and signal cables in cable tray, raceways, or supported every 4'-0" on bridal rings.

PART 3 - EXECUTION

3.1 GENERAL WIRING METHODS

A. Use no wire smaller than No. 12 AWG for power and lighting circuits, and no smaller than No. 16 AWG for control wiring.

B. Use No. 10 AWG conductor for 20 ampere, 120-volt branch circuit home runs longer than 75 feet.

C. Place an equal number of conductors for each phase of a circuit in same raceway or cable.

D. Splice only in accessible junction or outlet boxes.

E. Neatly train and lace wiring inside boxes, equipment, and panelboards. Make temporary connections to panelboard devices with sufficient slack conductor to facilitate reconnections required for balancing loads between phases.

F. Damaged conductors during installation shall be replaced.

G. Install products in accordance with manufacturer's instructions.

3.2 WIRING INSTALLATION IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling No. 4 AWG and larger wires.

B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

C. Completely and thoroughly swab raceway system before installing conductors.

3.3 CABLE INSTALLATION

A. When approved install in interior partitions only and for flexible connection to lighting fixtures. (Flexible connection not to exceed 6'-0".)

B. Use suitable cable fittings and connectors.

C. Cable shall not be installed below windows in exterior walls.

D. Cable shall not be used for branch circuit homeruns. Branch circuit homeruns shall be building wire in raceway.

E. Run concealed cable parallel and perpendicular to building elements at right angles. Parallel cable runs shall be run together. Run high and tight to structure. Coordinate cable runs with other trades.

F. Support cable every four feet and within 12 inches of every outlet box, junction box, cabinet, or fitting.

G. Cable shall not be used in emergency circuits.

H. Cable shall not be used as flexible connection to motors, transformers or other vibrating equipment.

I. Support cables above accessible ceiling, using spring metal clips or metal cable ties to support cables from structure. Do not rest cable on ceiling panels.

J. Provide protection for exposed cables where subject to damage.

3.4 WIRING CONNECTION AND TERMINATIONS

A. Splice only in accessible junction boxes.

B. For No. 8 AWG and smaller, use insulated spring wire connectors with plastic caps.

C. Use split bolt connectors for copper wire splices and taps, No. 6 AWG and larger. Tape un-insulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.

D. Thoroughly clean wires before installing lugs and connectors.

E. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

F. Terminate up to #10 AWG spare conductors with wire nuts. Use electrical tape for spare conductor #8 AWG and larger.

G. Use suitable reducing connectors or mechanical connector adaptors for connecting aluminum conductors to copper conductors.

H. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

I. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

3.5 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Division 1.

B. Inspect wire and cable for physical damage and proper connection.

C. Torque test conductor connections and terminations to manufacturer's recommended values.

D. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.

3.6 WIRE AND CABLE INSTALLATION SCHEDULE

A. Concealed Interior Locations: Building wire in raceways or cable as approved herein.
   1. Cables may be used for lighting luminaire connections and in interior partitions for branch circuits if approved by the owner

B. Exposed Interior Locations: Building wire in raceways.

C. Above Accessible Ceilings: Building wire in raceways.

D. Wet or Damp Interior Locations: Building wire in raceway.

E. Exterior Locations: Building wire in raceways.

F. Underground Locations: Building wire in raceways.

3.7 WIRE AND CABLE COLOR CODING

A. Wires No. 6 AWG and smaller shall be factory color coded. Wire No. 4 AWG and larger shall be color-coded with color tape 6-inch length of exposed ends, and at every accessible junction box on the branch circuit or feeder.

120/208 Volts
A = Black
B = Red
C = Blue
Neutral = White
Ground = Green

B. Maintain the color coding throughout the system from panel to the last device on the branch circuit.

3.8 FIELD QUALITY CONTROL

A. Prior to energizing, all feeders from transformers, switchboards, and building service cables, are to be tested with a 500-volt insulation megohm meter to determine insulation resistance levels to assure requirements are fulfilled. All field test data is to be recorded and submitted. Test is to include meggering for one minute between conductors and between each conductor and ground. Cables are to be meggered after installation with cables disconnected at both ends. The values must be not less than as follows:

Conductor Size (AWG or MCM)	Resistance Megohms 1000 ft.)
#16 AWG to #8 AWG	200
#6 AWG to #2/0 AWG	100
#3/0 AWG to 500 KCMIL	50

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. Power System Grounding

B. Communication System Grounding

C. Electrical Equipment and Raceway Grounding and Bonding

1.2 REFERENCE STANDARDS

A. Comply with the requirements of the reference standards noted herein, except where more stringent requirements are listed herein or otherwise required by the Contract Documents.

B. NFPA Compliance: NFPA 70 "National Electrical Code (NEC).

C. UL Compliance: Applicable requirements of UL Standards Nos. 467 "Electrical Grounding and Bonding Equipment," and 869, "Electrical Service Equipment," pertaining to grounding and bonding of systems, circuits and equipment. In addition, require compliance with UL Std 486A, "Wire Connectors". Grounding and bonding products which are to be UL-listed and labeled for their intended usage.

D. IEEE Compliance: Applicable requirements and recommended installation practices of IEEE Standards 80, 81, 141 and 142 pertaining to grounding and bonding of systems, circuits and equipment.

1.3 SYSTEM DESCRIPTION

A. Ground the electrical service system neutral at service entrance equipment to metallic cold water service, building steel and to supplementary grounding electrodes, as indicated on drawings.

B. Ground each separately-derived system neutral to nearest metallic cold water pipe 2-inch diameter or larger, building steel and where present to the referenced ground bar as shown on drawings.

C. Provide communications system grounding conductor at point of service entrance and connect to nearest referenced ground bar as shown on drawings.

D. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Ground Rods: Copper or copper-clad steel, 3/4-inch diameter, minimum length 10 feet.

B. Mechanical Grounding Connectors: For all grounding connections above grade.

Manufacturer: Burndy Electrical
Material: Copper.
Compression Type: Irreversible.
UL listed under Standard UL467.

C. Wire:

Material: Copper.
Size: As indicated on the drawings. When size is not indicated, size per Article 250 of NEC requirements.

D. Grounding Connection Accessories:

Electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type service required.

2.2 Field Welding: Exothermic welded connections are required where grounding conductors connect to underground grounding conductors and to underground grounding electrodes, and for bonding to steel. All underground connection shall be exothermic welded.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide a separate, insulated equipment grounding conductor in feeder and branch circuits. Terminate each ground conductor to the bushing and ground lug.

B. Connect grounding electrode conductors to metal water pipe using a suitable ground clamp. Make connections to flanged piping at street side of flange.

C. Supplementary Grounding Electrode: Use grounding mats, or driven ground rods, where indicated. Install ground rods in suitable recessed well; fill with gravel after connection is made.

D. Use minimum No. 6 AWG copper conductor for communications service grounding conductor. Leave 10-feet slack conductor at terminal board or cabinet.

E. Provide isolated grounds for all microprocessor and data processing equipment, where indicated on drawings.

F. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts.

Where manufacturer's torquing requirements are not indicated, connections are to be tightened to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.

G. Provide code-sized ground cable bonding jumpers, installed with ground clamps, across all conduit expansion couplings and fittings.

H. Route grounding connections, conductors to ground, and grounding conductors to protective devices in the shortest and straightest paths possible to minimize transient voltage rises.

I. Provide a corrosion-resistant finish to field connections, buried metallic bonding products, and where factory applied protective coatings have been destroyed, where subject to corrosive action.

J. All continuous runs of cable tray and all isolated sections of cable tray shall be grounded at intervals not to exceed 20 feet.

K. Provide an equipment grounding conductor in all non-metallic conduits.

L. Provide an equipment grounding conductor in all flexible metallic conduits.

M. Grounding conductor in feeders and branch circuits extend ground conductor to switches, receptacle, equipment enclosures, equipment, and panels etc. and ground as required.

3.2 FIELD QUALITY CONTROL

A. Upon completion of installation of electrical grounding and bonding systems, the ground resistance shall be tested with an earth ground resistance tester in accordance with IEEE 81, "Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System". Where tests show resistance-to-ground is over values in Table 1 below, Contractor shall take appropriate action to reduce resistance to the values in Table 1, by driving additional ground rods; and then retest to demonstrate compliance. All results shall be recorded and submitted.

Table 1
Earth Ground
Resistance to

Equipment (Ohms)	
Pad Mount Transformer	5
Secondary Neutrals and Other Ground	10

END OF SECTION 260526

SECTION 260529 - SUPPORTING DEVICES AND SEALS

PART 1 - GENERAL

1.1 SUMMARY

A. Conduit and equipment supports.

B. Fastening hardware.

C. Wall and floor seals.

1.2 RELATED DOCUMENTS

A. Drawings, general and special conditions, Division 1 - General Requirements and other applicable technical specifications apply to work of this Section.

1.3 RELATED SECTIONS

A. Division 3 - Cast-in-Place Concrete. Concrete equipment pads.

B. Coordinate size, shape and location of concrete pads with Division 3.

C. Refer to Section 260500 for coordination requirements.

1.4 REFERENCE STANDARDS

A. A. Comply with the requirements of the reference standards noted herein, except where more stringent requirements are listed herein or otherwise required by the Contract Documents. A listing of applicable reference standards is contained in Division 1.

1.5 QUALITY ASSURANCE

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Support Channel: Galvanized or painted steel for non-corrosive environment.

B. Hardware: Corrosion-resistant.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using precast insert system, expansion anchors, preset inserts, or beam clamps. Do not use spring steel clips and clamps; however, caddy fasteners are accepted.

B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.

C. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.

D. Do not drill structural steel members.

E. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

F. Install all free-standing electrical equipment on a 4-inch concrete housekeeping pad.

G. Install surface-mounted cabinets and panelboards with minimum of four anchors.

H. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

I. Where conduit penetrates fire-rated walls, concrete and/or masonry walls and floors, it shall be sleeved. Seal opening around conduit with UL listed foamed silicone elastomer compound.

J. Where conduit penetrates waterproofed floors or exterior walls subject to entry of moisture, provide pipe sleeves two sizes larger than conduit, suitably flashed or sealed where appropriate. Seal annular space around conduit with UL listed foamed silicone elastomer compound.

K. Route conduit through roof openings for piping and ductwork where possible; otherwise, route through roof jack with pitch pocket.

L. No suspended conduit or box supports shall be less than 1/4-inch diameter steel rod. Rod used as pedestal support is not acceptable. The contractor shall not use tie wire or wire of any type to support conduits, junction boxes or pull boxes.

M. No more than five (5) 1/2-inch conduits, three (3) 3/4-inch conduits or two (2) 1-inch conduits shall be supported on a single 1/4-inch diameter steel rod.

N. All conduits shall be supported by approved hangers. Supports installed and used by other trades such as duct hangers, pipe hangers, ceiling hangers, etc. shall not be used for conduit support. No conduit shall be hung from air handling duct of any type. Electrical conduit systems "shall stand alone."

O. All luminaires shall be independently supported at opposite corners from structural steel or from trapeze supported from structural steel by electrical contractor.

P. Wall-mounted luminaires shall be supported from building structure with approved backing support to prevent any damage to the wall.

Q. Concrete anchors shall not be used to suspend heavy electrical loads such as electrical switch panels or four-inch and larger conduits. Anchors shall be designed to support conduits and cable tray when full fitted to maximum capacity with cables.

3.2 EQUIPMENT BASES

A. Provide equipment pad bases of concrete type, construction, and finish as herein specified. Bases shall be of dimensions indicated or, where not specifically indicated or specified, dimensions shall be 4 inches height with width and length providing 4 inches of projection of base beyond outline dimension of supported equipment.

B. Concrete shall be Class 3000, prepared in conformity with ACI 301, ASTM C 33, and ASTM C 94, as applicable. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping, using equipment and procedures for consolidation of concrete in accordance with ACI 309. Perform consolidation so that concrete is thoroughly worked around reinforcement and other embedded items and into corners. Perform curing of concrete by moist curing, by moisture-retaining cover curing, or by combinations thereof, as directed or approved.

C. Provide oiled wood forms for concrete placement, adequately braced to ensure straight and vertical sides for bases. Finished bases shall provide a 3/4-inch chamfer at all exposed edges. Except where vibration attenuating base mountings are specified, provide No. 4 dowels (conforming to ASTM A 615, Grade 60), grouted into place, for anchorage of bases to substrate for all applications for which imposed strains or dynamic forces produced by equipment operation introduce the possibility of displacement of bases. Spacing of dowels shall be not less than 24 inches o.c., with a minimum of 4 dowels for each base.

D. Bases where indicated shall be reinforced by installation of 6 x 6 No. 8 AWG welded wire fabric conforming to ASTM A 185. Apply measures, during concrete placement, to ensure that fabric remains vertically centered in bases.

E. Bring slab surfaces to correct level with straightedge and strikeoff. Do not disturb slab surfaces prior to beginning finishing operations. Float finish surfaces and provide steel trowel final finish.

F. For all equipment to be installed on concrete bases or other concrete construction, provide templates, anchor bolts, and accessories as required. When installing equipment, set equipment into final position, shim equipment bases, skids or rails for level positioning, and install non-shrink grout for uniform support, and securely bolt into final position.

END OF SECTION 260529

SECTION 260532 - CONDUIT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Metal Conduit

B. Flexible Metal Conduit

C. Liquidtight Flexible Metal Conduit

D. Electrical Metallic Tubing

E. Nonmetallic Conduit

F. Fittings and Conduit Bodies

1.2 RELATED SECTIONS

A. Division 1 - Cutting and Patching.

B. Division 2 - Trenching: Excavation and backfill for conduit and utilities on site.

C. Division 3 - Cast-In-Place Concrete: Protective envelope for underground conduit installations.

D. Division 7 - Sheet Metal Flashing and Trim

E. Section 260526 - Grounding and Bonding

F. Section 260529 - Supporting Devices and Seals

G. Section 260534 - Electrical Boxes and Fittings

H. Section 260553 - Electrical Identification

1.3 REFERENCES

A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.

B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.

C. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

D. ANSI/NFPA 70 - National Electrical Code.

E. NECA - "Standard of Installation".

F. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

G. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).

H. NEMA TC 3 – PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.4 DESIGN REQUIREMENTS

A. Conduit Size: ANSI/NFPA 70.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 260500.

B. Accurately record actual routing of conduits larger than two (2) inches or larger, regardless of location (i.e., above ceiling, below slab, etc.). Dimension from building columns.

C. Accurately record actual routing of all conduits installed in and under the slab. Dimension from the building columns.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products under provisions of Section 260500 and Division 1.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

1.7 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of conduit prior to rough-in.

C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system and to coordinate with the work of other trades.

PART 2 - PRODUCTS

2.1 CONDUIT REQUIREMENTS

A. Minimum Size, unless otherwise specified:
   1. Homeruns:
      a. 3/4-Inch above accessible ceilings.
      b. 3/4-Inch above unaccessible ceilings and in concrete slab.
      c. 1-Inch below grade and below slab on grade.

B. Branch Circuits after the first junction point: 3/4-Inch C unless otherwise specified.

C. Underground Installations:
   1. More than 5-Feet from Foundation Wall: Use PVC Schedule 40 nonmetallic conduit, except as otherwise noted.
   2. Within 5-Feet from Foundation Wall: Use rigid steel plastic coated conduit.
   3. In or Under Slab on Grade: Use PVC Schedule 40 nonmetallic conduit.
   4. Minimum Size: 1-Inch.

D. Outdoor Locations, Above Grade: Use rigid steel conduit.

E. In Slab Above Grade:
   1. Use PVC Schedule 40 nonmetallic conduit, unless otherwise specified.
   2. Maximum Size Conduit in Slab: 3/4-Inch or as permitted by the Structural Engineer, based on field conditions.

F. Wet and Damp Locations: Use rigid steel conduit if subject to physical damage. Thickwall nonmetallic conduit in areas not subject to physical damage and acceptable to the local authority.

G. Dry Locations:
   1. Concealed: Use electrical metallic tubing.
   2. Exposed: Use rigid steel conduit if subject to damage below 8-feet, otherwise use electrical metallic tubing.

2.2 METAL CONDUIT

A. Rigid Steel Conduit: ANSI C80.1.

B. Intermediate Metal Conduit (IMC): Rigid steel.

C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit.

2.3 PVC COATED METAL CONDUIT

A. Description: NEMA RN 1; rigid steel conduit with external PVC coating,20 mil thick.

B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.4 FLEXIBLE METAL CONDUIT

A. Description: Interlocked steel construction.

B. Fittings: ANSI/NEMA FB 1.

2.5 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Description: Interlocked steel construction with PVC jacket.

B. Fittings: ANSI/NEMA FB 1.

2.6 ELECTRICAL METALLIC TUBING (EMT)

A. Description: ANSI C80.3; galvanized tubing.

B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel, compression or set screw type.

2.7 NONMETALLIC CONDUIT

A. Description: NEMA TC 2; Schedule 40 PVC.

B. Fittings and Conduit Bodies: NEMA TC 3.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install conduit in accordance with NECA "Standard of Installation".

B. Install nonmetallic conduit in accordance with manufacturer's instructions.

C. Arrange supports to prevent misalignment during wiring installation.

D. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

E. Group related conduits; support using conduit rack. Construct rack using steel channel, provide space on each for 25 percent additional conduits.

F. Fasten conduit supports to building structure and surfaces under provisions of Section 260529.

G. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports

H. Do not attach conduit to ceiling support wires.

I. Arrange conduit to maintain headroom and present neat appearance.

J. Route exposed conduit parallel and perpendicular to walls.

K. Route conduit installed above accessible ceilings parallel and perpendicular to building elements and walls.

L. Route conduit in and under slab from point-to-point. Dimension from building columns.

M. Do not cross conduits in slab except with written approval from the Structural Engineer.

N. Routing conduits parallel in the slab is prohibited except with written approval from the Structural Engineer.

O. Maintain adequate clearance between conduit and piping.

P. Maintain 12-inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.

Q. Cut conduit square using saw or pipecutter; de-burr cut ends.

R. Bring conduit to shoulder of fittings; fasten securely.

S. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for twenty (20) minutes, minimum.

T. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

U. Install no more than equivalent of four 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate or factory elbows for bends in metal conduit larger than 2-inch size.

V. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

W. Provide suitable fittings to accommodate expansion and deflection where conduit crosses, control and expansion joints.

X. Provide suitable pull string in each empty conduit except sleeves and nipples.

Y. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

Z. Ground and bond conduit under provisions of Section 260526.

AA. Identify conduit under provisions of Section 260553.

BB. Transition from underground nonmetallic conduit to above grade metal conduit or electrical metallic tubing shall be made in or below the slab. The transition between nonmetallic conduit and above grade conduit shall be made with a rigid steel, plastic coated elbow.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using approved materials and methods.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified.

END OF SECTION 260532

SECTION 260533 - SURFACE RACEWAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section - 013329 - Sustainable Design Specification Section applies to this Section.

PART 2 - PRODUCTS

2.1 SURFACE METAL RACEWAY

A. Manufacturers:
   1. Panduit Corp.
   2. Square-D Company.
   3. Hubbell, Inc.
   4. Wiremold Company.

2.2 SURFACE METAL RACEWAY

A. Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.

B. Size: As shown on Drawings.

C. Finish: Gray enamel.

D. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories.

2.3 MULTIOUTLET ASSEMBLY

A. Manufacturers:
   1. Wiremold Company
   2. Hubbell, Inc.

B. Multioutlet Assembly: Sheet metal channel with fitted cover, with pre-wired receptacles, suitable for use as multioutlet assembly.

C. Size: As indicated on Drawings.

D. Receptacles: Provide covers and accessories to accept receptacles specified in Section 262726.

E. Receptacle Spacing: As indicated.

F. Receptacle Color: As specified in Section 262726.

G. Channel Finish: Gray enamel.

H. Fittings: Furnish manufacturer's standard couplings, elbows, and connectors.

2.4 WIREWAY

A. Manufacturers:
1. Cooper B-Line
2. Wiremold Company
3. Square-D
4. Hoffman

B. General purpose or Raintight type wireway.

C. Knockouts: As indicated on drawings.

D. Size: As indicated on Drawings.

E. Description: Cover: Screw cover with full gasketing.

F. Connector: Flanged.

G. Fittings: Lay-in type with removable top, bottom, and side; captive screws, drip shield.

H. Finish: Rust inhibiting primer coating with gray enamel finish

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Use flat-head screws, clips, and straps to fasten raceway channel to surfaces. Mount plumb and level.

C. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

D. Wireway Supports: Provide steel channel as specified in Section 260529.

E. Close ends of wireway and unused conduit openings.

F. Ground and bond raceway and wireway under provisions of Section 260526.

END OF SECTION 260533

SECTION 260534 - ELECTRICAL BOXES AND FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Wall and Ceiling Outlet Boxes

B. Floor Boxes

C. Pull and Junction Boxes

1.2 RELATED DOCUMENTS

A. Drawings, general and special conditions, Division 1 - General Requirements and other applicable technical specifications apply to work of this Section.

1.3 RELATED SECTIONS

A. Division 7 - Firestopping.

B. Division 8 - Access Doors: Wall and ceiling access doors.

C. Section 26 27 26 - Wiring Devices: Service fittings and fire-rated poke-through fittings for floor boxes.

D. Section 260535 - Cabinets and Enclosures.

E. Section 260580 – Equipment Wiring Systems.

1.4 REFERENCE STANDARDS

A. Comply with the requirements of the reference standards noted herein, except where more stringent requirements are listed herein or otherwise required by the Contract Documents. A listing of applicable reference standards is contained in Division 1.

B. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.

C. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.

D. ANSI/NFPA 70 - National Electrical Code.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.5 PROJECT CONDITIONS

A. Verify field measurements are as shown on Drawings.

B. Verify locations of floor boxes and outlets prior to rough-in.

C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose. Include installation within 10-feet of location shown. Refer to Architectural Drawings.

PART 2 - PRODUCTS

2.1 OUTLET BOXES

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1; galvanized steel, with 2-inch male fixture studs where required.

B. Cast Boxes: NEMA FB 1, Type FD, cast ferroalloy. Provide gasketed cover by box manufacturer. Provide threaded hubs.

2.2 FLOOR BOXES

A. Floor Boxes: ANSI/NEMA OS 1 or NEMA FB 1, fully adjustable.

2.3 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1; galvanized steel.

B. Sheet Metal Boxes Larger than 12-Inches in Any Dimension: Hinged enclosure in accordance with Section 260535.

C. Surface-Mounted Cast Metal Box: NEMA 250, Type 6; flat-flanged, surface-mounted junction box.
   1. Material: Galvanized cast iron.
   2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

C. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

D. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

E. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Division 7.

F. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.

G. Use flush mounting outlet boxes in finished areas.

H. Do not install flush mounting boxes back-to-back in walls; provide minimum 6-inch separation. Provide minimum 12-inch separation between back-to-back boxes in acoustic-rated walls.

I. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

J. Use stamped steel bridges to fasten flush mounting outlet box between studs.

K. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

L. Use adjustable steel channel fasteners for hung ceiling outlet box.

M. Do not fasten boxes to ceiling support wires.

N. Support boxes independently of conduit, except cast box that is connected to two (2) rigid metal conduits both supported within 12 inches of box.

O. Use gang box where more than one (1) device is mounted together. Do not use sectional box.

P. Use gang box with plaster ring for single device outlets.

Q. Use cast outlet box in exterior locations exposed to the weather and wet locations.

R. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.

S. Set floor boxes level.

T. Large Pull Boxes: Boxes larger than 100 cubic inches in volume or 12-inches in any dimension.
   1. Interior Dry Locations: Use hinged enclosure under provisions of Section 26 05 35.
   2. Other Locations: Use surface-mounted cast iron box.

U. Minimum junction and pull box size 4-11/16" x 4-11/16" x 2-1/4".

V. Minimum outlet box size 4" x 4" x 1-1/2".

W. Minimum telephone outlet box size 4-11/16" x 4-11/16" x 2-1/4".

X. Minimum junction box size for fire alarm pull stations, control module, monitor module, 4" x 4" x 2-3/4". Provide plaster ring at all pull station locations.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Coordinate installation of outlet box for products furnished under other sections.

B. Coordinate locations and sizes of required access doors with Division 8.

C. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

D. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.

E. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

3.3 ADJUSTING

A. Adjust floor box flush with finish flooring material.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closure in unused box openings.

END OF SECTION 260534

SECTION 260535 - CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Hinged cover enclosures.

B. Cabinets.

C. Terminal blocks.

D. Accessories.

1.2 RELATED SECTIONS

A. Section 26 05 29 - Supporting Devices and Seals

1.3 REFERENCES

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

B. NEMA ICS 4 - Terminal Blocks for Industrial Control Equipment and Systems.

C. ANSI/NFPA 70 - National Electrical Code.

1.4 EXTRA MATERIALS

A. Provide two of each cabinet key.

PART 2 - PRODUCTS

2.1 HINGED COVER ENCLOSURES

A. Construction: NEMA 250, Type 1 steel enclosure.

B. Covers: Continuous hinge, held closed by flush latch operable by key.

C. Provide interior plywood panel for mounting terminal blocks and electrical components; finish with matte white enamel.

D. Enclosure Finish: Manufacturer's standard enamel.

2.2 CABINETS

A. Boxes: Galvanized steel with removable endwalls.

B. Box Size: As indicated

C. Backboard: Provide 3/4-inch thick plywood backboard for mounting terminal blocks. Paint matte white enamel.

D. Fronts: Steel, surface type with concealed hinge, and flush lock keyed to match branch circuit panelboard. Finish with gray baked enamel.

E. Knockouts: As required

F. Provide metal barriers to separate compartments containing control wiring operating at less than 50 volts from power wiring.

G. Provide accessory feet for free-standing equipment.

2.3 TERMINAL BLOCKS

A. Terminal Blocks: ANSI/NEMA ICS 4.

B. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.

C. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.

D. Provide ground bus terminal block, with each connector bonded to enclosure.

2.4 FABRICATION

A. Shop assemble enclosures and cabinets housing terminal blocks or electrical components in accordance with ANSI/NEMA ICS 6.

B. Provide conduit hubs on enclosures.

C. Provide protective pocket inside front cover with schematic diagram, connection diagram, and layout drawing of control wiring and components within enclosure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive Work.

3.2 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.

B. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner.

C. Install cabinet fronts plumb.

END OF SECTION 260535

SECTION 260553 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. Buried and Duct Bank Warnings

B. Electrical Power, Control and Communication Conductors and Conduit

C. Operational Instructions and Warnings

D. Danger Signs

E. Equipment/System Identification Signs

1.2 RELATED SECTIONS

A. Division 9 - Painting.

1.3 REFERENCE STANDARDS

A. Comply with the requirements of the reference standards noted herein, except where more stringent requirements are listed herein or otherwise required by the Contract Documents. A listing of applicable reference standards is contained in Division 1.

1.4 QUALITY ASSURANCE

A. ANSI Compliance: Applicable requirements of ANSI A13.1, "Piping and Piping Systems".

B. FS Compliance: Applicable requirements of FS L-P-387 "Plastic Sheet, Laminated, Thermosetting (for designation plates)".

C. UL Compliance: Applicable requirements of UL Standard 969, "Marking and Labeling Systems," pertaining to electrical identification systems.

D. NEMA Compliance: Applicable requirements of NEMA Standard Nos. WC-1 and WC-2 pertaining to identification of power and control conductors.

E. Comply with "OSHA" sign standards for danger, caution, warning, etc.

1.5 SUBMITTALS

A. Submit product data under provisions of Division 1.

B. Include schedule for all specified applications of electrical identification.

C. Low-Emitting Paints and Coatings
   1. Submit product data or other published information verifying the VOC (Volatile Organic Compound) content is less than or equal to the allowable VOC content established by the governing standards.

PART 2 - PRODUCTS

2.1 ELECTRICAL IDENTIFICATION MATERIALS

A. General: The manufacturer's standard products of categories and types required are to be used for each application.

B. Color-Coded Emergency Power Conduit Markers:
   1. Manufacturer's standard self-adhesive vinyl tape not less than 3 mils thick. Tape 1-1/8-inch wide by 4-1/2-inch long marker for 2-inch and smaller conduit. Tape 2-1/4-inch wide by 9-inch long marker for 2-1/2-inch and larger conduit. Black lettering is to indicate highest voltage of cable(s) in conduit.
   2. Colors: Red tape.

C. Underground Type Plastic Line Marker:
   1. Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6-inches wide x 4 mils thick. Printing is required on tape, which most accurately indicates type of service.
   2. Color: Yellow

D. Cable/Conductor Identification Bands:
   1. For cables smaller than No. 2/0 manufacturer's standard vinyl-cloth self-adhesive cable/conductor markers of wrap-around type, either pre-numbered plastic coated type, or write-on type with clear plastic self-adhesive cover flap are to be used and numbered to show circuit identification.
   2. For cables No. 2/0 AWG and larger, heat shrink sleeving is to be used for phase color coding.

E. Plasticized Tags:
   1. Manufacturer's standard preprinted or partially preprinted accident-prevention and operational tags, on plasticized card stock with matte finish suitable for writing, approximately 3-1/4-inch x 5-5/8-inch, with brass grommets and wire fasteners, and with appropriate preprinted wording including large-size primary wording, e.g., DANGER, CAUTION, DO NOT OPERATE.

F. Baked Enamel Danger Signs:
   1. Manufacturer's standard "DANGER" signs of baked enamel finish on aluminum; of standard Red, Black and White graphics; 14-inch x 10-inch size except where 10-inch x

7-inch is the largest size which can be applied where needed; with recognized standard explanation wording, e.g., XXXX VOLTS, KEEP AWAY, BURIED CABLE, DO NOT TOUCH SWITCH, etc.

G. Engraved Plastic-Laminate Signs:
1. Engraved stock melamine plastic laminate, complying with FS L-P-387, in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated, White face and Black core (Black letters on a White background) except as otherwise required (emergency power and fire alarm shall be Red with White letters), punched for mechanical fastening with a minimum of two (2) screws.
2. Thickness: 1/16-Inch, for units up to 20 square inches or 8-inch length; 1/8-inch for larger units.
3. Fasteners: A minimum of two (2) self-tapping stainless steel screws.
4. Minimum letter height shall be as follows:
    a. 1/4-Inch:
        1) Panelboard name.
        2) Switchboard name.
        3) System control panel name.
        4) Voltage rating.
        5) Ampere rating.
        6) Individual circuit breaker number and load name.
        7) Individual switch circuit number and load name.
        8) Individual motor starter circuit number and load name.
        9) Individual indicating light function.
        10) Individual pushbutton function.
        11) Individual selector switch functions.

H. Lettering and Graphics:
1. Names, abbreviations and other designations used in electric identification work are to be coordinated with corresponding designation shown, specified or scheduled. Numbers, lettering and wording as required or as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical systems and equipment.

I. Adhesive Marking Tape for Device Cover Plates:
1. Avery-type or equal with 3/16-inch minimum height letters. Labels shall have black letters on clear labels for normal and red letters on clear labels for emergency. Embossed Dymo-Tape labels are not acceptable.

J. Paints and Coatings
1. Paints and Coating applied on site within the weather proofing exteriro in this section must comply with Green Seal Standard GS-11, Green Seal Standard GC-03, OR South Coast Air Quality Management District Rule 111.3. Refer to LEED Specification 01352 specific VOC requirements.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. General Installation Requirements:

1. Regulations: Governing regulations and requests of governing authorities are to be complied with for identification of electrical work.

B. Underground Conduit and Ductbank Identification:
   1. During back-filling/top-soiling of each exterior underground conduit and ductbank, a continuous underground-type plastic line marker, located directly over conduit or ductbank at 12-inches below finished grade or 4-inches below paving, shall be provided.

C. Cable/Conductor Identification:
   1. The application of cable/conductor identification, with circuit number, on each cable/conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present is required. The identification is to match the marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project's electrical work.

D. Junction Box and Pull Box Identification:
   1. On the Cover of each junction box and pull box: The circuit number(s) of the enclosed conductors are to be legibly written with a Black permanent ink broad tip marking pen and the system identified for FA (Fire Alarm) EM (Emergency) PA (Public Address), S (Security) TC (Temperature Control).
   2. Covers for emergency system junction boxes and pull boxes shall be painted Red.
   3. Covers for the Fire Alarm System junction boxes and pull boxes shall be painted Red.

E. Operational Identification and Warnings:
   1. Wherever required to ensure safe and efficient operation and maintenance of electrical systems, and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls, devices and covers of electrical enclosures shall be provided. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposes.

F. Caution Signs:
   1. The following caution sign is to be provided for all circuit breakers and switchboards where turning off a circuit will automatically start an emergency operation:

      "CAUTION TURNING OFF THIS CIRCUIT WILL
      AUTOMATICALLY START EMERGENCY OPERATION."

   2. The following caution sign is to be provided for all automatic transfer switches, switches, circuit breakers, equipment, and emergency panels that are energized by the emergency power system:

      "CAUTION AUTOMATICALLY ENERGIZED BY
      EMERGENCY POWER SUPPLY SYSTEM."

G. Equipment/System Identification:
   1. An engraved plastic-laminated sign is to be provided on each major unit of electrical equipment in the building; including central or master unit of each electrical system including communication/control/signal/alarm systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, letter height as specified, black lettering on white field.

Provide text matching terminology and numbering of the contract documents and shop drawings. The sign shall include unit designation, source circuit number, circuit voltage, and other data specifically indicated. Also, the sign shall indicate normal source circuit number ("Fed from . . .") and emergency source circuit number when the equipment is a transfer switch or fed directly from a transfer switch. Include signs for each unit of the following categories of electrical work:

a. Switchboards, panelboards (include main bus ampacity on sign), electrical cabinets and enclosures.
b. Access panel/doors to electrical facilities.
c. Disconnect switch.
d. Push buttons, selector switches, indicating lights. (Circuit number and voltage not required on sign).
e. Power transfer equipment: Contactors and transfer switches.
f. Power generating units.
g. Telephone cabinets and switching equipment. (Circuit number and voltage not required on sign.)
    a. Fire Alarm Control Panel.

2. The installation of signs are required at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. The sign shall be secured to the substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate substrate.

H. For panelboards, provide framed, typed circuit schedules (label all spares and spaces in pencil) with explicit description and identification of items controlled by each individual breaker.

I. Provide tape labels for identification of individual receptacles and switches. Locate tape on front of plate and indicate associated source panelboard and circuit number.

END OF SECTION 260553

SECTION 260580 - EQUIPMENT WIRING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Electrical connections to equipment specified under other Sections or furnished by Owner.

1.2 RELATED SECTIONS

A. Division 1 - Owner-furnished equipment.

B. Division 14 - Elevators.

C. Divisions 22 & 23 - Electrical Requirements for Mechanical Equipment.

D. Division 21 - Fire Protection.

E. Division 22 - Plumbing Pumps.

F. Division 22 - Water Heaters.

G. Division 23 - HVAC pumps.

H. Division 23- Air Handling Units.

I. Section 260532 - Conduit.

J. Section 260519 – Building Wire and Cable.

K. Section 260534 - Electrical Boxes and Fittings.

1.3 REFERENCE STANDARDS

A. Comply with the requirements of the reference standards noted herein, except where more stringent requirements are listed herein or otherwise required by the Contract Documents. A listing of applicable reference standards is contained in Divisions1.

B. NEMA WD 1 - General-Purpose Wiring Devices.

C. NEMA WD 5 - Specific-Purpose Wiring Devices.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - CORDS AND CAPS

A. Hubbell

B. General Electric

C. Pass & Seymour

D. Arrow, Hart & Hegeman

2.2 CORDS AND CAPS

A. Straight-Blade Attachment Plug: NEMA WD 1.

B. Locking-Blade Attachment Plug: NEMA WD 5.

C. Attachment Plug Configuration: Match receptacle configuration at outlet provided for equipment.

D. Cord Construction: Oil-resistant thermoset insulated Type SO multi-conductor flexible cord with identified equipment grounding conductor, suitable for hard usage in damp locations.

E. Cord Size: Suitable for connected load of equipment and rating of branch circuit overcurrent protection.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 PREPARATION

A. Review equipment submittals prior to installation and electrical rough-in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.

3.3 INSTALLATION

A. Use wire and cable with insulation suitable for temperatures encountered in heat-producing equipment.

B. Make conduit connections to equipment using flexible conduit. Use liquid-tight flexible conduit in damp or wet locations.

C. Install pre-finished cord set where connection with attachment plug is indicated or specified, or use attachment plug with suitable strain-relief clamps.

D. Provide suitable strain-relief clamps for cord connections to outlet boxes and equipment connection boxes.

E. Make wiring connections in control panel or in wiring compartment of pre-wired equipment in accordance with manufacturer's instructions. Provide interconnecting wiring where indicated.

F. Install disconnect switches, controllers, control stations, and control devices such as limit switches and temperature switches as indicated. Connect with conduit and wiring as indicated.

3.4 EQUIPMENT CONNECTION SCHEDULE

A. Furnish, set in place, and wire, except as may be otherwise indicated, all heating, ventilating, air conditioning, plumbing, fire protection, and other motors and controls in accordance with the schedule in section 23 01 00. Carefully coordinate with work performed under the Mechanical and other Divisions of these specifications.

END OF SECTION 260580

SECTION 260923 - LIGHTING CONTROL DEVICES

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following lighting control devices:

Adjust list below to suit Project.

1. Indoor photoelectric switches.
2. Indoor occupancy sensors.

B. Related Sections include the following:

List below only products that the reader might expect to find in this Section but are specified elsewhere.

1. Division 26 Section "Network Lighting Controls" for low-voltage, manual and programmable lighting control systems.
2. Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

C. Related Sections include the following:

List below only products that the reader might expect to find in this Section but are specified elsewhere.

1. Division 26 Section "Lighting Controls" for low-voltage, manual and programmable lighting control systems.
2. Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.2 DEFINITIONS

Retain abbreviations that remain after this Section has been edited.

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

Delete subparagraph below if control connections are indicated on Drawings.

1. Interconnection diagrams showing field-installed wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including luminaires, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 INDOOR PHOTOELECTRIC SWITCHES

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. Retain one of three paragraphs and list of manufacturers below. See Division 01 Section "Product Requirements."

A. Manufacturers:
   1. Intermatic, Inc.
   2. Lithonia Lighting; Acuity Lighting Group, Inc.
   3. MicroLite Lighting Control Systems.
   4. Novitas, Inc.
   5. Square D; Schneider Electric.
   6. TORK.
   7. Watt Stopper (The).

Photoelectric switch in paragraph and subparagraphs below is used to turn lighting on and off, depending on amount of daylight reaching the work plane. Switch described is for lighting control of interior spaces. Switching range should correspond to typical interior lighting levels for the space in which it is mounted.

Paragraph below is suitable for general indoor daylight harvesting applications. Sensors and accessories are for switching ballasts or lamps. Dimming controls are specified in Division 26 Sections "Central Dimming Controls" and "Modular Dimming Controls."

B. Ceiling or Mounted Photoelectric Switch: Solid-state, light-level sensor unit, with separate relay unit mounted on luminaire, to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photoresistors are not acceptable.
   1. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.

Relay unit in subparagraph below is suitable for controlling a single lighting circuit, provided the circuit load does not exceed the listed aggregate load.

2. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.

Retain second option in first subparagraph below for lighting control of interior spaces with large window areas, including atriums and corridors; otherwise, retain first option.

3. Light-Level Monitoring Range: 10 to 200 fc, with an adjustment for turn-on and turn-off levels within that range.
4. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with deadband adjustment.
5. Indicator: Two LEDs to indicate the beginning of on-off cycles.

Paragraph and subparagraphs below are suitable for specialized application of controlling lighting units in an area where one or more skylights are the source of illumination, and lighting level is controlled in direct relation to brightness of the sky.

2.2 INDOOR OCCUPANCY SENSORS

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. Retain one of first three paragraphs and list of manufacturers below. See Division 01 Section "Product Requirements."

A. Manufacturers:
1. Hubbell Lighting.
2. Leviton Mfg. Company Inc.
3. Lithonia Lighting; Acuity Lighting Group, Inc.
4. Novitas, Inc.
5. TORK.
6. Watt Stopper (The).
7. Square D; Schneider Electric

B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.

Retain subparagraphs and associated subparagraphs below to specify various types of units required for Project.

1. Operation: Unless otherwise indicated, turn lights “on” manually when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:
   a. Sensor: Suitable for mounting in any position on a standard outlet box.
   b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
   c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.

7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lx); keep lighting off when selected lighting level is present.

Retain one or more of three paragraphs and associated subparagraphs below. Revise coverage area of detectors and add detectors with different coverage patterns and features to suit Project.

C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
   1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
   2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 2000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
   3. Detection Coverage (Corridor): Detect occupancy within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling.

D. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
   1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).

Coverage areas listed in four subparagraphs below are typical.

   2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
   3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
   4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
   5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling in a corridor not wider than 14 feet (4.3 m).

E. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.
   1. Sensitivity Adjustment: Separate for each sensing technology.
   2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
   3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

2.3 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

Coordinate this Article with Drawings.

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch (13 mm).

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
   1. Identify controlled circuits in lighting contactors.
   2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
   1. After installing sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
   2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.6 DEMONSTRATION

This Article covers optional services; retain if Project warrants. Coordinate with Division 01 training requirements. If Project includes programmable lighting controls, coordinate with testing of that system.

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified in Division 26 Section "Network Lighting Controls."

B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 260923

SECTION 262413 - SWITCHBOARDS

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes service and distribution switchboards rated 600 V and less.

1.2 DEFINITIONS

Retain abbreviations that remain after this Section has been edited.

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. RFI: Radio-frequency interference.

D. RMS: Root mean square.

E. SPDT: Single pole, double throw.

1.3 SUBMITTALS

A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each switchboard and related equipment.
   1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
      a. Enclosure types and details for types other than NEMA 250, Type 1.
      b. Bus configuration, current, and voltage ratings.
      c. Short-circuit current rating of switchboards and overcurrent protective devices.

Retain first subparagraph below if optional barriers are specified.

      d. Descriptive documentation of optional barriers specified for electrical insulation and isolation.

e. Utility company's metering provisions with indication of approval by utility company.
f. Mimic-bus diagram.

Retain first subparagraph below if series rating of overcurrent protective devices is used.

g. UL listing for series rating of installed devices.
h. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Power, signal, and control wiring.

Retain paragraph below if mimic bus is specified.

Retain paragraph and subparagraphs below if required by seismic criteria applicable to Project. Coordinate with Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

C. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Routine maintenance requirements for switchboards and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
3. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.4 QUALITY ASSURANCE

If an independent testing agency is required, see Division 01 Section "Quality Requirements" for general testing and inspecting agency qualification requirements. If additional control is needed, use one of first two paragraphs below to specify 29 CFR 1910.7 or other more specific criteria (e.g., NETA). 29 CFR 1910.7 defines a nationally recognized testing laboratory as it applies to testing and inspecting for safety, and lists, labels, or accepts equipment and materials that meet certain OSHA criteria.

Retain first paragraph and subparagraph below if Contractor is required to provide services of an independent testing agency in "Field Quality Control" Article in Part 3.

A. Source Limitations: Obtain switchboards through one source from a single manufacturer.

Retain first paragraph below to allow drawing details based on one manufacturer's product to establish requirements and still allow competition. Coordinate with Division 01 requirements.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NEMA PB 2, "Deadfront Distribution Switchboards."

E. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver in sections or lengths that can be moved past obstructions in delivery path.

Delete one of first two paragraphs below or edit to suit Project.

B. Store indoors in clean dry space with uniform temperature to prevent condensation. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.

C. If stored in areas subjected to weather, cover switchboards to provide protection from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside switchboards; install electric heating (250 W per section) to prevent condensation.

D. Handle switchboards according to NEMA PB 2.1 and NECA 400.

1.6 PROJECT CONDITIONS

Revise paragraph below to describe specific requirements for moving switchboards into place. Where appropriate, indicate alterations to existing facilities that may be required to accommodate an indicated delivery path. Coordinate with Drawings.

Retain paragraph and subparagraphs below for switchboards installed in typical environmental conditions. For switchboards installed outdoors or in unusual environmental conditions, revise to indicate minimum ambient temperature and expected humidity range. See Editing Instruction No. 2 in the Evaluations.

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
   1. Ambient Temperature: Not exceeding 104 deg F (40 deg C).
   2. Altitude: Not exceeding 6600 feet (2000 m).

Retain paragraph and subparagraphs below or revise to accommodate unusual service conditions that cannot be eliminated. See Editing Instructions No. 2 and No. 3 in the Evaluations.

B. Service Conditions: NEMA PB 2, usual service conditions, as follows:
   1. Ambient temperatures within limits specified.
   2. Altitude not exceeding 6600 feet (2000 m).

Retain paragraph and subparagraphs below if interruption of existing electric service is required.

1.7 COORDINATION

Edit first paragraph below for types of construction and encumbrances that affect switchboard installation.

A. Coordinate layout and installation of switchboards and components with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

Extra materials may not be allowed for publicly funded projects. Coordinate with Division 26 Section "Fuses" for quantities of spare fuses to be provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

Edit this Article with other Part 2 articles in which manufacturers are named. See Division 01 Section "Product Requirements" for an explanation of the terms "Available Manufacturers" and "Manufacturers" and the effect these terms have on "Comparable Product" and "Product Substitution" requirements.

Switchboards described in this Article include service and distribution types most commonly applied. Select types required for Project from options provided below. Coordinate with Drawings. If more than one type is required, identify by Drawing identification number.

Coordinate type of switchboard with types of overcurrent protective devices and with switchboard arrangement and available space. Consult manufacturer to determine layout requirements. See Evaluations for further discussion.

Coordinate first paragraph and list below with Part 2 "Manufacturers" Article. Retain "Available" for nonproprietary and delete for semiproprietary specifications.

1. Square D.
2. General Electric Co.; Electrical Distribution & Protection Div.
3. Siemens Energy & Automation, Inc.
4. Eaton, Cutler-Hammer

B. Front-Connected, Front-Accessible Switchboard: Fixed, individually mounted main device, panel-mounted branches, and sections rear aligned.

C. Front- and Side-Accessible Switchboard: Fixed, individually mounted main device; panel-mounted branches; and sections rear aligned.

Coordinate two paragraphs below with Drawings. Delete rating data if on Drawings.

D. Nominal System Voltage: 208Y/120 V.

E. Main-Bus Continuous: Refer to Drawings.

Retain first paragraph below for projects in seismic areas. Coordinate with Part 1 "Submittals" Article for submittal of manufacturer's seismic qualification certification.

F. Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

G. Enclosure: Steel, NEMA 250, Type 1.

H. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

Retain paragraph below if required.

I. Barriers: Between adjacent switchboard sections.

Add internal barriers and extra insulation to isolate energized components, such as buses and vertical sections, if required to protect against damage from arcing ground faults. See Evaluations for further discussion.

J. Insulation and isolation for main bus of main section and main and vertical buses of feeder sections.

Heaters and controls below, usually specified for outdoor switchboards, are sometimes specified for indoor units.

K. Utility Metering Compartment: Fabricated compartment and section complying with utility company's requirements. If separate vertical section is required for utility metering, match and align with basic switchboard.

Pull sections in paragraph below are often required when incoming supply is beneath switchboard.

L. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

M. Buses and Connections: Three phase, four wire, unless otherwise indicated.

Retain one of three subparagraphs below for main-bus material.

1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity with feeder circuit-breaker line connections.

Retain two subparagraphs below with any of three subparagraphs above.

Delete first subparagraph below if front-access sections are specified.

2. Load Terminals: Insulated, rigidly braced, silver-plated, copper runback bus extensions equipped with pressure connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full ampere rating of circuit-breaker position.
3. Ground Bus: 1/4-by-2-inch- (6-by-50-mm-) minimum-size, hard-drawn copper of 98 percent conductivity, equipped with pressure connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
4. Contact Surfaces of Buses: Silver plated.
5. Main Phase Buses, Neutral Buses, and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.

Retain subparagraph below if optional barriers are not specified.

6. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

Retain one of two subparagraphs below or delete both for three-phase, three-wire systems.

7. Neutral Buses: 100 percent of the ampacity of phase buses, unless otherwise indicated, equipped with pressure connectors for outgoing circuit neutral cables. Bus extensions for busway feeder neutral bus are braced.

Retain paragraph below for future provisions.

N. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

Insulation may not be required by authorities having jurisdiction. Delete paragraph below unless Project conditions require additional bus insulation. Uninsulated buses are standard.

O. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating: 105 deg C.

2.2 OVERCURRENT PROTECTIVE DEVICES

Coordinate this Article with schedules and Drawings.

A. Molded-Case Circuit Breaker: NEMA AB 3, with interrupting capacity to meet available fault currents.
   1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
   2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
   3. Electronic trip-unit circuit breakers shall have RMS sensing, field-replaceable rating plug, and the following field-adjustable settings:
      a. Instantaneous trip.
      b. Long- and short-time pickup levels.
      c. Long- and short-time time adjustments.

B. Enclosed, Insulated-Case Circuit Breaker: Fully rated, encased-power circuit breaker with interrupting capacity rating to meet available fault current.
   1. Fixed circuit-breaker mounting.
   2. Two-step, stored-energy closing.
   3. Microprocessor-based trip units with interchangeable rating plug, LED trip indicators, and the following field-adjustable settings:
      a. Instantaneous trip.
      b. Long- and short-time pickup levels.
      c. Long- and short-time time adjustments with I^2t response.
   4. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."

Retain one of first two paragraphs and associated subparagraphs below.

2.3 INSTRUMENTATION

A. Instrument Transformers: NEMA EI 21.1, IEEE C57.13, and the following:
   1. Potential Transformers: Secondary voltage rating of 120 V and NEMA accuracy class of 0.3 with burdens of W, X, and Y.

Coordinate first subparagraph below with Drawings and indicate specific accuracy classes and burdens required for each application.

   2. Current Transformers: Ratios shall be as indicated with accuracy class and burden suitable for connected relays, meters, and instruments.
   3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kV.

Retain subparagraph below for certain ground-fault protection situations such as double-ended switchboards on four-wire, grounded neutral systems. Coordinate with Drawings.

   4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondaries to ground overcurrent relays to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker ground-fault protection.

Delete paragraph and subparagraphs below if conventional analog meter installation is required.

B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

   1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
      a. Phase Currents, Each Phase: Plus or minus 1 percent.
      b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
      c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
      d. Megawatts: Plus or minus 2 percent.
      e. Megavars: Plus or minus 2 percent.
      f. Power Factor: Plus or minus 2 percent.
      g. Frequency: Plus or minus 0.5 percent.
      h. Megawatt Demand: Plus or minus 2 percent; demand interval programmable from 5 to 60 minutes.
      i. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent. Accumulated values unaffected by power outages up to 72 hours.
   2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

Delete remaining paragraphs and subparagraphs below if all metering functions can be provided by multifunction digital meters specified above.

Retain paragraph below for circuit breakers with solid-state trip devices.

Retain one or both of first two paragraphs below for installations with drawout circuit breakers.

Retain paragraph below for installations in humid environments.

2.4 IDENTIFICATION

Coordinate this Article with Drawings.

A. Mimic Bus: Continuously integrated mimic bus factory applied to front of switchboard. Arrange in single-line diagram format, using symbols and letter designations consistent with final mimic-bus diagram. Coordinate mimic-bus segments with devices in switchboard sections to which they are applied. Produce a concise visual presentation of principal switchboard components and connections.

Revise paragraph below to require other types of presentation media if factory-painted mimic bus is not desirable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install switchboards and accessories according to NEMA PB 2.1 and NECA 40.

B. Install and anchor switchboards level on concrete bases, 4-inch (100-mm) nominal thickness. Concrete base is specified in Division 26 Section "Supporting Devices and Seals," and concrete materials and installation requirements are specified in Division 03.

Revise four subparagraphs below based on installed equipment. Indicate dowel-rod quantity, size, and spacing on Drawings.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
2. For switchboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to switchboards.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

D. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

E. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.

Retain paragraph below if spare-fuse cabinets are specified in Part 2 "Accessory Components and Features" Article.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:
   1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

Retain one of three paragraphs below.

3.5 CLEANING

A. On completion of installation, inspect interior and exterior of switchboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 262413

SECTION 262416 - PANELBOARDS

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

Adjust list below to suit Project.

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.2 DEFINITIONS

Retain abbreviations that remain after this Section has been edited.

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. RFI: Radio-frequency interference.

D. RMS: Root mean square.

E. SPDT: Single pole, double throw.

1.3 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    a. Enclosure types and details for types other than NEMA 250, Type 1.
    b. Bus configuration, current, and voltage ratings.
    c. Short-circuit current rating of panelboards and overcurrent protective devices.

Retain first subparagraph below if series rating of overcurrent protective devices is used.

d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Power, signal, and control wiring.

Retain paragraph and subparagraphs below if required by seismic criteria applicable to Project. Coordinate with Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

Retain option in first paragraph below if "Load Balancing" Paragraph is retained in Part 3 "Field Quality Control" Article.

C. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
   1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
   2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.4 QUALITY ASSURANCE

If an independent testing agency is required, see Division 01 Section "Quality Requirements" for general testing and inspecting agency qualification requirements. If additional control is needed, use one of first two paragraphs below to specify 29 CFR 1910.7 or other more specific criteria (e.g., NETA). 29 CFR 1910.7 defines a nationally recognized testing laboratory as it applies to testing and inspecting for safety, and lists, labels, or accepts equipment and materials that meet certain OSHA criteria.

Retain first paragraph and subparagraph below if Contractor is required to provide services of an independent testing agency in "Field Quality Control" Article in Part 3.

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

Retain first paragraph below to allow drawing details based on one manufacturer's product to establish requirements and still allow competition. Coordinate with Division 01 requirements.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

1.5 PROJECT CONDITIONS

Retain paragraph and subparagraphs below for panelboards installed in typical environmental conditions. For panelboards installed outdoors or in unusual environmental conditions, revise to indicate minimum ambient temperature and expected humidity range.

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
   1. Ambient Temperature: Not exceeding 104 deg F (40 deg C).
   2. Altitude: Not exceeding 6600 feet (2000 m).

Retain paragraph and subparagraphs below or revise to accommodate unusual service conditions that cannot be eliminated.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
   1. Ambient temperatures within limits specified.
   2. Altitude not exceeding 6600 feet (2000 m).

Retain paragraph and subparagraphs below if interruption of existing electrical service is required.

1.6 COORDINATION

Edit first paragraph below for types of equipment that affect panelboard installation.

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.7 EXTRA MATERIALS

Extra materials may not be allowed for publicly funded projects.

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Keys: Six spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Eaton Corporation, Cutler-Hammer
2. General Electric Co.; Electrical Distribution & Protection Div
3. Siemens Energy & Automation, Inc.
4. Square D

2.2 PANELBOARDS

Retain first paragraph below for projects in seismic areas. Coordinate with Part 1 "Submittals" Article for submittal of manufacturer's seismic qualification certification.

A. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1.
   1. Rated for environmental conditions at installed location.
      a. Outdoor Locations: NEMA 250, Type 3R.
   2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

Retain subparagraph above or below.

   3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

First three subparagraphs below are optional features. Coordinate with Drawings.

   4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
   5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
   6. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
   7. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.

B. Phase and Ground Buses:
   1. Material: Hard-drawn copper, 98 percent conductivity.

Subparagraphs below are optional features. Coordinate with Drawings.

   2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

C. Conductor Connectors: Suitable for use with conductor material.
   1. Main and Neutral Lugs: Compression type.
   2. Ground Lugs and Bus Configured Terminators: Compression type.

First two subparagraphs below are optional features. Coordinate with Drawings.

   3. Feed-Through Lugs: Compression type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

Coordinate paragraph below with Drawings.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

Retain paragraph below for panelboards incorporating one or more main service disconnect switches.

Retain paragraph below if future provisions are required.

F. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.3 PANELBOARD SHORT-CIRCUIT RATING

Retain one of two paragraphs below for series-rated system or system that has panelboards and circuit breakers rated for full value of short-circuit current available at location of equipment. Coordinate with Drawings.

A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 DISTRIBUTION PANELBOARDS

Coordinate this Article with Drawings.

A. Doors: Secured with vault-type latch with tumbler lock; keyed alike. Main Overcurrent Protective Devices: Circuit breaker.

B. Branch Overcurrent Protective Devices:

Retain one of three subparagraphs below.

1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers

2.5 OVERCURRENT PROTECTIVE DEVICES

Coordinate this Article with schedules and Drawings.

A. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.
   1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
   2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
   3. Electronic trip-unit circuit breakers shall have RMS sensing; field-replaceable rating plug; and with the following field-adjustable settings:
      a. Instantaneous trip.
      b. Long- and short-time pickup levels.
      c. Long- and short-time time adjustments.
   4. GFCI Circuit Breakers: Single- and two-pole configurations with **5**-mA trip sensitivity.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
   1. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
   2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
   3. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.

Retain paragraph below for installations in humid environments.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

Retain first paragraph below if seismic controls are required for Project. Coordinate with Drawings.

B. Comply with mounting and anchoring requirements specified in Division **[26] [16]** Section "Vibration and Seismic Controls for Electrical Systems."

C. Mount top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.

D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

E. Install overcurrent protective devices and controllers.

Subparagraph below assumes that settings are indicated on Drawings or a coordination report is available for Contractor to use.

1. Set field-adjustable switches and circuit-breaker trip ranges.

F. Install filler plates in unused spaces.

Retain paragraph below unless ceilings are not accessible.

G. Stub three 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub five 1-inch empty conduits into raised floor space or below slab not on grade.

Retain option in paragraph below if "Load Balancing" Paragraph is retained in Part 3 "Field Quality Control" Article.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."

Retain option in first paragraph below if "Load Balancing" Paragraph is retained in Part 3 "Field Quality Control" Article.

B. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

Coordinate this Article with Drawings.

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Building Wire and Cable."

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

Retain one of three paragraphs below.

B. Perform the following field tests and inspections and prepare test reports:

Retain subparagraphs below with either of last two paragraphs above and edit to suit Project. Delete subparagraphs if testing will be performed by Owner-engaged testing and inspecting agency.

   1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

Circuit changes made during load balancing may negate color-coding of phases and circuits. If load balancing proves undesirable or is to be performed by others, delete first paragraph and subparagraphs below.

3.5 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 262416

SECTION 262720 - MODULAR WIRING SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Modular Wiring System – Distribution:
   1. High Capacity Power Distribution Modules
   2. Open power cables
   3. Closed power cables
   4. T-Connect modules

B. Modular Wiring System – Workstation Termination:
   1. Raised Access Floor Termination Modules

1.2 RELATED SECTIONS

A. Section 096900 – Access Flooring

C. Section 233600 – Air Terminal Units

D. Section 233713 – Diffusers, Registers, and Grilles

E. Section 260500 – Basic Electrical Materials and Methods

F. Section 260500 – Wiring Methods

1.3 REFERENCES

A. International Mechanical Code, Section 602.2.1.4 – Combustible Electrical Equipment in Plenums

B. MIL-STD-202 – Test Methods for Electronic and Electrical Component Parts

C. NFPA 70 – National Electrical Code
   1. Article 300-22(c)(1) – Environmental Air Handling Spaces
   2. Article 353 – Multioutlet Assemblies
   3. Article 604 – Manufactured Wiring Systems
   4. Article 800-52(a) – Installation of Communications Wires, Cables and Equipment

D. TIA/EIA 568-A – Commercial Building Telecommunications Cabling Standard

E. TIA/EIA 569-A – Commercial Building Standard for Telecommunications Pathways and Spaces

F. UL 183 – Manufactured Wiring Systems

G. UL 486A – Wire Connectors and Soldering Lugs for Use with Copper Conductors

H. UL 2043 – Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air Handling Spaces

1.4 SYSTEM DESCRIPTION

A. Modular wiring system shall ensure efficient electrification and delivery of power from power panels to workstations or equipment at any location. System shall be prefabricated, flexible and totally able to be relocated as needed, with true plug-and-play modularity, for electrification of power receptacles located in workstations and other common areas of the building. System shall be U.L. Listed, designed and approved for use below raised access floor systems and other air handling spaces per NEC Article 300.22(C).

B. Modular wiring system is based on zone wiring requirements. Power distribution is achieved below a raised access floor system through the use of multi-conductor power cables run from circuit breaker panel to prewired power distribution modules. This method of wiring eliminates need for individual home run cabling. From zone locations, modular connectorized power cables distribute power to any point where electrical power is required, terminating into workstation modules installed within user workspace, or directly to common-use receptacles located throughout the work space.

C. Modular connectors shall be non-conductive and non-corrosive, and shall accommodate up to 10 conductors employing the following safety features:
   1. Mating connectors shall be a positive locking type that prevents inadvertent unplugging, and be keyed by physical or mechanical means to maintain correct polarity, preventing the interconnection of dissimilar voltages.
   2. The connector design shall be such that no part or portion of the mating assembly can be inserted into the connector, and make contact with any current-carrying part of the system.
   3. Grounding conductor contact on each modular assembly shall provide for First Make/Last Break (FM/LB) feature, such that grounding connection is made before contact being made with current-carrying conductors when connectors are mated. Grounding conductor shall break its connection only after current- carrying conductors have broken their connections when connectors are disengaged.
   4. All conductors are to be individually insulated in their own housing, and the connector surround housing shall totally enclose the pin connector and the cable’s conductors as they enter into the rear of the 10-pin connector.
   5. Contacts of 10-pin connector shall conform to MIL-STD-202, 204 Cond. A and 213 Cond. A. to ensure durability, and UL 486A for crimp retention force.
   6. Plastic housings encase contacts within a modular connector.
      a. UL flammability rating of 94V0.
      b. Genderless and keyed to prevent possible mismatching of dissimilar voltages.
      c. Color coded to match industry-standard wiring colors (for example, green, black, red, blue, white, and gray) to aid in system installation and troubleshooting.

1.5 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's product data, including installation instructions.

C. Project Record Documents: Submit project record documents, including as-built drawings and wiring diagrams.

D. Warranty: Submit manufacturer's standard warranty.

1.6 QUALITY ASSURANCE

A. Modular Wiring System:
   1. Electrical Distribution System: All system components shall be UL Listed as Manufactured Wiring System, compliant with UL 183 and 2043, approved for use in environmental air handling spaces in accordance with National Electrical Code, Article 300-22(c)(1).
   2. All system components shall be compliant with International Mechanical Code, Section 602.2.1.4.
   3. The installed electrical distribution system shall be compliant with grounding and shielding requirements of TIA/EIA 568-A and 569-A and National Electrical Code, Article 800-52(a).
   4. UL listing shall allow for 3-phase, 120/208 volts and/or 1-phase, 120/240 volts, 50 Hz or 60 Hz power distribution, 20 amps.
   5. Manufactured Wiring System: Compliant with National Electrical Code, Article 604.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened, protective containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage: Store materials in secure, clean, dry area indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials and finish from damage and moisture during handling and installation.

1.8 WARRANTY

A. Modular Wiring System: Warranted to be free from defects in materials and workmanship for period of 5 years.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Communications Integrators, Inc
B. Wiremold
C. Hubbell

2.2 MODULAR WIRING SYSTEM – DISTRIBUTION

A. High Capacity Power Distribution Module (PDM):
   1. Refer to Electrical Drawings for location and requirements.

2.3 MODULAR WIRING SYSTEM – WORKSTATION TERMINATION

A. Workstation Termination Modules: Modular access floor boxes.
   1. Description: Standard UL-listed and UL-labeled assembly for recessed mounting flush with top of raised access floor panels for power, communication, and signal services.

2. High Capacity, Standard Floor Height: Use in raised access floors with minimum of 6 inches finished floor height.
   a. Receptacles: One to four 20-amp duplex receptacles.
   b. Voice and Data Termination Points: Separated and electromagnetically shielded from power. Accommodate most manufacturer's CAT 6 or enhanced CAT 5 jacks.
   c. Voice and Data Cut-Outs:
      [1) Cutouts: Sized for RJ45 jacks.
      [2) Jacks: RJ45 CAT 6
3. Cover and Box: Hinged polycarbonate cover with opening for passage of cables when cover is closed. Include frame and steel box or formed-steel plate for mounting electrical receptacles.
4. Location: Center of Raised Access Floor panel quadrant.
5. Receptacles and Wiring: Equip each modular access floor box with power receptacles.
   a. Receptacle Type: Commercial-grade, 2-pole, 3-wire grounding, 20 A, 125 V, NEMA 5-20R, unless otherwise indicated.
   b. Number of Receptacles for Access Floor Box: [1-4]
   c. Wiring Method for Recessed Modular Connector: 1 power-in connector, 1 power-out connector, built into modular access floor box housing, of type to fit power-in and power-out connectors of branch-circuit cables supplied with building electrical system as specified in Modular Wiring System – Distribution of this section.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive modular wiring system. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install modular wiring system in accordance with manufacturer's instructions, system design drawings, National Electrical Code, and local municipal codes as required.

B. Coordinate installation of modular wiring system with other work in progress.

END OF SECTION 262720

SECTION 262726 - WIRING DEVICES

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Receptacles, receptacles with integral GFCI, and associated device plates.
   2. Twist-locking receptacles.
   3. Wall-box motion sensors.
   4. Isolated-ground receptacles.
   5. Snap switches and wall-box dimmers.
   6. Wall-switch and exterior occupancy sensors.
   7. Pendant cord-connector devices.
   8. Cord and plug sets.
   9. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

B. Related Sections include the following:

List below only devices that the reader might expect to find in this Section but are specified elsewhere.

   1. Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

1.2 DEFINITIONS

Retain term and abbreviations that remain after this Section has been edited.

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. SPD: Surge Protection Device.

F. UTP: Unshielded twisted pair.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

Retain first paragraph below if products have critical features needing hands-on appraisal.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.5 COORDINATION

Retain this Article if receptacles for Owner-furnished equipment with plugs have unknown or special configurations.

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

Retain subparagraph below if cord and plug sets are specified in Part 2.

1. Cord and Plug Sets: Match equipment requirements.

1.6 EXTRA MATERIALS

Extra materials may not be allowed for publicly funded projects.

A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Service/Power Poles: One for every 10, but no fewer than one.
   2. Floor Service Outlet Assemblies: One for every 10, but no fewer than one.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

Manufacturers listed below produce an extensive line of nationally distributed wiring devices. Add manufacturers if desired.

1. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
2. Leviton Mfg. Company Inc. (Leviton).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. Retain one of two subparagraphs and list of manufacturers below. See Division 01 Section "Product Requirements."

Isolated-ground receptacles are available in a variety of configurations and ratings including locking-blade types up to 50 A and 250 V. Revise first paragraph and subparagraphs below to suit Project; indicate different types on Drawings.

B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. Retain one of first two subparagraphs and list of manufacturers below. See Division 01 Section "Product Requirements."

1. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

C. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. Retain one of first two subparagraphs and list of manufacturers below. See Division 01 Section "Product Requirements."

2.3 GFCI RECEPTACLES

Non-feed-through-type GFCI unit may be selected where no protection of downstream receptacles is required.

A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. Retain one of two subparagraphs and list of manufacturers below. See Division 01 Section "Product Requirements."

2.4 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. Retain one of two subparagraphs and list of manufacturers below. See Division 01 Section "Product Requirements."

B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. Retain one of first two subparagraphs and list of manufacturers below. See Division 01 Section "Product Requirements."

1. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.5 PENDANT CORD-CONNECTOR DEVICES

Revise NEMA configuration in paragraph below to suit Project. Delete "External Cable Grip" Subparagraph if not required.

A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.
   1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
   2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.6 CORD AND PLUG SETS

Retain this Article if cord and plug sets for equipment are furnished by Owner or are specified in other Sections. Coordinate with other Sections and with Part 3.

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
   1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
   2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.7 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. Retain one of two subparagraphs and list of manufacturers below. See Division 01 Section "Product Requirements."

C. Pilot Light Switches, 20 A:

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. Retain one of first two subparagraphs and list of manufacturers below. See Division 01 Section "Product Requirements."

1. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key-Operated Switches, 120/277 V, 20 A:

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. Retain one of first two subparagraphs and list of manufacturers below. See Division 01 Section "Product Requirements."

1. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. Retain one of two subparagraphs and list of manufacturers below. See Division 01 Section "Product Requirements."

2.8 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

Four-way switching may be added to first paragraph below after verifying availability with manufacturers.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.

1. 600 W; dimmers shall require no derating when ganged with other devices. Illuminated when "OFF."

Retain subparagraph above or below. If retaining below, insert other dimmers with their characteristics. UL 1472 covers ratings from 300 W to 2000 W in increments of 50 W.

Use fluorescent lamp dimmer switches in paragraph below with compatible dimming-type ballasts. Coordinate with Division 26 Section "Interior Lighting." Use uniform ballast and lamp types to obtain consistent dimming characteristics.

D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.9 OCCUPANCY SENSORS

Each manufacturer's switch rating is different, but rated design values are generally not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.

Retain one of two paragraphs and associated subparagraphs below. Adaptive technology includes the ability to sense and memorize usage patterns in the space and help eliminate false offs.

A. Wall-Switch Sensors:

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. Retain one of first two subparagraphs and list of manufacturers below. See Division 01 Section "Product Requirements."

1. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).

Retain one of first two paragraphs and associated subparagraphs below for square and near-square rectangular rooms.

2.10 WALL PLATES

A. Single and combination types to match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
   3. Material for Unfinished Spaces: Galvanized steel.
   4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant , die-cast aluminum with lockable cover.

2.11 FLOOR SERVICE FITTINGS

Service fittings in first paragraph below are available for voice and data communication cabling as well as for power. Edit to suit Project.

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular.

D. Power Receptacle: NEMA WD 6 configuration 5-20R.

2.12 MULTIOUTLET ASSEMBLIES

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. Retain one of two paragraphs and list of manufacturers below. See Division 01 Section "Product Requirements."

If not indicated on Drawings, add mounting heights, raceway sizes, and types and spacing of receptacle devices to paragraph below. Add descriptions of special features in assemblies such as fused receptacles, special-purpose switches, and channels for communication wiring.

A. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

Some finish options may be available from manufacturers. Select one of two paragraphs below and edit to suit Project.

B. Raceway Material: Metal, with manufacturer's standard finish.

C. Wire: No. 12 AWG.

2.13 FINISHES

See Editing Instruction No. 2 in the Evaluations for a discussion of wiring device colors. Coordinate with Drawings.

A. Color: Wiring device catalog numbers in Section Text do not designate device color.
   1. Wiring Devices Connected to Normal Power System: Ivory, unless otherwise indicated or required by NFPA 70 or device listing.

Delete first subparagraph below and edit paragraph and subparagraph above if a separate emergency power system serving wiring devices is not provided.

   2. Wiring Devices Connected to Emergency Power System: Red.
   3. SPD Devices: Blue.
   4. Isolated-Ground Receptacles: Orange.

PART 3 - EXECUTION

3.1 INSTALLATION

NECA 1 referenced in paragraph below includes device mounting-height requirements. See "Product Selection and Application Considerations" Article in the Evaluations for device mounting heights in that standard.

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

See Editing Instruction No. 4 in the Evaluations for timing and sequencing of construction to assist in avoiding contamination of devices during construction.

B. Coordination with Other Trades:
   1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.

2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
   a. Cut back and pigtail, or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.
   c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:
1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
10. Install wall switches 42 inches above floor, OFF position down.
11. Install convenience receptacles 18 inches above floor, 2 inches above counters or backsplash, grounding pole on bottom.

E. Receptacle Orientation:

Retain subparagraph below if the position of the ground pin is important for consistency. Trade and professional literature is inconsistent in recommending benefits of either orientation.

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

Recommendation in subparagraph below is made in IEEE 602.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:
   1. Install dimmers within terms of their listing.
   2. Verify that dimmers used for fan speed control are listed for that application.
   3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

Coordinate two paragraphs below with Drawings.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."
   1. Receptacles and Switches: Identify panelboard and circuit number from which served. .

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fuses.

1.2 REFERENCES

A. NFPA 70 - National Electric Code.

B. NEMA FU 1 - Low Voltage Cartridge Fuses.

1.3 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL and referenced standards as suitable for purpose specified and indicated.

1.4 MAINTENANCE MATERIALS

A. Provide two fuse pullers.

1.5 EXTRA MATERIALS

A. Provide three of each size and type fuse installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Bussman.
2. Littelfuse.
3. Ferraz-Shawmut.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuses in accordance with manufacturer's instructions.

B. Install fuse with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fusible Switches

B. Nonfusible Switches

1.2 RELATED SECTIONS

A. Section 262813- Fuses.

1.3 REFERENCES

A. NECA - Standard of Installation (published by the National Electrical Contractors Association).

B. NEMA FU1 - Low Voltage Cartridge Fuses.

C. NEMA KS1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (published by the International Electrical Testing Association).

E. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS FOR REVIEW

A. Section 260500: Procedures for submittals.

B. Product Data: Provide switch ratings and enclosure dimensions.

1.5 SUBMITTALS FOR CLOSEOUT

A. Record actual locations of enclosed switches in project record documents.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers
   1. Eaton Corporationr
   2. General Electric
   3. Square-D
   4. Siemens

2.2 FUSIBLE SWITCH ASSEMBLIES

A. Description: NEMA KS 1, Type HD, enclosed load interrupter knife switch. Handle lockable in OFF position.

B. Fuse Clips: Designed to accommodate NEMA FU1, Class R fuses.

2.3 NONFUSIBLE SWITCH ASSEMBLIES

A. Description: NEMA KS 1, Type HD enclosed load interrupter knife switch. Handle lockable in OFF position.

2.4 ENCLOSURES

A. Fabrication: NEMA KS 1.
   1. Interior Dry Locations: Type 1.
   2. Exterior Locations: Type 3R.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with NECA "Standard of Installation".

B. Install fuses in fusible disconnect switches.

C. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.2 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.5.

END OF SECTION 262816

SECTION 264313 - SURGE PROTECTION DEVICE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes SPD's for low-voltage power, control, and communication equipment.

1.2 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. SVR: Suppressed voltage rating.

C. SPD: Surge Protection Device.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating weights, operating characteristics, furnished specialties, and accessories.

B. Product Certificates: For surge protection devices, signed by product manufacturer certifying compliance with the following standards:
   1. UL 1283.
   2. UL 1449.

C. Operation and Maintenance Data: For surge protection devices to include in emergency, operation, and maintenance manuals.

D. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer.

B. Product Options: Drawings indicate size, dimensional requirements, and electrical performance of suppressors and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with IEEE C62.41, "IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits," and test devices according to IEEE C62.45, "IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits."

E. Comply with NEMA LS 1, "Low Voltage Surge Protection Devices."

F. Comply with UL 1283, "Electromagnetic Interference Filters," and UL 1449, 3rd Edition, "UL Standard for Safety for Surge Protective Devices."

1.5 PROJECT CONDITIONS

A. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:
   1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
   2. Operating Temperature: 30 to 120 deg F (0 to 50 deg C).
   3. Humidity: 0 to 85 percent, noncondensing.
   4. Altitude: Less than 20,000 feet (6090 m) above sea level.

1.6 COORDINATION

A. Coordinate location of field-mounted surge suppressors to allow adequate clearances for maintenance.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within five years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Replaceable Protection Modules: One of each size and type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   1. Current Technology, Inc.
   2. Eaton Corporation.
   3. General Electric Company.
   4. LEA International.
   5. Liebert Corporation; a division of Emerson.
   6. Siemens Energy & Automation, Inc.
   7. Square D; Schneider Electric.

2.2 SERVICE ENTRANCE SUPPRESSORS

A. Surge Protection Device Description: Modular design with field-replaceable modules, sine-wave-tracking type with the following features and accessories:
   1. Fuses, rated at 200-kA interrupting capacity.
   2. Fabrication using bolted compression lugs for internal wiring.
   3. Integral disconnect switch.
   4. Redundant suppression circuits.
   5. Redundant replaceable modules.
   6. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
   7. LED indicator lights for power and protection status.
   8. Audible alarm, with silencing switch, to indicate when protection has failed.
   9. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status. Coordinate with building power monitoring and control system.
   10. Surge-event operations counter.

B. Peak Single-Impulse Surge Current Rating: 160 kA per phase.

C. Connection Means: Permanently wired.

D. Protection modes and UL 1449 SVR for grounded wye circuits with voltages of 208Y/120, 3-phase, 4-wire circuits shall be as follows:
   1. Line to Neutral: 400 V for 208Y/120.
   2. Line to Ground: 400 V for 208Y/120.
   3. Neutral to Ground: 400 V for 208Y/120.

2.3 ENCLOSURES

A. NEMA 250, with type matching the enclosure of panel or device being protected.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTION DEVICES

A. Install devices at service entrance on load side, with ground lead bonded to service entrance ground.

B. Install devices for panelboard and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
   1. Provide multipole, 100-A circuit breaker as a dedicated disconnect for suppressor, unless otherwise indicated.

3.2 PLACING SYSTEM INTO SERVICE

A. Do not energize or connect service entrance equipment to their sources until surge protection devices are installed and connected.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust equipment installation, including connections, and to assist in field testing. Report results in writing.
   1. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. Remove and replace malfunctioning units and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transient voltage suppression devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 264313

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Interior luminaires, lamps, and ballasts.
   2. Emergency lighting units.
   3. Exit signs.
   4. Lighting luminaire supports.

B. Related Sections include the following:
   1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
   2. Division 26 Section "Network Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.
   3. Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.2 DEFINITIONS

A. BF: Ballast factor.

B. CRI: Color-rendering index.

C. CU: Coefficient of utilization.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Luminaire: Complete lighting fixture, including ballast housing if provided.

G. RCR: Room cavity ratio.

1.3 SUBMITTALS

A. Product Data: For each type of luminaire, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
   1. Physical description of lighting fixture including dimensions.
   2. Emergency lighting units including battery and charger.
   3. Ballast.
   4. Energy-efficiency data.
   5. Life, output, and energy-efficiency data for lamps.

6. Photometric data, in IESNA format, based on laboratory tests of each lumianire type, outfitted with lamps, ballasts, and accessories identical to those indicated for the luminaire as applied in this Project.

B. Shop Drawings: Show details of continuous linear luminaires or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
   1. Wiring Diagrams: Power and control wiring.
   2. For continuous linear luminaires, including recessed, pendant, and surface mounted, provide manufacturers drawings showing components for each continuous length, including but not limited to power feed locations, staggered lamping (if applicable), lens breaks, corners/connectors, and suspension points. Also include any emergency ballasts and/or separate switching zones on these drawings. Drawings shall be provided for each specific luminaire installation on the floor plan and the submittal shall contain a floor plan keying the manufacturer's drawings with the floor plan.

C. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.

D. Operation and Maintenance Data: For lighting equipment and luminaires to include in emergency, operation, and maintenance manuals.

E. Warranties: Special warranties specified in this Section.

F. LEED Submittal: Mercury content of lamps from MSDS sheets in picograms per lumen.

1.4 SUBSTITUTIONS

A. During the Bidding Process: Alternate luminaires will not be reviewed by the engineer during the bidding process.

B. During the Submittal Process: Alternate luminaires will be reviewed by the engineer during the submittal process. Approval of alternate luminaires during the shop drawing process is at the sole discretion of the engineer. Any luminaires deemed not equal by the engineer shall be resubmitted, if no acceptable alternate luminaire can be found any cost difference shall be borne by the contractor, including any expediting fees charged by the manufacturer in order to meet the construction schedule.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of luminaires and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
   2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

B. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.
   2. Warranty Period for Electromagnetic Ballasts: Three years from date of Substantial Completion.

C. Special Warranty for T8 Fluorescent Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
   1. Warranty Period: One year from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Lamps: 10 for every 50 of each type and rating installed. Furnish at least one of each type.
   2. Plastic Diffusers and Lenses: 1 for every 50 of each type and rating installed. Furnish at least one of each type.
   3. Battery and Charger Data: One for each emergency lighting unit.
   4. Ballasts: 1 for every 50 of each type and rating installed. Furnish at least one of each type.
   5. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Refer to Luminaire Schedule on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting Luminaires: Set level, plumb, and square with ceilings and walls. Install lamps in each lumianire.

B. Support for Lighting Luminaires in or on Grid-Type Suspended Ceilings: Use grid as a support element.
   1. Install a minimum of four ceiling support system rods or wires for each lumianire. Locate not more than 6 inches (150 mm) from lighting luminaire corners.
   2. Support Clips: Fasten to luminaire and to ceiling grid members at or near each luminaire corner with clips that are UL listed for the application.
   3. Luminaires of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support luminaire independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.

Retain subparagraph below if Project is in a seismic area.

   4. Install at least one independent support rod or wire from structure to a tab on luminaire. Wire or rod shall have breaking strength of the weight of luminaire at a safety factor of 3.

C. Suspended Luminaire Support:
   1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
   2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers.
   3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.

D. Adjust aimable luminaire to provide required light intensities.

E. Connect wiring according to Division 26 Section "Building Wire and Cable."

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 265100

SECTION 265600 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Exterior luminaires with lamps and ballasts.
   2. Luminaire-mounted photoelectric relays.
   3. Poles and accessories.

B. Related Sections include the following:
   1. Division 26 Section "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.2 DEFINITIONS

A. CRI: Color-rendering index.

B. HID: High-intensity discharge.

C. Luminaire: Complete lighting fixture, including ballast housing if provided.

D. Pole: Luminaire support structure, including tower used for large area illumination.

E. Standard: Same definition as "Pole" above.

1.3 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
   1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
   2. Details of attaching luminaires and accessories.
   3. Details of installation and construction.
   4. Luminaire materials.
   5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
   6. Ballasts, including energy-efficiency data.
   7. Lamps, including life, output, and energy-efficiency data.
   8. Materials, dimensions, and finishes of poles.
   9. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
   10. Anchor bolts for poles.

B. Shop Drawings:
   1. Wiring Diagrams: Power and control wiring.

C. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C2, "National Electrical Safety Code."

C. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

Delete first paragraph below if no fiberglass or laminated wood poles.

C. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
   1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
   2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
   3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
   4. Warranty Period for Lamps: Replace lamps and fuses that fail within 12 months from date of Substantial Completion; furnish replacement lamps and fuses that fail within the second 12 months from date of Substantial Completion.
   5. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Glass and Plastic Lenses, Covers, and Other Optical Parts: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
3. Ballasts: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: 10 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Refer to Luminaire Schedule on Drawings.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources.

3.2 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. Verify operation of photoelectric controls.

END OF SECTION 265600

SECTION 270100 - OPERATIONS AND MAINTENANCE OF COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 RECORD DOCUMENTATION SHALL INCLUDE:

A. Complete set of as-built drawings for Record (Electronic and Hard Copy).

B. Operation and Maintenance (O&M) Manuals (Hard Copy).

C. Complete reports of all test results (Electronic and Hard Copy). Electronic test results shall be in the native file format produced by the test set. Provide manufacturer software to open and view test reports.

D. All warranty documents (Hard Copy).

E. Spare Parts:

1. The Owner will be responsible for procuring and maintaining all spare parts after the project is complete.
2. Spare quantities of copper and fiber patch cords as called out in Section 271600.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 270100

SECTION 271000 - STRUCTURED CABLING GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

B. Division 26 - Electrical.

1.2 PROJECT OVERVIEW

A. Denver Public Library is planning to build a new branch library to serve the West Denver neighborhood. The library will be located on the corner of Colfax Avenue and Irving Street, just west of Federal Blvd.

B. The building is two story with a single telecommunications room (TR) serving the building. The TR will also serve as the Entrance Facility (EF) for all service providers. All horizontal cable and connectivity installed shall be category 6.

C. The building will utilize an access floor to facilitate an under floor air distribution system. Horizontal cables will route via the floor system from the telecommunications outlet to the TR located on the second floor. Where outlets are located in areas without access floor, cables will route via accessible ceiling from the telecommunications outlet to the TR.

D. Security cameras for the project will be cabled with a combination of category 6 and 18 AWG 2-conductor stranded cable.

1.3 APPROVED STRUCTURED CABLING MANUFACTURER

A. The following structured cabling manufacturer is approved for the project. .

1. Commscope SYSTIMAX

B. Only full and complete structured cabling systems shall be installed. All cable and components shall be from the manufacturer specified.

1.4 CONTRACTOR REQUIREMENTS AND CABLING SYSTEM WARRANTY

A. The Structured Cabling Contractor (SCC) shall have attended and provide evidence of completion of the appropriate Commscope installation course.

B. The SCC shall provide a one year materials and labor warranty covering the installed structured cabling system. Warranty period shall commence upon owner acceptance.

1.5 SYSTEM DESCRIPTION

A. Furnish and install a data cabling infrastructure system that will support a multi-product, multi-vendor environment.

B. The structured cabling plan shall be designed, installed and administered according to the TIA/EIA telecommunications infrastructure standards and shall be equipment and cable vendor independent.

C. The mechanical properties and transmission categories of all components used, including all wire/cable and all connecting hardware shall be Category 6 compliant for all horizontal voice and data cable links.

D. The data communications for the project shall consist of Owner furnished network equipment. The SCC shall furnish and install a structured cabling system able to support up to and including Gigabit Ethernet.

E. The voice communications equipment for the project will be provided by others. The SCC shall furnish and install a structured cabling system able to support the Owners voice requirements including VoIP.

F. Horizontal Cabling

1. Furnish and install Category 6, 4-pair UTP cables for all horizontal data links from the telecommunications outlet to the patch panel located in the Telecommunications Room (TR). Drawings note the quantity to provide at the outlet.
2. Provide cable rated for the installation space. Where cables pass through more than one type of rated space (e.g. non-plenum and plenum), provide the highest rated cable to meet code requirements.
3. The maximum horizontal cable distance from the telecommunications outlet to the horizontal cross-connect within the telecommunication rooms shall be 295 feet.
4. Unless otherwise noted, all outlet boxes, floor boxes and conduits will be provided by the Electrical Contractor (EC).

G. Telecommunications Outlets

1. All telecommunications outlets shall consist of 8-position, 8-wire modular RJ-45 Category 6 jack(s) at noted locations on drawings. Drawings note the quantity to provide at the outlet.
2. Telecommunications outlets may be located in walls, floors, ceilings, millwork or systems furniture. Drawings note the type of outlet at each location.
3. Terminate all horizontal data and/or voice cables according to the TIA/EIA 568B wiring scheme unless otherwise noted.
4. Wall mounted faceplates shall be a 4-port configuration unless otherwise noted. Coordinate color with architect. Provide blank inserts to match faceplate for unused ports where required.
5. Outlets in floor box locations shall use a 3-port, DECORA style mounting strap. Coordinate color with architect. Provide blank inserts to match mounting strap for unused ports where required.
6. Wall phone faceplates shall be a single port configuration with two mounting studs.

H. Telecommunications Room (TR)

1. The primary function of the Telecommunications Room is the location of data network equipment and the distribution of copper horizontal data and/or voice cables and termination of copper and fiber backbone cables.
2. Furnish and install freestanding equipment racks that will contain horizontal and backbone copper patch panels and owner supplied and installed equipment. Verify locations and requirements with the Technology Consultant, Architect/Engineer and Owner prior to installation.
3. Telecommunications Rooms shall be designed and provisioned according to the requirements in TIA/EIA Standard 569B and the construction documents.
4. Wall mounted 66-wiring blocks comprise the service provider DEMARC and voice backbone cross-connect portion of the structured cabling system. Wiring blocks shall provide the mechanical terminations of the voice backbone cable and voice tie cable. Blocks shall include cross-connect wire management. All blocks shall provide the means to attach machine generated labels.
5. Modular to IDC termination patch panels will be used to terminate voice backbone cable at the TR. Patch panels shall be rated Category 5e and provide the mechanical terminations of the voice backbone cabling and the associated cross-connection of the cable to the horizontal cable patch panels via contractor furnished and owner installed patch cables. Voice backbone cable will terminate in the TR on the backbone patch panel using two-pair per port unless otherwise noted.
6. Category 6 modular to IDC termination patch panels comprise the horizontal cross-connect portion of the data cables. Patch panels shall provide the mechanical terminations of the horizontal cabling from the telecom outlets and the associated cross-connection of the cable to network hardware via contractor furnished and owner installed patch cables.
7. Category 6 modular jacks used in the patch panels shall be un-keyed 4-pair. The jacks shall be color coded for both T568A and T568B wiring. Modular jacks shall be UL listed and meet or exceed the requirements of TIA/EIA 568B.2-1.

1.6 SCOPE OF WORK

A. The work covered under this section of the specifications consists of furnishing all labor, materials, consumables, tools, services and facilities and in performing all operations, including installation of wire and cable, telecommunication outlets and faceplates, patch panels, wiring blocks, racks, horizontal and vertical wire management, wire raceways and cable support, grounding and bonding, testing and labeling and all other functions necessary for the complete installation of a structured cabling system supporting data networking, telecommunications, distribution of CATV signals and connection of IP based security devices in accordance with the specifications and drawings, except as specifically noted otherwise.

B. The SCC shall coordinate with other trades and vendors prior to the start of work.

C. The work of this section shall include, but not be limited to furnishing and installation of the following:

1. Category 6 unshielded twisted-pair horizontal cables.
2. Category 3 multi-pair, backbone cables.
3. 18 AWG 2-conductor stranded cable for camera power.

4. Telecommunications outlets/connectors, mounting straps and faceplates.
5. Category 6 Modular-to-IDC patch panels (data and voice horizontal cable).
6. Category 5e Modular-to-IDC patch panels (voice backbone cable).
7. Build out of Telecommunications Rooms.
8. Overhead paging system including wiring, speakers, backboxes, page controls, and related equipment for a complete paging system.
9. As required: basket tray, ladder rack, and J-hooks including all necessary support hardware and fittings.
10. Grounding and bonding.
11. Cross-connect cable for voice circuits at termination blocks.
12. Firestopping of telecommunications pathways that penetrate fire-rate wall, floors, and ceilings.
13. Category 6 patch cables for voice/data cross-connects in telecommunications rooms.
14. All materials necessary for complete and proper cable management.
15. Testing all copper cabling.
16. Labeling all copper cabling, faceplates and patch panels/wiring blocks.
17. Indicating main cable pathways on floor tiles.
18. Furnishing as-built documentation including floor plans showing outlet labels and test reports.

1.7 WORK SPECIFICALLY EXCLUDED AND PROVIDED BY OTHERS ARE AS FOLLOWS:

A. Fire Alarm cabling.

B. Security cable and devices, except as noted above, video surveillance cameras, recording equipment and access control devices.

C. Integration of paging system with telephone system.

D. Network hardware such as core switches, workgroup switches, routers, firewalls and other Customer Premise Equipment.

E. Telephone system hardware such as telephone hand-sets, PBX/Remote Shelves, servers, software, termination blocks, tail cables, and other associated telephone equipment hardware.

F. Computer systems and peripherals such as servers, workstation computers and printers.

G. Outlet boxes for data/voice and CATV outlets shall be furnished and installed by the EC under applicable sections of Division 26 and the drawings.

H. Conduits and raceways necessary to provide complete Structured Cable System pathways, in conformance with applicable sections of Division 26 and the drawings.

I. Floor cores and conduit sleeves shall be furnished and installed by the EC under other Division 26 sections and the drawings.

J. 120 volt AC power for technology equipment as specified in and in accordance with applicable sections of Division 26 and the drawings.

K. Grounding bus bar in TRs and ERs shall be furnished and installed by the EC under Division 26 and the drawings.

L. HVAC required providing conditioned air or other means of proper cooling for Technology equipment and spaces.

1.8 REFERENCES, REGULATIONS AND CODE COMPLIANCE

A. All workmanship and materials shall conform to and be installed, inspected and tested in accordance with the governing rules and regulations of federal, state and local governmental agencies.

B. All workmanship and materials shall conform to the latest industry standards and publications referenced in this section as applicable:

1. National Electric Code (NEC), NFPA 70
2. ANSI/TIA/EIA – 568B Commercial Building Telecommunications Cabling Standard
3. ANSI/TIA/EIA – 569B Commercial Building Standard for Telecommunications Pathways and Spaces
4. ANSI/TIA/EIA – 606-A Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
5. ANSI/TIA – 607-B Commercial Building Grounding and Bonding Requirements for Telecommunications
6. TIA TSB-140 Additional Guidelines for Field- Testing Length, Loss and Polarity of Optical Fiber Cabling Systems
7. BICSI Telecommunications Distribution Methods Manual, 12th Edition
8. ASTM E-814 Fire Tests of Through Penetration Fire Stops
9. UL 1479 – Fire Tests of Through Penetration Firestop
10. Underwriters Laboratory (UL)
11. Federal Communications Commission (FCC)
12. National Electrical Manufacturers Association (NEMA)
13. City and County of Denver Technology Standards Section I "Technology Cabling, Infrastructure and Installation", Revision 1.0, dated September 24, 2009.

1.9 DEFINITIONS

Approved/Approval:	Written permission to use a material or system.
As Called for:	Materials, equipment including the execution specified/shown in the contract documents.
Code Requirements:	Follow minimum code requirements.
Concealed:	Work installed in pipe and duct shafts, chases or recesses, inside walls, above ceilings, in slabs or below grade.
EC:	Electrical Contractor.
Entrance Facility (EF):	An entrance to a building for both public and private network

	service cables (including wireless) including the entrance point at the building wall and continuing to the entrance room or space. (TIA)
Equal/Equivalent:	Equally acceptable as determined by Owner's Representative.
Equipment Room (ER):	An environmentally controlled centralized space for telecommunications equipment that usually houses a main or intermediate cross-connect. (TIA) Sometimes referred to as the MDF. May include computer or server rooms.
Existing:	Equipment, device, and material present in an installation location prior to new work.
Exposed:	Work not identified as concealed.
Final Acceptance:	Owner acceptance of the project from Contractor upon certification by Owner's representative.
Furnish:	Supply and deliver to installation location.
Furnished By Others:	Furnished by someone other than contractor of specified system.
Inspection:	Visual observation of specified equipment or system.
Install:	Mount and connect equipment and associated material ready for use.
Labeled:	Marked with a machine produced designation.
Owner:	The end user and/or owner of equipment/system.
Relocate:	Disassemble, disconnect and transport equipment to new location.
Replace:	Remove and provide new item.
Review:	A general contractual conformance check of specified design and materials.
Rough-in:	Gang boxes and/or conduit for specified system.
Structured Cabling Contractor (SCC):	Contractor furnishing and installing telecommunications, security, or other low-voltage cable called out as part of the specifications and drawings. May also be referred to as the Telecommunications Contractor (TC).
Telecommunication Room (TR):	An enclosed architectural space for housing telecommunications equipment, cable terminations, and cross-connect cabling. (TIA) Also known as the IDF.

1.10 INTENT OF DRAWINGS

A. The drawings are diagrammatic unless detailed dimensions are included. Drawings show close approximate locations of equipment and devices. Exact locations are subject to the approval of Owner and Owner's representative.

B. Anything mentioned in the specifications and not shown in the drawings, or shown in the drawings and not mentioned in the specifications, shall be of like effect as if shown and mentioned in both. In case of differences between the specifications and drawings, the stricter provision, as determined by the project coordinator, shall govern. Omissions from the drawings or specifications, or the incorrect description of details of work which are evidently necessary to carry out the intent of the drawings and specifications, shall not relieve the contractor from performing such work.

1.11 REVIEW OF CONTRACT DOCUMENTS

A. The SCC shall carefully study the Contract Documents and report to the consultant and project manager any error, inconsistency, or omission they may discover. If contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission in the Contract Documents without such notice to the consultant or project manager, the contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the attributable cost for correction.

B. The SCC must verify all dimensions locating the work and its relation to any existing work, all existing conditions and their relation to the work, and all man-made obstructions and conditions, etc., affecting the completion and proper execution of the work as indicated by the Contract Documents.

1.12 EXAMINATION OF THE PREMISES

A. The SCC shall visit the site to familiarize themselves with the local conditions under which the work is to be performed and correlate observations with the requirements of the Contract Documents. No allowance will be made for claims of concealed conditions which contractor, in exercise of reasonable diligence in the observation of the site and the review of the local conditions under which the work is to be performed, has learned or should have learned, unless otherwise specifically agreed by owner and consultant in writing.

B. Before ordering any materials or performing any work, the contractor shall verify all measurements. No extra charge or compensation will be allowed for duplicate work or material required because of an unverified difference between an actual dimension and the measurement indicated in the drawings. Any discrepancies shall be submitted in writing to the Project Manager and Consultant for consideration before proceeding with the work.

1.13 SUBMITTALS

A. Submittals shall include product data literature and adequate descriptive literature, catalog cut sheets, and other data necessary for the Technology Designer and Architect/Engineer to ascertain that the proposed equipment and materials comply with the specification requirements.

B. Product data submittals shall consist of technical data sheets, manufacturers' specifications, illustrations, standard schedules, performance charts, instructions, brochures, diagrams and test data furnished to illustrate a product, material or system for the work to be performed. Product data literature is required on all items of material and equipment and shall be clearly marked, identifying specific items proposed.

C. Clearly indicate on each submittal set the items being submitted by marking or highlighting each item to clearly indicate to the reviewer items being submitted.

D. Provide submittals in quantities requested by the architect, engineer or general contractor. Provide submittals with bid responses if so requested.

E. Prior to assembling or installing the work, shop drawings shall be submitted for review and approval.

F. The SCC shall not purchase any materials or equipment for incorporation into the project prior to receipt of reviewed Submittals from the Technology Designer and/or Architect/Engineer.

G. Review of product data shall not relieve the SCC from responsibility for deviations from the drawings or specifications, unless the Contractor has, in writing, called attentions to such deviations at the time of submission and secured written approval.

H. The SCC shall develop and submit complete Submittals and do so in a timely manner. By failing to do so, the contractor agrees to be fully responsible for any and all damages, which might be incurred through the failure to do so.

I. Samples may be requested; which shall be physical examples, which represent materials, equipment, or workmanship and establish standards by which the work will be judged.

1.14 QUALITY ASSURANCE

A. All equipment shall equal or exceed the minimum requirements of NEMA, ASME, ANSI and Underwriters Laboratories.

B. All material and equipment furnished shall be new, unused, and free from defects. Equipment shall be clean and free of damage and corrosion, and shall be of the best quality obtainable for the purpose intended.

C. Where more than one of any specified item of equipment or material is required, such items shall be the product of one manufacturer throughout the facility.

D. All materials used shall bear labels attesting to Underwriters Laboratory approval, provided a standard is established for the material in question.

E. All materials shall conform strictly to the standards and specifications set forth in this document. Unless otherwise specified, all products furnished shall be designed, built and installed in accordance with the latest and best practice of the electrical and telecommunications industry, and shall conform to the standards of the NEMA, ANSI, TIA/EIA, ICEA, IEEE, NEC and this Specification wherever they apply.

1.15 CONTRACTOR QUALIFICATIONS

A. The SCC shall have a full working knowledge of low voltage applications such as, but not limited to data, voice, wireless, and CATV distribution systems. The contractor shall have the following qualifications:

1. Possess those licenses/permits required to perform telecommunications and other low voltage installations in the specified jurisdiction.
2. Have personnel trained and certified in the design and installation of the manufacturer's structured cabling system and equipment.
3. The SCC shall provide proof of current certification in the design and installation of the manufacturer's structured cabling system and equipment.
4. The SCC shall provide the resume of the project manager assigned to oversee the installation.
5. The SCC shall have a minimum of five (5) years of experience and five (5) years in business in this specialized field and shall have completed a minimum of three (3) projects similar in scope and size to this project.
6. Have personnel knowledgeable in local, state and national codes and the latest BICSI and Telecommunications Standards.
7. Provide proof of insurance for liability and workmen's compensation for all personnel on the jobsite.
8. Contractor personnel will be required to provide and use the proper tools in the performance of each activity. The tools must be in good working order. The Owner reserves the right to review the tool lists and tool maintenance procedures of the Contractor.
9. Other contractor qualifications as described in Division 01.

1.16 COORDINATION

A. The SCC shall contact the General Contractor and the Technology Consultant once project is awarded and prior to construction to discuss project approach, schedule and coordination.

B. The SCC shall provide and submit a weekly progress report once installation has begun. This report shall be provided to the General Contractor and a copy sent directly to the Technology Consultant.

C. The SCC shall coordinate the work of this Section with that of other Sections and Divisions as required ensuring that the entire work of this project will be carried out in a complete and coordinated fashion.

D. The SCC shall supply all necessary supervision and coordination of information to any subcontractor or installer who is performing related work to minimize interferences.

E. The SCC shall coordinate the installation of cabling, technology devices, and wireways with the work of other Divisions to ensure complete and proper installation of technology pathways, spaces and outlets. Coordinate telecommunications room requirements such as plywood, paint, power, grounding, flooring and room security with the General Contractor so as not to impede the installation schedule.

F. The SCC shall coordinate the installation of voice cross-connects at termination blocks/patch panels with the Owner.

G. The SCC shall be responsible for performing interconnections unless noted otherwise. Both the Owner and SCC shall coordinate "as-built", circuit identification and labeling information for complete project records.

H. The locations of technology devices and equipment are diagrammatically expressed on drawings. Exact locations of items of work shall be field coordinated. The SCC shall report any discrepancies between locations of devices on the drawings and work performed by the other trades to the General Contractor using the approved procedures within three days of discovery.

1.17 CLEANUP

A. The SCC will endeavor to keep telecommunications rooms clean and free of debris particularly when terminating fiber optic cables.

B. The SCC will clean-up work areas at the end of each day and remove trash or other debris.

C. Food and drink containers will not be permitted in telecommunications rooms or data centers at any time.

1.18 PERMITS, LICENSES AND INSPECTIONS

A. The SCC shall furnish and file with the proper authorities all drawings required by them in connection with this work. The SCC, if required, shall obtain all official permits, licenses and inspections and shall pay all legal and proper fees and charges.

B. The SCC shall, at inception of the work, provide the Project Engineer with copies of all required building and trade permits.

C. The SCC shall be responsible for arranging all inspections and for securing all required signatures. Upon completion of the work, properly completed permits shall be returned to the Project Coordinator, if any are required.

1.19 PROTECTION OF MATERIALS AND EQUIPMENT

A. Materials and equipment shall be protected from damage during shipment, storage at the site and throughout the construction period. No damaged items shall be installed and immediate steps shall be taken to obtain replacement so as not to interrupt construction schedule.

B. Coordinate site storage of materials and equipment with the General Contractor or Owner.

C. If required by the General Contractor, provide a lockable container for material and equipment storage.

1.20 SITE SAFETY AND ACCESS

A. Determine from General Contractor all job site requirements such as access, parking and material storage areas.

B. Telecommunications technicians working on the job shall follow all safety procedures set by the General Contractor. Technicians must furnish their own safety equipment including but not limited to hard hats, safety glasses, proper footwear (confirm if steel toed boots/shoes are required), fall arrest equipment and safety vests. All safety equipment must be in good working order.

C. If required by General Contractor, attend all safety orientations and meetings.

D. Provide to General Contractor up to date MSDS information in a 3-ring binder listing materials planned for use on the job site that require MSDS information. Provide the number of copies requested.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS

A. Provide materials that meet the following minimum requirements:

1. Cabling and components shall be by the manufacturer specified or an approved equal unless no substitutions are allowed. Where no manufacturer is specified, cable and/or components shall meet or exceed the performance specifications given.
2. Electrical equipment and systems shall meet UL standards and requirements of the NEC. This listing requirement applies to the entire assembly. Any modifications to equipment to suit the intent of the specifications shall be performed in accordance with these requirements.
3. Equipment shall meet all applicable FCC regulations.
4. All materials, unless otherwise specified, shall be new, unused and the standard products of the manufacturer. Used equipment or damaged material will be rejected.
5. The listing of a manufacturer as “acceptable” does not indicate acceptance of a standard or catalogued item of equipment. All equipment and systems must conform to the Specifications and meet the quality of the design make.
6. Where applicable, all materials and equipment shall bear the label and listing of Underwriters Laboratory or Factory Mutual. Application and installation of all equipment and materials shall be in accordance with such labeling and listing.

2.2 WORKMANSHIP, SUBSTITUTIONS AND WARRANTY

A. Materials and workmanship shall meet or exceed industry standards and be fully eligible for the maximum guarantee offered by the manufacturer. All components, material and workmanship not covered by the manufacturer’s system warranty shall be guaranteed for one year after the date of final acceptance. Cable integrity and associated terminations shall be thoroughly

inspected, fully tested, and guaranteed as free from defects, transpositions, opens, shorts, kinks, damaged jacket insulation, or similar conditions that may compromise system performance.

B. All labor must be thoroughly competent and skilled, and all work shall be executed in strict accordance with the best practice of the trades.

C. The SCC shall be responsible for and make good, without expense to the Owner, any and all defects arising during this warranty period that are due to imperfect materials, appliances, improper installation or poor workmanship.

D. After a Contract is awarded, requests to substitute for previously approved materials shall be submitted by the SCC to the Project Engineer within seven (7) days, complete with reasons for substitution and savings which accrue to Owner if substitutes are approved. Substitutes, after Contract award, will be considered only if equal or superior to that specified.

E. Approval of alternate or substitute equipment or material in no way voids Contract document requirements.

F. Under no circumstances shall the Owner be required to prove that an item proposed for substitution is not equal to the specified item. It shall be mandatory that the SCC submit to the Owner all evidence to support his contention that the item proposed for substitution is equal to the contract specified item. The Owner's decision as to the equality of substitution shall be final and without further recourse.

G. The SCC shall provide the manufacturer's warranty for both parts and labor for the warranty period upon final acceptance of the system by Owner. The SCC shall provide a copy of the warranty certificate to the Architect/Engineer and Owner for review.

PART 3 - EXECUTION

3.1 STRUCTURED CABLING

A. All material and equipment shall be installed in a neat and workmanlike manner.

B. All material and equipment shall be installed per manufacturer's specifications using methods and tools approved by the manufacturer.

C. All material and equipment shall be installed per the drawings and specifications.

D. The installation shall be in compliance with the requirements of the NEC, OSHA and the rules, regulations and requirements of the FCC.

E. The installation shall be in compliance with federal, state, county and city laws, regulations, ordinances and codes applicable to the installation.

F. The locations of conduits, conduit sleeves, outlet boxes, floor boxes, stub-ups/downs, panels, equipment racks and other related equipment as indicated on the drawings are approximate and are understood to be subject to such revision as may be found necessary at the time of

installation. The SCC should have exact and definite locations accepted by the Owner before proceeding with the installation.

G. For telecommunications outlets in wall mounted applications, the Electrical Contractor shall furnish and install a 4" square by 2-1/8" deep gang box with a single-gang mud ring reducer for flush mounting single gang faceplates in the wall space along with a 1" conduit from the gang box to wireways located in accessible spaces. Provide pull strings in all conduits for the SCC.

H. For telecommunications outlets in floor mounted applications, the Electrical Contractor shall furnish and install floor boxes including covers and adapters suitable for installation of telecommunications outlets within the floors and any floor duct or conduits necessary to convey cable to wireways in accessible spaces. Conduits shall be sized appropriately to handle planned cable counts and sizes. Provide adapters designed to mount the specified manufacturer's jacks.

I. The SCC shall furnish and install wire raceways to fully support all installed cable. Raceways may consist of J-hooks or adjustable cable support (slings) rated for Category 6 cable, basket tray or ladder rack as called out in the drawings and/or specifications. The SCC shall coordinate wire raceway installation with other trades so as not to impede their work.

J. The SCC shall furnish and install ladder rack and wire raceways within the Telecommunications Rooms as shown on the drawings. The ladder rack and wire raceways shall include all accessories for a complete routing system.

K. The SCC shall furnish and install equipment racks, frames or cabinets as called out in the drawings and/or specifications.

L. The SCC shall furnish and install all cable hangers, horizontal and vertical wire managers, cross-connect managers and other cable management hardware for a neat and orderly installation.

M. Horizontal cabling shall not be spliced and must be continuous from the cross-connect to the workstation outlets. SCC will neatly dress all horizontal cable from point of entry in Equipment Rooms and Telecommunications Rooms to the termination point. Provide cable slack as specified. Where cable slack is specified, neatly support slack with cable slings or similar methods. Do not store cable slack on ladder racks.

N. All copper backbone cabling shall not be spliced but must be continuous from termination point to termination point.

O. The proximity of horizontal and backbone cabling to electrical facilities that generate high levels of electromagnetic interference (EMI) shall be taken into account. These facilities include, but are not limited to copiers, motors, transformers and fluorescent lighting. TIA/EIA 569-B standards shall provide separation requirements.

P. All horizontal copper UTP cables shall be terminated according to the T568-B wiring scheme unless otherwise specified.

3.2 GROUNDING AND BONDING

A. Grounding shall meet the requirements and practices of applicable authorities and codes. In addition, telecommunications grounding and bonding shall conform to ANSI-J-STD-607-A.

B. A telecommunications grounding system shall be installed by the electrical contractor in the Entrance Facility, ER and each TR. The system shall consist of a Telecommunications Main Grounding Busbar (TMGB) located in the Entrance Facility and a Telecommunications Grounding Busbar (TGB) located in the ER and each TR. Each TGB shall be connected to the TMGB and the TMGB connect to the main building ground system.

C. The SCC shall ground all equipment racks, frames, cabinets, ladder rack and basket tray to room TMGB/TGB using minimum #6 AWG stranded wire with green jacket. Use bonding jumpers between each section of ladder rack or basket tray and between ladder racks or basket trays and equipment racks, frames and cabinets. Use 2-hole, long-barrel lugs where ground bonds are fastened to equipment racks, ladder racks and busbars. Lugs shall have compression type fittings and be designed for the purpose of bonding equipment to ground. Use factory made bonding conductors where possible. Use proper crimping tools and dies when field installing lugs. Mechanical lugs with screw connections are not permitted. Scrape paint or power coat from equipment racks and ladder racks to bare metal before attaching lugs.

3.3 FIRESTOPPING

A. All telecommunication pathways that penetrate fire-rated walls, floors or ceilings shall be properly firestopped, per the applicable codes and shall be the responsibility of the SCC unless otherwise noted.

B. Provide fire-resistant UL approved firestopping systems to restore fire ratings to all wall, floor or ceiling penetrations. Firestopping systems must be UL classified and meet NEC and local codes.

C. All penetrations through fire rated floors and walls shall be sealed to prevent the passage of smoke, fire, toxic gas or water through the penetration, before, during or after a fire. The fire rating of the penetration seal shall be at least that of the floor or wall into which it is installed, so the original fire rating of the floor or wall is maintained as required by Article 300-21 of the NEC.

D. No flammable material may be used to line the chase or hole in which the firestop material is to be installed.

E. All firestopping materials shall be installed in accordance with the manufacturer's directions and recommendations.

F. The sealant shall remain resilient and pliable to allow for the removal and/or addition of cable without the necessity of drilling holes. It shall adhere to itself in order to allow any and all repairs to be made with the same material. It shall allow for vibration, expansion and/or contraction without affecting the seal, cracking, crumbling and spalling.

G. The firestop sealant shall comply with the fire-exposure and hose-stream endurance requirements of ASTM E-119.

3.4 LABELING

A. Cable labels shall provide a unique identification scheme that shall ease cable tracing. The SCC shall coordinate with the Owner to determine Owner specific labeling sheme prior to labeling cables and termination equipment. If Owner does not furnish a cabling administration scheme, the SCC shall submit intended labeling scheme to the Technology Consultant, Architect/Engineer and Owner for approval.

B. Labels shall be permanent, waterproof, and readable from one foot with permanent lettering and shall not be removable by normal cable handling or normal operations. As part of the final installation, no hand written labels will be allowed. All labels shall be typed or computer generated.

C. Verify labeling for all cables, faceplates, floor boxes, termination blocks, patch panels and racks with Owner prior to installation.

D. All cables shall be labeled at each end. For proper administration, additional cable labeling may be required on the cable at intermediate locations such as conduit ends and along cable tray and cable support runs.

E. Contractor shall indicate routing of main cable pathways on floor tiles using paint or other approved means so owner can easily locate basket tray routes. Color blue shall be used to designate communications cable pathways.

3.5 TESTING

A. The SCC shall test 100% of all cables installed. Telecommunications cables shall meet or exceed the current ANSI/TIA/EIA-568 specifications for the category of cable installed. All test reports shall be printed and included in the final record documentation package.

B. UTP Copper Cable

1. The SCC shall be responsible for recording all test data.
2. Copies of all test results are to be submitted to the Owner or authorized representative for review as part of the final record documentation package and remain with the Owner for their records.
3. Category 6 cabling systems shall be performance verified using an automated test set. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the ANSI/TIA/EIA-568 standard, and the result shown as pass/fail. Test results shall be printed directly from the test unit or from a download file using an application from the test equipment manufacturer. The printed test results shall include all tests performed, the expected test result and the actual test result achieved. The test shall be a permanent link test, unless otherwise specified by the manufacturer.

C. Intra-building Fiber Optic Backbone Cable

1. Follow procedures described in TIA/EIA TSB-140 for Tier 1 tests when testing intrabuilding fiber optic backbone cables. Multimode links are to be tested at 850 nm and 1300 nm in accordance with ANSI/TIA/EIA-526-14-A, Method B, One Reference Jumper. Singlemode links are to be tested at 1310 nm and 1550 nm in accordance with

ANSI/TIA/EIA-526-7, Method A.1, One Reference Jumper. Test fibers in both directions unless otherwise directed.

2. Test for system attenuation using a power meter and light source set to the same wavelength. Power meter must be calibrated and traceable to the National Institute for Standards and Technologies (NIST).
3. Test jumpers must be of the same optical fiber core size as the cabling system (e.g. test 50/125µm systems using 50/125 µm jumpers).
4. Test 100% of installed fiber. Provide printed test reports for inclusion in final record documentation package. Test reports will show measured loss for each fiber in dB and length of each fiber in feet.
5. End to end testing is considered to be from the equipment end through the cross-connect to the terminal end.

D. Inter-building Fiber Optic Backbone Cable

1. Follow procedures described above for testing intra-building fiber optic cable plus TSB 140 Tier 2 procedures to include OTDR testing.
2. Include all OTDR trace documentation with final record package.

E. Coaxial Cables

1. Test all coaxial cables for continuity, shorts and opens.

END OF SECTION 271000

SECTION 271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

B. Division 26 Electrical

1.2 SUMMARY

A. This section includes Entrance Facility (EF), Equipment Room (ER) and Telecommunications Room (TR) equipment including: copper patch panels and termination blocks; fiber optic enclosures, panels, adapters and connectors; equipment racks, frames and cabinets; vertical and horizontal wire managers; ladder rack and mounting hardware; and grounding for telecommunications rooms.

1.3 WORK INCLUDED

A. The Structured Cabling Contractor (SCC) shall provide all labor, materials and equipment for the complete installation of work called for in the Contract Documents unless otherwise noted.

1.4 SUBMITTALS

A. Product data for each type of product indicated.

1.5 QUALITY ASSURANCE

A. All communications equipment rooms shall be installed in a neat and workmanlike manner.

B. Equipment and materials shall be of the quality and Manufacturer indicated.

C. Where "approved equal" is stated, the equipment shall be equivalent in every way to that of the equipment specified, subject to approval by the Owner's representative.

D. Communication grounding and bonding shall be in accordance with applicable codes and regulations. The requirements of IEC 1000-5-2 and ANSI/TIA-607-B shall be observed throughout the entire cabling system.

E. Materials and work specified herein shall comply with all applicable requirements of the following codes and standards. All codes and standards are to be construed as current, latest, as amended or as adopted:

1. ANSI/TIA/EIA – 568-C Commercial Building Telecommunications Cabling Standard, 2000-2004
2. ANSI/TIA/EIA – 569-B Commercial Building Standard for Telecommunications Pathways and Spaces, 2004
3. ANSI/TIA/EIA – 606-A Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 2002
4. ANSI/TIA-607-B Commercial Building Grounding and Bonding Requirements for Telecommunications
5. NFPA 70 – National Electric Code
6. BICSI – Telecommunications Distribution Methods Manual, 12th Edition
7. NEMA – VE-2 – Metal Cable Tray Installation Guidelines
8. City and County of Denver Technology Standards Section I "Technology Cabling, Infrastructure and Installation", Revision 1.0, dated September 24, 2009.

PART 2 - PRODUCTS

2.1 COPPER PATCH PANELS AND TERMINATION BLOCKS

A. Category 6 Patch Panels

1. The patch panels shall be designed for optimum performance; interfacing multi-vendor equipment rated and labeled Category 6 and meets or exceeds Category 6/Class E requirements of ISO/IEC 11801, CENELEC EN50173-1 and TIA/EIA- 568-B.2-1.
2. Patch panel design shall consist of Modular-to-IDC Type construction. The patch panel shall provide insulation displacement contacts (IDC) on printed circuit boards (PCB) for mechanical termination of horizontal data cabling. The printed circuit board shall be utilized as the interconnection method between the IDC Type connectors and 8-position, modular RJ-45 jacks.
3. The patch panels shall be universal and support both T568-A and T568-B wiring schemes for both the IDC Type connectors and the modular RJ-45 jacks.
4. Utilizes 110 punch-down terminations on back panel.
5. Write-on designation labels with protective clear plastic covers, or equivalent, shall be provided on both the front and rear of the patch panels for circuit identification.
6. Patch panels shall be supplied with cable management hardware facilitating proper installation and cable management techniques. Accessories supplied shall be designed to provide strain relief on cables, maintain the wire pair twists as close as possible to the termination points and support the proper bend radius of the cables.
7. Patch panels shall be modular in nature and shall be factory pre-assembled. Patch panels shall be rack mountable and comply with EIA 19" rack mounting standards.
8. Be available in 24- and 48-port configurations.
9. Design Make:

    a. Commscope SYSTIMAX GS3-24 and GS3-48
    b. No substitutions

B. Category 5e Patch Panels

1. The patch panels shall be designed for optimum performance; interfacing multi-vendor equipment rated and labeled Category 5e and meets or exceeds Category 5e requirements of ISO/IEC 11801, CENELEC EN50173-1 and TIA/EIA- 568-B.2-1.
2. Patch panel design shall consist of Modular-to-IDC Type construction. The patch panel shall provide insulation displacement contacts (IDC) on printed circuit boards (PCB) for mechanical termination of horizontal data cabling. The printed circuit board shall be utilized as the interconnection method between the IDC Type connectors and 8-position, modular RJ-45 jacks.
3. The patch panels shall be universal and support both T568-A and T568-B wiring schemes for both the IDC Type connectors and the modular RJ-45 jacks.
4. Utilizes 110 punch down terminations on back panel.
5. Write-on designation labels with protective clear plastic covers, or equivalent, shall be provided on both the front and rear of the patch panels for circuit identification.
6. Patch panels shall be supplied with cable management hardware facilitating proper installation and cable management techniques. Accessories supplied shall be designed to provide strain relief on cables, maintain the wire pair twists as close as possible to the termination points and support the proper bend radius of the cables.
7. Patch panels shall be modular in nature and shall be factory pre-assembled. Patch panels shall be rack mountable and comply with EIA 19" rack mounting standards.
8. Be available in 24- and 48-port configurations.
9. Design Make:
   a. Commscope SYSTIMAX — 1100PSCAT5E-24, 1100PSCAT5E-48
   b. No substitutions

C. Type 66 Wall Mounted Wiring Blocks

1. The wiring blocks shall be made from high impact flame retardant thermoplastic with fanning strips to provide management for cross-connect jumper wires and provide a labeling surface for circuit identification.
2. The blocks shall accommodate 22 through 26 AWG solid insulated cable or 18-19 AWG solid stripped cable.
3. The wiring blocks shall be minimally Category 5 compliant.
4. All wiring blocks shall be 66-blocks and available in 50-pair configurations.
5. Provide bracket for mounting to wall surface.
6. Design Make:
   a. Siemon — S66M1-50 66-block
   b. Siemon — S89B Stand-off bracket
   c. No substitutions

2.2 FIBER OPTIC TERMINATION EQUIPMENT

A. Rack Mounted Fiber Optic Enclosures

1. Rack mount fiber enclosures shall be designed to manage and organize fiber optic cable to and from equipment or cross-connects.
2. Enclosures shall accept modular cassettes.
3. Enclosures shall provide space to hold splice trays.
4. Available with fusion splice trays.
5. Includes hinged front door, front cable management and top cover panel.

6. Shall be 1U in size.
7. Provide area for cable identification.
8. Design Make:
    a. Commscope Uniprise 600G2-1U-MOD-SD
    b. No substitutions

B. Pre-terminated Fiber Modular Cassettes – Data Backbone

1. Designed to install in rack mount enclosure.
2. Cassettes contain twelve pre-terminated LC connectors with singlemode fiber pigtails.
3. Cassettes shall include blue colored LC adapters.
4. Available blank panel for installation in unused enclosure ports.
5. Design Make:
    a. Commscope SYSTIMAX MODG2-12LC-LS-PT
    b. No substitutions

2.3 EQUIPMENT RACKS, FRAMES AND CABINETS

A. Free Standing Equipment Racks – 2-Post

1. Racks shall be constructed of aluminum and include (2) top angles, (2) base angles and (2) 3” deep channels.
2. Available as 84” high.
3. Channels shall be tapped to accept #12/24 mounting screws.
4. Channels shall have RMU markings.
5. Shall be black in color.
6. Design Make:
    a. Chatsworth Products (CPI) 2-Post Rack 55053-703 or 46353-703
    b. No substitutions

B. Free Standing Equipment Racks – 4-Post

1. Racks shall be constructed of aluminum and steel.
2. Available as 84” high with usable depth up to 29”.
3. Include square punched holes in standard EIA spacing adaptable with optional cage nuts to match equipment mounting requirements.
4. Shall be black in color.
5. Design Make:
    a. Chatsworth Products (CPI) 4-Post Rack 50120-703
    b. No substitutions

C. Sliding Shelf

1. 19” wide by 24” deep sliding shelf, non vented.
2. Shall extend 23” from rack.
3. Self-locking in closed and fully open position.
4. Shall be black in color to match equipment racks.
5. Design Make:
    a. Chatsworth Products (CPI) 12345-719
    b. No substitutions

2.4 CABLE MANAGEMENT

A. Vertical Cable Manager

1. Double-sided design for cable management front and rear.
2. 1 RMU cable guides on the front and rear for managing patch cords.
3. Shall include a front and rear cover that can be opened right or left or removed entirely.
4. Available in 6” widths.
5. Design Make:
   a. Chatsworth Products (CPI) 35521-703 (6”)
   b. No substitutions

B. Horizontal Cable Manager

1. Available in 1U and 2U high wire managers.
2. Rings may be made of metal or flexible material.
3. Rings on front only.
4. Shall be black in color.
5. Design Make:
   a. Chatsworth Products (CPI) 1U w/ Front Cover 35441-701
   b. Chatsworth Products (CPI) 2U w/ Front Cover 35441-702
   c. No substitutions

C. Conduit Waterfall

1. Provides bend radius control for cables entering/exiting 4" (101.6mm) EMT conduit.
2. Secure to conduit without tools utilizing integral thumb screw and captive nut.
3. Design Make:
   a. Panduit CWF400
   b. Approved equal

2.5 LADDER RACK, SUPPORTS AND ACCESSORIES

A. Ladder Rack (Cable runway)

1. Ladder rack shall be manufactured from 3/8” wide by 1-1/2” high tubular steel with .065” wall thickness.
2. Ladder rack (side stringers) will be 9’-11½” long. Cross members will be welded in between stringers on 12” centers beginning 5-3/4” from one end so that there are 10 cross members per ladder rack. There will be 10-1/2” of open space in between each cross member.
3. Ladder rack will be delivered individually boxed, and available in the 12” and 18” widths.
4. Finish shall be epoxy-polyester hybrid powder coat (paint) in black.
5. Design Make:
   a. Chatsworth Products (CPI) 10250-712, 10250-718
   b. No substitutions

B. Ladder Rack Mounting Hardware

1. Wall angle support kits:
   a. Shall be available in widths and colors to match ladder rack.
   b. Shall include hardware for mounting ladder rack.

2. Triangle support bracket kits:
   a. Shall be available in widths and colors to match ladder rack.
   b. Shall be constructed as a triangular welded bracket;
   c. Shall carry a load rating of 100 lb;
   d. Shall include hardware for mounting ladder rack.

3. Match ladder rack color.
   a. Design Make:
      1) Chatsworth Products (CPI)
      2) No substitutions

C. Ladder Rack Splice Kits

1. Splice kits will provide a method of mechanically connecting ladder rack sections and turns together end-to-end or side-to-end to form a continuous pathway for cables.
2. Splices (splice plates) will be manufactured from steel. Splice, grounding and insulator bar kits will include installation hardware.
3. Finish (of splice plates and hardware) shall be zinc plate.
4. Splice kits shall consist of butt splices and junction splices as required.
5. Design Make:
   a. Chatsworth Products (CPI)
   b. No substitutions

D. Rack-to-Runway Mounting Plate

1. Used to secure ladder rack to top of equipment rack.
2. Material is ¼" thick cold-rolled steel.
3. Can mount either parallel or perpendicular.
4. Finish shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified.
5. Design Make:
   a. Chatsworth Products (CPI)
   b. No substitutions

2.6 POWER STRIPS

A. Rack Mounted.

1. Designed for installation in standard 19" equipment racks.
2. Rated at 20 Amps.
3. Six (6) or more outlets.
4. No switch or if equipped with switch has means to prevent accidental activation of switch such as cover or lock-out.
5. Equipped with minimum 10' power cord.
6. Design Make:

   a. Wiremold

b. Hubbell
c. Leviton
d. Panduit
e. Approved equal

2.7 FIRE RATED CABLE PATHWAYS

A. Wiring devices:

1. Cables passing through fire-rated floors or walls shall pass through fire-rated wiring devices which contain an intumescent insert material that adjusts automatically to cable additions or subtractions.
2. The device (per code requirements) shall include both internal and external firestopping.
3. Cables penetrating through fire-rated floors or walls shall utilize fire-rated pathway devices capable of providing an F rating equal to the rating of the barrier in which the device is installed.
4. The device shall be tested for smoke leakage (L rating) and shall not require the use of any optional sealing materials to achieve the published rating.
5. The device shall utilize a fire and smoke sealing system that automatically adjusts to the addition or removal of cables.
6. Wiring devices shall be capable of allowing a 0 to 100-percent visual fill of cables.
7. Wire devices shall be of a sufficient size to accommodate the quantity and size of electrical wires and data cables required and shall be suitable for use with new or existing cable installations.
8. The installed device (in normal use) shall require no maintenance and shall accommodate future cable changes without mechanical adjustment and/or removal or replacement of protective materials.
9. Wire devices to be provided with steel wall plates allowing for single or multiple devices to be ganged together.
10. The device shall be modular and shall provide mechanical installation options for common wall and floor constructions as well as common construction conditions including over-sized or damaged openings or existing sleeves.
11. Design Make:

    a. Horizontal penetrations:
        1) Specified Technologies Inc., EZ-PATH Series Fire Rated Pathway
    b. No substitutions

2.8 RAISED FLOOR CABLE GROMMETS

A. Flush Mount Brushed Grommet
1. Provides a means for communications cable entering room below raised floor to exit floor into room space above.
2. Can be installed at edge of floor tile.
3. Provides removable back-brush feature so floor tile can be removed without disconnection of cable.
4. Includes integrated trim.
5. Design Make:
    a. PDU Cables:

1) Air Guard Flush Mount

b. Approved equal

2.9 GROUNDING

A. Equipment rack grounding hardware, grounding wire, jumpers and connectors shall conform to applicable grounding and bonding industry standards – TIA-942, J-STD-607-A, IEEE Std 1100 (IEEE Emerald Book), and UL.

B. Equipment rack grounding hardware includes:

1. Rack grounding strip kits
2. Equipment jumper kits

C. Lugs used for bonding conductors shall be two-hole, long-barrel compression type fittings.

D. Design Make:

1. Panduit
2. No substitutions

PART 3 - EXECUTION

3.1 COPPER TERMINATION

A. All material and equipment shall be installed in a neat and workmanlike manner.

B. All material and equipment shall be installed per manufacturer's specifications, using methods and tools approved by the manufacturer.

C. Install Category 6 horizontal cable in strict accordance with the manufacturer's recommendations and in compliance with TIA/EIA Category 6 standards.

D. Support cables using ladder rack or approved means from point of entry in the telecommunications room to the termination field. Cables shall be neatly dressed in the telecommunications rooms in bundles of no more than 24 cables.

E. Provide cable support bars or similar means where cables terminate on the rear of copper patch panels.

F. All horizontal and copper backbone cable will be terminated on rack mounted equipment unless otherwise stated. Install copper patch panels as shown in elevation drawings.

G. Provide 10 foot slack for Category 6 horizontal cable at the telecommunications room. Use cable slings or similar means to neatly support cable slack. Do not store slack on ladder rack or cable trays.

H. Provide 10 foot slack for copper backbone cable at the telecommunications room. Neatly coil cable slack on wall.

I. Terminate all Category 6 horizontal data cable on rack mounted, 48-port, Category 6 patch panels. Provide quantity of panels needed to completely terminate all horizontal cable and provide a minimum of 24 open ports for future growth.

J. Terminate all Category 6 cable for CCTV cameras on rack mounted, 24-port, Category 6 patch panels. Install dedicated patch panels for Category 6 security cabling.

K. Terminate Category 3 voice backbone cable on wall mounted 66-blocks at the voice wall field and on 48-port C5e patch panels at the equipment racks. Terminate using two-pair per port unless otherwise specified. Terminate pairs with pair one on pins 4 and 5 and pair two on pins 3 and 6.

L. Test all copper cables per Section 27 10 00.

3.2 FIBER OPTIC CABLE TERMINATION

A. Provide rack mount fiber enclosure with termination hardware for City IT services singlemode fiber. Fiber installation by others. Coordinate termination with fiber installer.

3.3 RACKS, FRAMES, CABINETS AND LADDER RACK

A. Equipment racks, cabinets and frames shall be installed per drawings.

B. Provide transitions from sleeves/high ladder racks to lower ladder racks using cable transition hardware such as waterfalls or cable radius drops.

C. Ground and bond all equipment racks, cabinets, frames and ladder racks per code and ANSI J-STD-607-A.

D. Install patch panels, wire managers and power strips as shown on rack elevation drawings. Prior to install, review with Owner or Technology Consultant to confirm final equipment placement in all racks.

3.4 CONDUIT WATERFALLS

A. Install conduit waterfalls on 4” conduits and 4” conduit sleeves where cables transition down to raceways and ladder racks.

B. Install waterfalls on conduits as noted on drawings.

3.5 GROUNDING

A. Ground all racks, cabinets and ladder racks in accordance with J-STD-607-A using approved methods and materials.

B. Ground all racks, cabinets and ladder racks to the room grounding bus bar using a minimum #6 AWG conductor.

C. Use 2-hole, long-barrel lugs where ground bonds are fastened to equipment racks, ladder racks and busbars. Lugs shall have compression type fittings and be designed for the purpose of bonding equipment to ground. Use factory made bonding conductors where possible. Use proper crimping tools and dies when field installing lugs. Mechanical lugs with screw connections are not permitted. Scrape paint or power coat from equipment racks and ladder racks to bare metal before attaching lugs.

3.6 LABELING

A. Label all cables. Label horizontal cables using owner approved labeling scheme. Label horizontal cables at the outlet and patch panel within 12" of termination. Label backbone cables to show origination and destination. Affix labels in a visible location. All labels must be machine made and permanently attached.

B. Label all data and voice patch panels per owner approved labeling scheme.

C. Label all voice backbone patch panels and 66-blocks per example unless otherwise directed.

D. Label all fiber optic enclosures with cable origin and destination.

E. Label fiber innerduct using fiber marker labels with origin and destination information.

F. Label racks, frames and cabinets per owner direction.

3.7 FIRE RATED CABLE PATHWAYS

A. EC shall furnish and install fire rated able pathways per manufacturer instructions.

END OF SECTION 271100

SECTION 271500 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

B. Division 26 Electrical

1.2 SUMMARY

A. This section includes horizontal cable, jacks and faceplates for data, voice and CATV distribution and cable support such as J-hooks, labeling and testing.

1.3 WORK INCLUDED

A. The Structured Cabling Contractor shall provide all labor, materials, and equipment for the complete installation of work called for in the Contract Documents unless otherwise noted.

1.4 SUBMITTALS

A. Product data for each type of product indicated.

1.5 QUALITY ASSURANCE

A. All telecommunications rooms shall be installed in a neat and workmanlike manner.

B. Equipment and materials shall be of the quality and Manufacturer indicated.

C. Where "approved equal" is stated, the equipment shall be equivalent in every way to that of the equipment specified, subject to approval by the Owner's representative.

D. Communication grounding and bonding shall be in accordance with applicable codes and regulations. The requirements of IEC 1000-5-2 and ANSI/TIA-607-B shall be observed throughout the entire cabling system.

E. Materials and work specified herein shall comply with all applicable requirements of the following codes and standards. All codes and standards are to be construed as current, latest, as amended or as adopted:

1. ANSI/TIA/EIA – 568-C Commercial Building Telecommunications Cabling Standard

2. ANSI/TIA/EIA – 569-B Commercial Building Standard for Telecommunications Pathways and Spaces, 2004
3. ANSI/TIA/EIA – 606-A Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
4. ANSI/TIA-607-B Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
5. NFPA 70 – National Electric Code
6. BICSI – Telecommunications Distribution Methods Manual, 12th Edition
7. NEMA – VE-2 – Metal Cable Tray Installation Guidelines
8. City and County of Denver Technology Standards Section I "Technology Cabling, Infrastructure and Installation", Revision 1.0, dated September 24, 2009

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLE

A. Data Cable

1. The cable shall meet all requirements of ANSI/TIA/EIA-568-B.2-1 for Category 6 cable performance.
2. The cable shall meet all requirements of ANSI/ICEA Publication S-80-576 that are applicable to four-pair inside wiring cable for plenum spaces within a building.
3. The horizontal data cabling shall be Category 6, 4-pair UTP cabling with manufacturers transmission characteristics specified up to 250 MHz.
4. Horizontal data cable shall be plenum unless otherwise noted.
5. Horizontal data cables shall be gray (slate) unless otherwise noted.
6. Design Make:
   a. CommScope SYSTIMAX 2071
   b. No substitutions

B. CATV Cable

1. Coaxial cable shall be designated as RG-6.
2. Coaxial cables shall be minimum quad shield, 60% braid unless otherwise noted.
3. Center conductor shall be 18 AWG (.040 in.) of bare copper or copper covered steel construction.
4. Cables shall meet NEC Article 820 for plenum rating and be UL listed.
5. Maximum attenuation shall be 8.2 dB/100 ft. at 1000 MHz.
6. Design Make:
   a. Commscope
   b. Belden
   c. Approved equal

2.2 TELECOMMUNICATIONS OUTLETS AND FACEPLATES

A. Telecommunications Outlets

1. The outlets shall meet or exceed the ANSI/TIA/EIA 568-B.2-1 Category 6 performance standard.
2. Outlets must be third party verified to meet the Category 6 standard.
3. The outlets shall terminate 4-pair 24 and 22 AWG 100 ohm solid unshielded twisted pair cable.
4. The outlets shall consist of 8-position, 8 wire modular RJ-45 jacks.
5. All outlets shall be produced by the same manufacturer and shall be designed to snap into and out of the faceplate.
6. The outlets shall support TIA/EIA 568A and 568B wiring schemes for terminating the horizontal cables.
7. Jacks shall be green unless otherwise noted.
8. Design Make:
    a. Commscope SYSTIMAX MGS 400
    b. No substitutions

B. Wall Mounted Telecommunications Faceplates

1. Faceplates shall fit a single-gang box and available in 1-port and 4-port configurations.
2. Provide label with clear label cover.
3. Available in standard colors to match electrical plates.
4. Available with blank inserts for unused ports.
5. Design Make:
    a. Commscope SYSTIMAX L-type or LE-type
    b. No substitutions

C. Wall Mounted Telecommunications Faceplates – Stainless Steel

1. Faceplates shall fit a single-gang box and available in 1-port and 4-port configurations.
2. Provide label with clear label cover.
3. Design Make:
    a. Commscope SYSTIMAX M11SP-L and M14SP-L
    b. No substitutions

D. Flush Mounted Modular Mounting Frames

1. Mounting frame shall be designed to accept standard Decora style faceplate or mounting adapter.
2. Accept three MGS 400 data jacks.
3. Available in standard colors.
4. Design Make:
    a. Commscope SYSTIMAX M108FR3-xxx
    b. No substitutions

E. Wall Phone Faceplate

1. Single-gang stainless steel construction.
2. Provides mounting studs positioned to mount standard wall mount telephones.
3. Stud spacing shall be 3.28 inches.
4. Accepts M-series Category 6 jack.
5. Design Make:
    a. Commscope SYSTIMAX M10LW, Material ID 760117572

b. No substitutions

F. Surface Mount Box

1. Accepts M-series Category 6 jack.
2. 2-port style.
3. Be manufactured from high impact, flame retardant, UL rated 94 V-0, thermoplastic.
4. Plenum rated.
5. Design Make:
   a. Commscope SYSTIMAX M202 SMB
   b. No substitutions

2.3 HORIZONTAL CABLE SUPPORT

A. Non-continuous cable supports (J-hooks)

1. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables and will be UL Listed.
2. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.
3. Non-continuous cable supports sized 1 5/16" and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.
4. Non-continuous cable supports shall have an electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments.
5. Shall be rated to support Category 6 cable.
6. Shall be available in 2" and 4" sizes.
7. May be attached to access floor pedestals using designed for purpose attachment hardware without drilling pedestal.
8. Design Make:
   a. Erico
   b. Approved equal

B. Adjustable Cable Support (Cable Sling)

1. Provides support for UTP and fiber optic cables and innerduct.
2. May be installed in areas requiring plenum rated cable.
3. Complies with UL, NEC and EIA/TIA requirements for structured cabling systems.
4. Design Make:
   a. Erico
   b. Approved equal

C. Wire mesh cable tray, supports, and accessories

1. Wire mesh cable tray shall be manufactured from round steel wire that is a minimum of .196" (5mm) in diameter. Wires shall be welded at intersections to form a 2" x 4" (50.8mm x 101.6mm) grid pattern. The tray shall be U-shaped with equal height sidewalls.

2. Individual tray sections will be 10’ (3048mm) and 8” (203.2mm), 12” (304.8mm), or 18” (457.2mm) wide unless otherwise noted. Sidewalls will be 4” (101.6mm) high unless otherwise noted.
3. Wire mesh cable tray will be zinc electroplated after fabrication.
4. Wire mesh cable tray will be UL Classified for grounding purposes.
5. Supports will be sized at minimum to match the width of the wire mesh cable tray that is supported. The support may be wider than wire mesh cable tray.
6. Support design will allow the support to be placed under a wire mesh cable tray at any point mid-span or directly under a pathway splice or intersection.
7. Supports will be manufactured from steel extrusion and/or sheet metal.
8. For under raised floor installation, supports will be designed to attach to access floor pedestals using U-bolts and brackets that securely hold basket tray sections.
9. Design Make:
    a. Chatsworth Products — FastTrac
    b. B-Line — Wire Basket
    c. GS Metals — Flextray
    d. Cablofil
    e. Approved equal

2.4 FIRE RATED CABLE PATHWAYS

A. Wiring devices:
1. Cables passing through fire-rated floors or walls shall pass through fire-rated wiring devices which contain an intumescent insert material that adjusts automatically to cable additions or subtractions.
2. The device (per code requirements) shall include both internal and external firestopping.
3. Cables penetrating through fire-rated floors or walls shall utilize fire-rated pathway devices capable of providing an F rating equal to the rating of the barrier in which the device is installed.
4. The device shall be tested for smoke leakage (L rating) and shall not require the use of any optional sealing materials to achieve the published rating.
5. The device shall utilize a fire and smoke sealing system that automatically adjusts to the addition or removal of cables.
6. Wiring devices shall be capable of allowing a 0 to 100-percent visual fill of cables.
7. Wire devices shall be of a sufficient size to accommodate the quantity and size of electrical wires and data cables required and shall be suitable for use with new or existing cable installations.
8. The installed device (in normal use) shall require no maintenance and shall accommodate future cable changes without mechanical adjustment and/or removal or replacement of protective materials.
9. Wire devices to be provided with steel wall plates allowing for single or multiple devices to be ganged together.
10. The device shall be modular and shall provide mechanical installation options for common wall and floor constructions as well as common construction conditions including over-sized or damaged openings or existing sleeves.
11. Design Make:
    a. Horizontal penetrations: Specified Technologies Inc., EZ-PATH Series 44 Fire Rated Pathway.
    b. No substitutions

PART 3 - EXECUTION

3.1 COORDINATION

A. Jacks and Faceplates

1. Confirm all jack, insert and faceplate colors with Owner and Architect before order.
2. Confirm all outlet locations and heights if not specified on drawings.

B. Conduit

1. Confirm with EC all telecom outlet boxes, floor boxes, conduit sleeves and conduits have been installed and are ready for cable installation.
2. Confirm with EC that all conduits to have pull strings.

C. Horizontal Cable Wireways

1. Coordinate installation of cable wireways with work of other trades.
2. Clearly indicate main cable pathways (basket tray) on floor tiles using paint or other approved means of marking tiles. Color blue shall be used to designate communications cabling pathways.

3.2 DATA CABLE

A. All material and equipment shall be installed in a neat and workmanlike manner.

B. All material and equipment shall be installed per manufacturer's specifications, using methods and tools approved by the manufacturer.

C. Installation and configuration shall conform to the requirements of the current revision levels of ANSI/ EIA/TIA Standards 568 & 569, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer's installation instructions.

D. Install horizontal data cables from the TR to the telecommunications outlet. Support cables via SCC provided cable wireways and/or EC provide conduits. The maximum horizontal distance from the telecommunications outlet to the horizontal cross-connect within the telecommunications rooms shall be 295 feet.

E. Install horizontal cable as a continuous run for origination to destination without splices or taps. Provide 12" cable slack at each outlet location. Follow cable manufacturer's recommendations for managing slack at the outlet.

F. Do not bend cables, in handling or in installing, to smaller radii than minimums recommended by manufacturer.

G. Install cables without damaging conductors, shield, or jacket. Cables that are damaged or kinked must be replaced. Damaged cables will not be accepted.

H. Pull cables without exceeding cable manufacturer's recommended pulling tensions. Use pulling means that will not damage media.

I. Label both ends of each horizontal cable with the cable number within 6" of terminations.

J. Test all horizontal cables per Section 27 10 00.

3.3 TELECOMMUNICATIONS OUTLETS AND FACEPLATES

A. All material and equipment shall be installed in a neat and workmanlike manner.

B. Terminate Category 6 jacks per manufacturer's specifications, using methods and tools approved by the manufacturer.

C. Install jacks in quantities shown on drawings. Install green jacks for all standard wall and floor mounted data outlets unless otherwise noted. Install black jacks for wall phone locations unless otherwise noted.

D. In floor boxes provide M108 style mounting strap and install in GFI device opening.

E. Protect installed jacks from damage.

F. Install faceplates so they are level. Label each faceplate or floor box outlet per approved labeling scheme using permanent label and clear cover. Use as large of type font as possible for labels to aid legibility. Install labels to be square with faceplate.

G. For wireless access point locations, install jack in 2-port plenum rated surface box. Provide minimum 20' cable slack at wireless access point location to allow for relocation by the wireless vendor. Affix permanent label to surface box with outlet number.

3.4 CABLE BASKET TRAYS

A. All material and equipment shall be installed in a neat and workmanlike manner.

B. All material and equipment shall be installed per manufacturer's specifications, using methods and tools approved by the manufacturer.

C. Install basket tray as shown on the drawings. Plan routing of basket tray to follow building lines. Stay within accessible areas such as hallways wherever possible. Coordinate routing of basket trays with work of other trades so access to cable pathways is not restricted.

D. Attach basket tray using suitable hardware. Provide dedicated support structure for basket tray. Do not attach basket tray to work of other trades without prior approval. Attach basket tray to under floor support pedestals using hardware designed for that purpose. Do not drill or tap floor support pedestals to attach basket tray support hardware.

E. Make all tray bends or transitions smooth. Provide radius turns where trays change direction or intersect with other tray sections. Coordinate transitions so as not to interfere with other work.

F. Bond tray sections using UL listed hardware or provide continuous grounding conductor with bond to each tray section.

G. Ground tray or grounding conductor to TR ground bus bar per J-STD-607-A and NEC.

H. Contractor shall indicate basket tray path on access floor tile using paint or other approved means of marking. Marking color shall be blue.

3.5 NON-CONTINUOUS CABLE SUPPORTS (J-HOOKS AND/OR CABLE SLINGS)

A. Use J-hooks or slings to form cable wireways in accessible ceilings and in accessible floor systems (raised floor).

B. Plan routing of cable wireways to follow building lines. Stay within accessible areas such as hallways wherever possible. Coordinate routing of wireways with work of other trades so access to cable pathways is not restricted.

C. Size J-hooks or slings appropriately for cables being managed. Install J-hooks or slings to support cables at minimum every 5’ unless otherwise directed. Use additional J-hooks or slings to form additional, parallel pathways where cable quantities exceed recommended capacities.

D. Install J-hooks or slings with attachment hardware suitable for the area. Provide dedicated support hardware for J-hooks or slings. Do not attach J-hooks or slings to ceiling grid wires or other work in ceiling spaces.

E. Where J-hooks or slings are used to route cables other than network cables, such as CATV cable, security cable, intercom/paging or audio visual cable, provide separate support and maintain separation from telecommunications pathways. Where multiple wireways are installed to separate cable types, clearly denote wireways function using color coding or other approved method.

3.6 FIRESTOPPING AND FIRE RATED CABLE PATHWAYS

A. SCC to install listed Firestopping materials in EC installed conduits and sleeves used for telecommunications, CATV, security and intercom/paging cable.

B. EC to install fire rated cable pathways in accordance with manufacturer’s recommendations.

END OF SECTION 271500

SECTION 271600 - COMMUNICATIONS CONNECTING CORDS, DEVICES AND ADAPTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

B. Division 26 Electrical.

1.2 SUMMARY

A. This section includes copper and fiber patch cords for connection of network and telecommunications equipment.

1.3 WORK INLCUDED

A. The Structured Cabling Contractor shall provide all labor, materials and equipment for the complete installation of work called for in the Contract Documents unless otherwise noted.

1.4 SUBMITTALS

A. Product data for each type of product indicated.

1.5 QUALITY ASSURANCE

A. All equipment rooms shall be installed in a neat and workmanlike manner.

B. Equipment and materials shall be of the quality and Manufacturer indicated.

C. Where "approved equal" is stated, the equipment shall be equivalent in every way to that of the equipment specified, subject to approval by the Owner's representative.

D. Communication grounding and bonding shall be in accordance with applicable codes and regulations. The requirements of IEC 1000-5-2 and ANSI-J-STD – 607-A shall be observed throughout the entire cabling system.

E. Materials and work specified herein shall comply with all applicable requirements of the following codes and standards. All codes and standards are to be construed as current, latest, as amended or as adopted:

1. ANSI/TIA/EIA – 568-C Commercial Building Telecommunications Cabling Standard

2. ANSI/TIA/EIA – 569-B Commercial Building Standard for Telecommunications Pathways and Spaces
3. ANSI/TIA/EIA – 606-A Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 2002
4. ANSI/TIA-607-B Commercial Building Grounding and Bonding Requirements for Telecommunications
5. NFPA 70 – National Electric Code
6. BICSI – Telecommunications Distribution Methods Manual, 12th Edition
7. City and County of Denver Technology Standards Section I "Technology Cabling, Infrastructure and Installation", Revision 1.0, dated September 24, 2009

PART 2 - PRODUCTS

2.1 PATCH CORDS

A. Category 6 Patch Cords

1. Equipment patch cords will be used in Telecommunications Rooms to connect data network equipment to the horizontal cable system.
2. Equipment patch cords will also be used in the Telecommunications Rooms as a means to cross-connect voice stations to the voice backbone for connection to analog phone lines.
3. Work area patch cords will be used to connect user equipment to telecommunications outlets and/or VoIP phone sets.
4. Patch cords shall be factory made and constructed from Category 6, 24 AWG UTP stranded cable and Category 6 Modular (RJ-45) plugs.
5. Patch cords will meet or exceed TIA/EIA-568-B.2-1 Category 6 standard and be third party verified.
6. Category 6 patch cords shall be from the same manufacturer as the installed cable system.
7. Data patch cords shall be green unless otherwise specified.
8. Patch cords used for analog connections shall be red unless otherwise specified.
9. Design Make:
    a. Commscope SYSTIMAX GS8E Series
    b. No substitutions

B. Voice Cross-connect Wire

1. Cross-connect wire will be used to cross-connect voice circuits between 66-wiring and 110-wiring blocks.
2. Cross-connect wire shall be 2-pair.
3. Design Make:
    a. Belden
    b. Approved equal

PART 3 - EXECUTION

3.1 PATCH CORDS

A. Data and Voice Equipment Patch Cord Lengths and Colors.

1. Furnish (2) green Category 6 equipment patch cord for each telecommunications outlet (faceplate) in walls, floors, millwork and modular workstations.
2. Furnish patch cords in 3', 5' and 7' lengths. Breakdown quantities as:
   a. 50% 3-foot
   b. 30% 5-foot
   c. 20% 7-foot
   d. Furnish 20% additional as spares

3. Furnish (10) total 7', red Category 6 equipment patch cords for analog connections.

B. Data and Voice Work Area Patch Cord Lengths and Colors.

1. Furnish (2) Category 6 work area patch cord for each telecommunications outlet (faceplate) in walls, floors, millwork and modular workstations.
2. Furnish cords in 7, 10' and 14' lengths. Breakdown quantities as:
   a. 50% 7-foot
   b. 30% 10-foot
   c. 20% 14-foot
   d. Furnish 20% additional as spares

C. Confirm all colors and lengths with Owner and Architect prior to order.

3.2 PATCH CORD INSTALLATION

A. Furnish patch cords to Owner for installation by Owner unless otherwise specified.

3.3 VOICE CROSS-CONNECT PATCH CORDS AND WIRE

A. Cross-connect voice wiring blocks using 2-pair voice cross-connect wire where needed.

B. Confirm cross-connect colors with owner prior to order.

END OF SECTION 271600

Section 274100 - AUDIO-VIDEO SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

B. Division 26 Electrical

C. Division 27 Communications

D. Division 28 Electronic Safety and Security

1.2 DEFINITION OF TERMS

A. The term “Owner” shall refer to Denver Public Library

B. The term “Architect” shall refer to studiotrope Design Collective

C. The term “Consultant” shall refer to Technology Plus

D. The term “General Contractor” shall refer to General Contractor

E. The term “Contractor” shall refer to the successful bidder, who has the responsibility for installation and performance of the work specified herein.

1.3 SYSTEM DESCRIPTION

A. COMMUNITY LEARNING PLAZA

1. The Community Learning Plaza shall include a ceiling mounted projector and ceiling mounted electric screen. This projection is intended for use when the room is fully open. Audio for this space shall be heard via ceiling speakers. Because of the size of the room when open a wireless microphone system shall be included for “voice lift”. Located in (2) two floor boxes, shown on the floor plan drawing, shall be connection points for a laptop to be displayed on the screen. There shall be a keypad to be used for selecting which floor box connection is being used as well as system ON/OFF and volume control.

2. An electronic whiteboard shall be wall mounted in the CLP. The electronic whiteboard shall be purchased by DPL and installed by DPL. It is shown in the AV drawing package for reference and infrastructure only. GC to coordinate installation of infrastructure needed between trades (ie. power, data, framing, backing, etc).

B. MEETING ROOM 220

1. In the Meeting Room on the second floor shall be a wall electronic whiteboard. The input to this flat panel shall be located in a floor box below the conference table. The electronic whiteboard shall be purchased by DPL and installed by DPL. It is shown in the AV drawing package for reference and infrastructure only. The AV contractor is responsible for the floor box plates and the cabling from the plates to the back of the electronic whiteboard.

1.4 QUALIFICATIONS

A. Provide written and verifiable evidence of each of the listed qualifications:

1. The bidders must demonstrate that they have the experience, capability and resources necessary to perform the work and complete according to schedule.
2. The Contractor shall meet all applicable regulations.
3. The Contractor shall be a firm normally employed in the commercial and performance A/V industry.

B. The Contractor must adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels.

C. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size.

D. The Contractor shall own and maintain tools and equipment necessary for successful installation, equalization and testing of the systems and have personnel who are adequately trained in the use of such tools and equipment.

E. A resume of qualifications shall be submitted with the Contractor's proposal indicating the following:

1. A list of five recently completed projects using the product proposed of similar type and size with contact names and telephone numbers for each.
2. A technical resume of experience for the Contractor's Project Manager and on-site installation Supervisor who shall be assigned to this project.
3. Be a direct dealer for key equipment
4. Bondable to one (1) percent or as required on the project

1.5 CONTRACTOR'S RESPONSIBILITIES

A. The intent of this specification is to provide the groundwork for a complete and satisfactory operating system. All equipment and installation material required to fulfill the above shall be furnished whether or not specified or on the drawings.

B. The work herein specified shall be performed by fully competent workers, in a thorough manner. All work shall be completed to the satisfaction of the Consultant.

C. The Contactor will provide shop drawings and cut sheets for review and approval before any work will commence. This will include all information necessary for the complete wiring and installation of the system.

D. The Contractor shall provide touch panel renditions and control system step-by-step operation for review and approval by Consultant and Owner prior to uploading software and GUI files.

E. The Contractor will provide a schedule for fabrication, rack builds, cable pulls, equipment installation, termination and acceptance testing.

F. The Contractor will provide on-site coordination with other trades and on-going supervision for the project.

G. Any questions concerning this document should be addressed in writing to:

H. Jeff Pyle jeffp@technologyplus.com

I. The Contractor shall provide training sessions as described in this document.

J. The Contractor is responsible for providing weekly status reports to the General Contractor and the Consultant outlining the progress on the project. The following should be included in this status report:

1. Date of project submittals
2. Percentage of completion of rack fabrication and other in-house work
3. Percentage of completion of wire pulls and other wire installation
4. Date of equipment arrival on-site
5. Percentage of completion of wire termination and equipment installation
6. Non-conformance to schedule or other issues

K. All materials and equipment supplied by the Contractor shall be new, the latest model and meet or exceed the published specifications of the manufacturer, unless otherwise approved by the Consultant.

L. All equipment shall meet applicable code requirements.

M. Standards:

1. All work shall be performed in accordance with the latest revisions of the following standards and codes:
   a. Local Building Codes
   b. Local Electrical Codes
   c. NEC National Electrical Code

N. Other references:

1. ANSI/TIA/EIA-569-B - Commercial Building Standard for Telecommunications Pathways and Spaces
2. ANSI/TIA/EIA-607-A - Commercial Building Grounding and Bonding Requirements for Telecommunications
3. ISO/IEC 11801 - Generic Cabling Standard

4. ANSI/IEEE C62.41-1991 Recommended practice on Surge Voltages in Low Voltage AC Power Circuits
5. UL -1283 Standard for Safety - Electromagnetic Interference Filters
6. UL -1449, 2nd Edition Standard for Safety - Transient Voltage Surge Suppressors
7. NFPA 70 National Electrical Code
8. NFPA 75 Standard for the Protection Electronic Computer Systems

O. CCITT National Electrical Manufacturers Association; (NEMA LS1-1992 Guidelines) Low Voltage Surge Protection Devices

P. Prior to beginning any work, the Contractor will submit the following:

1. Shop drawings, showing all manufacturers' product model and type
2. Number identification for all cables and wires
3. Detailed information on the input and output connections for each device.
4. Drawings of rack equipment locations
5. Details of any custom design devices.

Q. At the completion of all work, the Contractor will submit the following:

1. The Contractor will provide two copies each of the following:
   a. Test results for all systems
   b. Operation manuals for each piece of equipment
   c. "As-Built" drawings
   d. Systems Operation and Maintenance Manuals
   e. Any software specifically written for the project
   f. Source code for all systems must be provided.
   g. Systems Operation and Maintenance Manuals
   h. All details specific to the software-equipment functionality
   i. List of all MAC addresses, IP addresses, ports, etc, for all equipment attached to the Owner's networks.

1.6 SUB-CONTRACT

A. No sub-contract will be permitted for the Contractor's responsibilities, unless specifically identified in the bid submission and approved by the Owner and Consultant.

B. Should sub-contractor be utilized, the Contractor shall have sole responsibility for the satisfactory implementation and performance of the system.

1.7 SYSTEM WARRANTY REQUIREMENTS

A. Warranty Statement

1. The Contractor shall include a statement of warranty on the installed system and all equipment. The warranty period shall be for one (1) year from the date of acceptance or the first beneficial use, whichever is first, against defective materials, design, workmanship and improper adjustment. Any defective material shall be removed,

repaired or replaced and installed at no cost to the Owner, provided it does not show abuse.

2. The Contractor shall warranty all equipment for that period, superseding the manufactures warranty where necessary. The warranty shall include all costs incurred by the Contractor for removing, repairing and re-installing malfunctioning equipment.
3. Some Manufacturers require that only authorized dealers install and warranty their equipment. If the Manufacturer does not authorize the Contractor, it is the Contractor's responsibility to make the appropriate arrangements and bear all cost and consequences of that arrangement.
4. The warranty shall include a four (4) site visits to perform preventive maintenance, repairs and adjustments as necessary to insure that the system performance meets specifications.

B. All manufacturers' equipment warranties are to be activated in the Owner's name and will commence on the date of system acceptance. The Contractor will warrant contractor-modified equipment for the warranty period described above.

C. Support

1. The Contractor will respond to a request for service within two (2) hours by telephone and on site support, if required, will occur within twenty-four (24) hours after the request for service.
2. Telephone support will be available during the Contractor's published normal business hours Monday through Friday.

D. Service Contract

1. The Contractor shall offer a separate service contract for two (2) years on a year-to-year basis. This service contract shall cover a minimum of two (2) visits per year and scheduled as per the Owner's request, to perform preventive maintenance, repairs and adjustments, as necessary.
2. The service contract will include the scheduled replacement of lamps for projectors and other display devices. This contract should also include adjustment of equipment to maintain optimum image and sound quality as well as maintaining all other components of all installed systems to meet the specifications of this document.
3. The service contract shall commence immediately after expiration of the warranty period.
4. The contract should include separate costs and contact information for emergency and after hour's service.

1.8 EQUIPMENT DELIVERY AND STORAGE

A. Costs of all shipping and storage requirements shall be borne by the Contractor unless otherwise directed in writing by the Consultant. The Contractor will make appropriate arrangements and coordinate with authorized personnel at the site for the acceptance, protection and storage of the delivered equipment. Unless specific arrangements are made the Contractor will be responsible for all equipment delivered to the site until formal acceptance by the Owner.

1.9 SITE REQUIREMENTS

A. The Contractor will clean up the project site on a daily basis. The Contractor will be responsible for the coordination of their work with other trades who are working in the same location on the project site. The Contractor will be responsible for repairing any damage caused to the premises by the Contractor's installation activities.

1.10 OWNER TRAINING

A. The Contractor will provide training by a qualified instructor to personnel designated by the Owner. In the event the Contractor does not have an instructor on staff, a Manufacturer's representative will be provided by the Contractor at no additional cost to provide the training.

B. All training shall take place after the system acceptance tests and the systems are operational.

C. The training will be divided into four (4) sessions of two (2) hours each and this training is to be done with the Owner's designated representatives. The Contractor will provide the schedule for training and a sign in sheet.

D. Should the Owner request additional training; the Contractor will make the appropriate arrangements and provide to the Owner the costs for this training.

E. All training materials and the training plan shall be reviewed and approved by the Owner prior to training sessions.

1.11 PUBLICATION

A. No information relative to this job may be released for publication without prior written approval from the Owner, Architect and the Consultant.

1.12 INSURANCE

A. The Contractor shall procure and maintain the required comprehensive liability and property damage insurance as required by the General Contractor for the duration of this project.

PART 2 - PRODUCTS

2.1 AUDIOVISUAL EQUIPMENT

CLP 166

ITEM	QTY	MFG	MODEL
VIDEO			
Video Projector	1	Sharp	XG-PH80W-N
Projector Lens	1	Sharp	AN-PH814EZ
Ceiling Mount	1	Chief Mfg	CMA330
Mount Adapter	1	Chief Mfg	RPMAU
Mounting Pole	1	Chief Mfg	Length as Req'd
Ceiling Mounted Electric Screen	1	Dalite	37570L
Floorbox Input Plate (VGA)	2	Extron	70-309-14
Floorbox Input Plate (Audio)	2	Extron	70-293-13
Matrix Switch	1	Extron	IN1508
Electronic Whiteboard	1	OFE	OFE
AUDIO			
Power Amplifier	1	Extron	60-883-02
Ceiling Speakers	12	TOA	H-1
Wireless Microphone System	1	Shure	SLX14/85
DSP	1	Biamp	Nexia TC
Stationary IR Transmitter	1	Listen Tech	LT-82-01
Universal Rack Mounting Kit	1	Listen Tech	LA-326
Stationary IR Radiator - White	1	Listen Tech	LA-140-WH
8-Unit Charging Station	1	Listen Tech	LA-350-01
NiMH Battery Pack for IR Receivers	4	Listen Tech	LA-364
IR Stethoscope 4-Channel Receiver	2	Listen Tech	LR-42
IR Lanyard 4-Channel Receiver	2	Listen Tech	LR-44
Ear Speaker	4	Listen Tech	LA-164
Neck Loop	2	Listen Tech	LA-166
ASL Notification Signage Kit	1	Listen Tech	LA-304
OTHER			
Equipment Rack	1	Middle Atlantic	ERK-2125
System Controller	1	Crestron	CP2e
Keypad	1	Crestron	CNX-B12-W
Power Supply	1	Crestron	PW-242-RU

Meeting Room 220

ITEM	QTY	MFG	MODEL
VIDEO			
Electronic Whiteboard	1	OFE	OFE
Floorbox Input Plate (VGA)	1	Extron	70-309-14
Floorbox Input Plate (Audio)	1	Extron	70-293-13
Floorbox Input Plate (USB)	1	Extron	70-455-12

PART 3 - EXECUTION

3.1 GENERAL

A. General

1. Installation practices shall be in accordance with, but not limited to, the specifications and drawings and shall be performed in accordance with the applicable standards, requirements and recommendations including those of the National, State and Local authorities having jurisdiction.
2. Any variation of the above requires a written request for modification submitted through the proper channels, and the changes will not commence without receiving written approval.

B. Physical Installation

1. All equipment shall be secured in place unless requirements of portability dictate otherwise.
2. Fastenings and supports of the equipment shall be adequate to support their loads with a safety factor of at least three. All boxes, equipment, etc., shall be secured plumb and square.
3. Aesthetic factors should be considered for the installation of all equipment, racks, projectors and other visible items to ensure a pleasant appearance. If in doubt, a request should be made, in writing, through the proper channels to verify the items in question before installation.

C. Trim Components

1. All trim components should match where applicable to the furniture, ceiling and walls. The Contractor should obtain a sample if required by the Architect or Consultant.

D. Cable Installation

1. Wire bundles will adhere to industry standards and be neat and free of cable twists or crossovers.
2. Cables will be marked with a permanent, printer generated cable marker at each end, which corresponds to information shown on drawings.
3. Cables will be grouped according to the signal levels. Separate groups will be formed for the following signal types:
   a. Low level audio
   b. High level audio
   c. Loudspeaker cables
   d. Control cables
   e. Video cables
   f. Data cables

4. No splices are permitted without the approval of the Consultant.

E. Equipment Rack Wiring

1. Power, control and high-level cables should be run on one side of the equipment rack and all other cables run on the opposite side of the equipment rack.
2. All cables should be tied or laced as required.
3. Use of a wire management system or rack frame is required for all vertical cable bundles.
4. Teflon or heat-shrink tubing shall be used to insulate the ground or drain wire.
5. Connections made with screw actuated pressure type terminal strips shall be made following the connector manufacturer's recommendations. Wires should not be tinned.
6. All cable entry will be through the tops or base of the rack.
7. Approved wire and cable types:

a.	RF (Horizontal)	Submit type
b.	RF (Vertical)	Submit type
c.	RGBHV	Extron MHR5
d.	Video Digital and Analog	Belden 1505A
e.	Digital Audio	Belden 1800B
f.	Analog Audio	Belden 8451
g.	Speaker	Submit type
h.	Control	Submit type
i.	CAT 5e	Belden Brilliance
j.	CAT 6	Submit type

8. The above list is for non-plenum cable. If plenum cable is required, use the equivalent plenum version of the above listed cable types.
9. Cables running in plenum areas without conduit shall be plenum rated cable. It is the responsibility of the Contractor to inspect the required drawings and verify plenum cable requirements.
10. All cable installation must comply with the bend radius requirements recommended by the cable manufacturer.
11. Consultant must approve the substitution of other cable types and manufacturers.

F. Grounding Procedures

1. Primary Ground
   a. A single primary ground shall be established for the systems in the project. Ground conductors from each system will connect to this primary system ground.
   b. A system ground will be provided in each equipment rack and shall consist of a copper buss bar large enough to accommodate all ground conductors.

2. Video Connectors
   a. All BNC connectors will be insulated from the mounting panel.

3. Audio Connectors
   a. All bushing type audio connectors will be insulated from the mounting panel.

4. Audio Cable Shields
   a. All audio cable shields shall be grounded at one end only except microphones cables, where the shield shall be connected at both ends but grounded at the patch panel or equipment input only.
   b. It shall be the responsibility of the Contractor to follow good engineering practices in the grounding of the system. Any deviations to the above must be approved by the Consultant prior to implementation.

3.2 CONTRACTOR SYSTEM CHECKOUT

A. Contractor will show by proof of performance test that the system is equal to or better than the equipment specifications listed herein. The proof shall be by actual tests.

B. During performance testing, all equipment shall be operated as would be expected under normal system operation conditions. All results will be documented in spreadsheet form.

C. Signal Paths

1. Test all switch cross points and pathways and document the results.

D. Video (Composite, Component, SDI, MPEG)

1. Test and verify all video signal paths from every source to every destination and document the results.
2. Utilize a signal generator capable of outputting the appropriate signal type(s) required for the system and view the image quality.
3. Test, measure and adjust equipment as needed to meet industry standards for displaying such signal types and document the results.
4. Check that the image is correctly displayed on the monitor(s).
5. Measure the signal to noise ratio and document the results.

E. RGB

1. Test and verify all RGB signal paths from every source to every destination and document the results.
2. Utilize a signal generator capable of outputting the appropriate signal type(s) required for the system and view the image quality.
3. Check that the image is correctly displayed on all monitor(s).
4. Utilize the required test patterns and adjust transmission quality for each source and destination.

F. Optical

1. Video display units shall be solidly mounted and braced. No vibration or movement of the image shall be observed.
2. The total averaged light output from a video display, in lumens, shall be within plus-or-minus 15.0% of that specified by the projector manufacturer.
3. The light fall-off from the center of the projected image to all four corners, as measured at the projected image plane, shall not exceed 45% for display images. The light intensity shall be measured at all five positions of the projected image.

G. Audio

1. Test and verify all audio paths from every source to every destination and document the results.

2. Connect the output of the appropriate audio signal generator to each device input, test for a clean signal path to each output, and document the results.
3. Monitor systems and signals and verify that the systems are free from audible noise and hum.
4. Unless specified otherwise, by the equipment manufacturer, all electronic equipment shall be 20Hz to 20 kHz, ± 1.0 db.

H. Control System

1. Test that all equipment to be controlled responds to the commands issued by the control system.
2. Test every controller for proper operation.
3. Verify that the control keypads, remotes and touch screen panel layouts match the layout provided by the Consultant.
4. Verify that the control keypads, remotes and touch screen panel functionality match the functionality requirements as provided by the Consultant.

I. At the conclusion of the tests, calibrate the system.

J. Establish and mark settings for all controls and mark accordingly. These settings will be included in the As-Built drawings.

K. Provide one set of As-Built drawings, manuals and other documentation to the Consultant for approval.

3.3 SYSTEM ACCEPTANCE TESTING

A. The Contractor will furnish all test equipment to perform all tests recommended by the manufacturers and required by the Consultant during commissioning.

B. The integrated system as shown on the drawings must be tested and commissioned as a fully functional system.

C. The Owner or its designated representative may perform or have any tests performed that the Owner requests to verify the testing of the system.

D. The Contractor shall provide a complete test plan to the Project Manager seven days prior to the proposed test date, specifying capabilities and functions to be tested. All test results shall be forwarded to the Project Manager upon completion.

E. Each component will be tested per the manufacturer's recommended tests, to ensure equipment is functioning properly.

F. The Owner may have representation at all testing.

G. The Owner may perform any tests the Owner believes appropriate before accepting the system.

H. A physical inventory will be taken of all equipment on site and will be compared to an equipment list included in the contract documents and as invoiced by the Contractor.

I. The Contractor will demonstrate the operation of the system and all equipment.

J. Final As-Built drawings and manuals will be available at this time.

1. Manufacturers' catalog sheets and specifications for all equipment.
2. Operating manuals for all equipment
3. Source code for all equipment that require programming
4. Test reports for each component and for the entire system
5. All test results will be submitted in hard paper copy and electronic file form
6. As-Built drawings in AutoCAD

K. Complete sets of these documents delivered to the Consultant.

L. If further adjustment is required or defective equipment is discovered, testing may be suspended and rescheduled at the option of the Consultant.

M. The Consultant may charge for additional time required by the Consultant and/or others to over-see the system repair and testing due to improper system installation or incorrect operation of the system. The costs shall be the responsibility of the Contractor.

N. All training sessions with Owner's staff and training media shall be completed.

O. As-built Drawings shall include cable pathways, device locations with correct labeling and locations. The as-built drawings shall be prepared using AutoCAD V. 14 or later. Provide the Owner with electronic versions of the as-builts on CDs.

P. A training program shall be produced specifically for the installed systems. The content of the training program shall allow facility personnel to become familiar with the operation and routine maintenance of their complete system. At a minimum training shall include:

1. Use and programming associated with all input and output equipment and method of operations.
2. Maintenance and care procedures for all installed systems.
3. Set-up and programming procedures of all installed systems.
4. Perform "on-the-job" training of staff during one exhibit setup and one exhibit opening.
5. Lists of spare parts and replacement components recommended to be stored at the site for ready access.

3.4 CONSULTANT AND CONTRACTOR RECOGNITION

A. The installation will bear the following identification plate mounted at the top of the agreed to equipment rack:

SYSTEMS DESIGNED BY:

TECHNOLOGY PLUS, INC.
AURORA, CO. 80014

303-340-8228

SYSTEMS INSTALLED BY:

CONTRACTOR
CITY, STATE ZIP
CONTACT PHONE

3.5 ON-SITE ASSISTANCE

A. Occupancy Adjustments: When requested by owner within one year of date of substantial completion, provide on-site assistance in tuning and adjusting the system to suit actual occupied conditions and to optimize performance.

END OF SECTION 274100

SECTION 275113 - PAGING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Extent of work is shown on the drawings, including locations, elevations and detail construction. Section includes:

1. Paging System Control
2. Power Supplies
3. Feedback Eliminators
4. Volume Controls
5. Loudspeaker Units

1.2 RELATED DOCUMENTS

A. Drawings, general and special conditions, Division 01 – General Requirements, and other applicable technical specifications apply to work of this Section.

1.3 RELATED SECTIONS

A. Division 26 - Electrical

B. Section 271000 - Structured Cabling General Requirements.

1.4 REFERENCES

A. Materials and workmanship shall conform to the latest issue of all industry standards, publications or regulations referenced in this Section and with the following references as applicable.

1. NFPA 70, NEC Latest edition, Article 300-22(c) UL2043 - National Electrical Code
2. NFPA 90A - Latest edition, Section 2-3.10.1(a), Exception 2
3. EIA Standard SE-101-A: Amplifiers for Sound Equipment
4. EIA Standard SE-103: Speakers for Sound Equipment
5. EIA Standard SE-104: Engineering Specifications for Amplifiers for Sound Equipment
6. American National Standards Institute (ANSI)
7. National Association of Broadcasters (NAB)
8. Audio Engineering Society (AES/EBU)
9. Underwriters Laboratories (UL): UL1480 (UUMW) UL Control #7P97 Air Handling Spaces, ANSIIUL263

1.5 SYSTEM DESCRIPTION

A. Zoned intercom/paging system for voice communications fitted out and arranged to interface with VoIP phone system. Work of this Section includes close coordination and cooperation with the installer of Section 271000 work, including special measures in locating interconnections to the public address system.

B. Input components:

1. Telephones via interface to owner provided VoIP phone system.

C. Features:

1. Page control capable of interface to VoIP telephone system
2. Minimum of 6 paging zones
3. Ability to place call to all zones

1.6 PERFORMANCE

A. Public address system can be accessed from any local phone on VoIP phone system by entering the public address code(s).

B. System shall provide a minimum of 6 paging zones as well as all call capability. Each zone's volume can be independently controlled by a master zone volume control.

C. Speakers shall be self-amplified and include a volume control for independent adjustment.

D. System shall be a complete and working system.

1.7 SUBMITTALS

A. Submit under provisions of Division 01.

1. Shop Drawings: Indicate electrical characteristics and connection requirements.
2. Indicate layout of speakers, elevations and location of equipment mounted in racks and cabinets, component interconnecting wiring, and wiring diagrams of field wiring to speakers and remote input devices.
3. Product Data: Provide documentation showing electrical characteristics and connection requirements for each component.
4. Test Reports: Submit certified test reports evidencing compliance with requirements for the following:
   a. Fire performance characteristics.
   b. Physical properties indicated.

5. Manufacturer's Installation Instructions:
   a. Indicate application conditions and limitations of use stipulated by Product testing agency.
   b. Include instructions for storage, handling, protection, examination, preparation, installation and starting of Product.

6. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.
7. The Contractor is responsible for verifying the completeness of all the parts and type numbers, and the overall suitability of the equipment to meet the main purpose of these specifications. Any additional materials and/or equipment needed in order to meet the requirements stated, even if not specifically mentioned herein or shown on the drawings shall be supplied by the Contractor without claim for additional payment.
8. All equipment specified shall be of most recent model type available.

1.8 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01.

B. Record actual locations of speakers, equipment and outlets for input/output connectors.

1.9 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 01.

B. Operation Data: Include instructions for adjusting, operating and extending the system.

C. Maintenance Data: Include repair procedures and spare parts documentation.

1.10 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this Section with minimum five (5) years experience, and with service facilities within one hundred fifty (150) miles of Project.

B. Supplier: Authorized distributor of specified manufacturer with minimum five (5) years experience.

C. Installer: Shall submit in writing with the bid proposal proof of compliance with the following requirements:

1. Regular business information under present name and address for a period of five (5) years.
2. The successful completion, with present staff, of four (4) projects of the type and magnitude of work specified herein. Indicate the following for each listed project:
    a. Name of project
    b. Owner
    c. Address
    d. Name and telephone number of a contact on site
    e. Year of completion
    f. Short narrative giving specific details as to the Scope of Work performed

1.11 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish Products listed and classified by Underwriters Laboratories, Inc., and conforming to referenced standards, as suitable for purpose specified and indicated.

C. Conform to requirements of Federal Communications Commission.

1.12 WARRANTY

A. Furnish warranty of public address system for twelve (12) months from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PAGING SYSTEM

A. Shall be a distributed system using amplified speakers and unshielded twisted pair (UTP) Category 5e or 6 cable.

B. Acceptable Manufacturers

1. Valcom
2. No substitutions

C. Page Control

1. Provides six paging zones
2. Provides all call and group call functions
3. Emergency page override
4. Provides interface to telephone systems
5. Design make:
    a. Valcom one-way page control Model # V-2006A

D. Power Supply

1. Provides additional power for systems exceeding page control built-in power.
2. Can be wall mounted.
3. Design make:
    a. Valcom

E. Feedback Eliminator

1. Can record multiple messages simultaneously
2. Can record a page while playing one
3. Provides feedback elimination for all zones
4. Design make:
    a. Valcom Stacking Feedback Eliminator Model # V-9964

F. Speaker Volume Control

1. Design make:

a. Valcom volume control Model # 1094A

2.2 PAGING SPEAKERS

A. Speakers are amplified with volume control.

B. Acceptable Manufacturers

1. Valcom
2. No substitutions

C. Ceiling Speakers - Lay-In ceilings

1. 2’ x 2’ speaker assembly designed to fit in lay-in ceiling grid.
2. Includes integral backbox.
3. Design make:
   a. Valcom Lay-in Speaker Model # V-9022

D. Ceiling Speakers - Gym board ceilings/Lay-in ceilings

1. 8” One-way design with built-in amplifier and removable volume control.
2. Design make:
   a. Valcom 8” One-Way Model V-1020C

E. Ceiling Speaker Mounting Hardware

1. Designed to accept 8” round speakers.
2. Design make:
   a. Valcom pre-construction bridge Model V-9912M
   b. Valcom combo bridge/backbox (if mounting in lay-in ceilings) Model V-9916M

F. Pendant Speakers

1. Includes built-in amplifier and volume control.
2. Includes 6’chain.
3. Available in black, gray and white.
4. Design make:
   a. Valcom Pendant Speaker Model V-1015B

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install Category 5e/6 UTP cable per Manufacturer’s instructions and in conformance with 271100.

B. Install paging system for indicated building areas in compliance with Manufacturer's printed instructions.

1. Confirm with architect colors for speakers prior to order.
2. Install 2X2 type speaker in lay-in ceilings. If 2X2 speakers will not work, provide V-1020C speakers with combo bridge/backbox.
3. For ceilings open to structure, install pendant type speaker V-1015.

C. Provide all necessary components for a complete system.

D. Label cable per 271000.

E. Use suitable cable fittings and connectors.

F. Provide additional power supply as need to power complete system with 20% spare capacity.

G. Ground and bond equipment and circuits in accordance with Division 26 requirements.

H. Provide protection for exposed cables where subject to damage.

I. All equipment wiring shall follow the balanced (three (3) conductor) configuration at all times.

3.2 TESTING AND ADJUSTMENTS

A. Test all conditions of public address system.

1. Equalize system using a 1/3rd octave frequency spectrum analyzer and pink noise signal generator. Equalize each zone separately.
2. Test all zones.
3. Test all inputs including telephone and class change tone generator.
4. Test priority-messaging (ducking) override functionality. Priority hierarchy must be coordinated with the Owner.

B. Adjust devices and wall plates to be flush and level.

C. Using an AC impedance meter or bridge, measure all loudspeaker circuits' impedance at 1.00 kHz while disconnected from the amplifier output and note the data. This will assure that the speaker circuits are free of faults and will not overload the amplifier.

D. Check for any buzzes, rattles or other sound system defects. Correct defects.

E. Provide two (2) operation/maintenance manuals to Owner. Include the following:
1. A written test report detailing all measured data in graphical form. These charts will be labeled with all units of measure shown.
2. As-Built Drawings and As-Built 1-line Drawings.
3. Software files used in programming all installed devices. This shall include un-compiled files, executables (*.exe) and preset files in a CD/ROM media format.
4. Owner's manuals of all devices installed. This shall include all relevant replacement parts lists and installation directions as provided by the Manufacturer.
5. One (1) week prior to the system demonstration, Technology Plus, Inc. Consultant must receive all documentation.

3.3 DEMONSTRATION

A. Provide systems demonstration.

B. Conduct walking tour of Project. Briefly describe function, operation and maintenance of each component.

C. Use submitted operation and maintenance manual as reference during demonstration.

D. The Contractor shall have all test equipment available during the system demonstration. Upon the request of the Technology Plus Inc., Consultant performance and confirmation of the stated results shall be able to be duplicated by the Contractor's Staff Audio Video Engineer within guidelines of operation and maintenance manuals.

E. The Contractor shall be financially responsible for all costs incurred by the Technology Plus Inc., Consultant due to system performance irregularities discovered during the demonstration phase of work. This shall include but not be limited to transportation, materials, lodging and the Technology Plus, Inc. Consultant's time.

3.4 OWNER'S PERSONNEL TRAINING

A. Provide two (2) sessions of two hours each covering operation and maintenance. The Contracted Audio Video Staff Engineer shall conduct the instruction and training.

B. Use submitted operation and maintenance manual as reference during training. Supplement with training materials, as required.

C. Provide written acceptance from Owner that the training met the Owner's requirements.

END OF SECTION 275113

SECTION 281300 - ACCESS CONTROL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Head-End Equipment and Components

B. Software

C. Door Controllers

D. Door Devices

E. Door Operation

F. Infrastructure

G. Raceway and Boxes

1.2 RELATED DOCUMENTS

A. Drawings, General and Special Conditions, and other Technical Specifications that apply to work of this section.

1.3 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 General Requirements, apply to this section.

B. Division 08: Openings

C. Division 26: Electrical

D. Division 27: Communications

E. Division 28: Electronic Safety and Security

1.4 REFERENCE STANDARDS

A. Materials and workmanship shall conform to the latest issue of all industry standards, publications or regulations referenced in this section and with the following references, as applicable.

1. Local Building Code
2. Local Electrical Code

3. NEC - National Electrical Code
4. UL – Underwriters Laboratories
5. ANSI – American National Standards Institute
6. NFPA – National Fire Protection Association
7. IEEE – Institute of Electrical and Electronics Engineers
8. TIA – Telecommunications Industry Association
9. EIA – Electronic Industries Alliance

B. If the requirements of these specifications or the Project Governing Drawings exceed those of the governing codes, regulations, and manufacturer installation requirements, then the requirements of these specifications and the drawings shall govern. However, nothing in the drawings or specifications shall be construed to permit work not conforming to all governing codes, regulations and manufacturer installation requirements.

1.5 SUMMARY

A. This section includes the Electronic Access Control System (EACS) as shown on the drawings. The work under this section consists of furnishing materials and equipment, performing labor and services necessary for the installation of the EACS as required for the Security System.

B. The intent of this Project is for the EACS and Video Surveillance System (VSS) Sections to be provided by a single Security Contractor (SC); if not in actuality, then contractors and sub-contractors shall function as a single SC. All materials and interfaces necessary shall be provided by the SC and sub-contractors to perform the features, functions and operating procedures required. This includes hardware, firmware and software, at no additional cost to the Owner.

C. The door hardware provider (Section 08) shall provide the proper and code compliant security door hardware. Connections to electronic locking mechanisms and all other devices connections will be made available in accessible locations by the hardware provider for use by the SC. Connections of the power supplies to the EACS and to the socketed door hardware equipment shall be by the SC. All doors controlled by the EACS will have, at minimum, a door position switch (DPS) and request-to-exit (REX) unless otherwise noted on the drawings.

D. Pricing shall disclose all software and maintenance costs, including on-going and/or annual requirements and “seat-based” costs for the consideration of the Consultant and selection by Owner. Features and functions specified herein shall be considered base bid and costs included unless otherwise stated by Vendor in proposal. Undisclosed costs or adders will not be allowed.

1.6 SYSTEM DESCRIPTION

A. SC to furnish and install all necessary electronic security devices and power supplies to make a complete and functional system as shown in the drawings and described in this section. SC to coordinate with GC on door preparation for security devices.

B. System control at the central computer location shall be under a single software program control, shall provide full integration of all components, and shall be alterable at any time, depending upon the facility requirements. Reconfiguration shall be accomplished through system programming, without hardware changes.

C. The EACS shall employ an open architecture, allowing communication between products from other approved manufacturers, as necessary.

D. Access control functions shall include validation based on time of day, day of week, holiday scheduling, automatic or manual retrieval of cardholder photographs, and access validation based on positive verification of card.

E. Utilizing assigned passwords and user groups, it shall be possible to define the levels of system operation for each individual user. User actions range from basic monitoring to full administrative control of the system database.

F. After installation, the Owner shall be able to perform administrative configuration changes, as desired, without the services of the manufacturer or SC.

G. Equipment repair shall be able to be accomplished on site, by module replacement, utilizing spare components.

H. The system shall be capable of utilizing the existing City LAN/WAN connections, RS-485 serial connections, or a dedicated security Ethernet network for controller/client communications.

I. Local, on-site monitoring and control shall be made available via SC provided computer workstation and client software.

J. The SC is responsible for coordinating with the City IT department on network connectivity. The SC shall not access the City LAN/WAN or make any modifications without written authorization from IT.

K. SC to coordinate with GC to provide compliant connections and interactions with the site fire alarm system, as required by local and NFPA code.

L. All exterior access controlled doors shall fail secure in the event of a catastrophic power failure. Doors shall allow free egress but restricted ingress. Exterior doors shall be keyed to allow ingress.

M. The SC shall furnish and provide back-up battery power to the EACS so that the system remains fully operational for a minimum of four (4) hours after loss of main power.

1.7 WORK INCLUDED

A. Provide all labor, materials and equipment for the complete installation of work called for in the Contract Documents.

1.8 WARRANTY AND SERVICE AGREEMENT

A. All equipment, materials and labor shall be guaranteed for a period of 12 months from the date of final acceptance by the Owner.

B. Provide any software maintenance updates or upgrades at no additional cost to the Owner for this period.

C. Perform two (2) scheduled preventative maintenance site visits during the warranty period.

D. Response Times: Normal business hours shall be 8 AM to 5 PM Monday through Friday. Calls for service before noon shall be responded to on-site before the end of the day. Calls after noon shall be responded to on-site by noon the following business day.

E. Provide extra costs for time outside of normal business hours if the Owner requires emergency service.

F. Submit an all-inclusive Annual Maintenance Agreement cost for years 2 through 5.

1.9 SUBMITTALS

A. Pre-approval of systems and products for bid proposal and permit:

1. Provide data for each type of product indicated. Data shall include marked-up catalog and specification sheets.
2. Provide system descriptions and manufacturer contact data.
3. Provide system and sub-system one-line drawings, point-to-point diagrams, door elevation drawings with connections, door schedule, sequence of operations, bill of materials and simplified operating features and functions.
4. Provide a narrative for the proposed system that details and responds to the specified system narrative herein on a topic by topic, feature by feature comparison.

B. Post-construction documentation:

1. Provide detailed as-built drawings, including locations for all security devices, wiring diagrams and door details.
2. Provide data sheets for each type of product installed.
3. Provide programmed sequence of operation for each type of door.
4. Provide three (3) complete O&M manuals with detailed system operation.
5. Provide warranty information for all installed products.

1.10 QUALITY ASSURANCE

A. All equipment rooms shall be installed in a neat and workmanlike manner.

B. Equipment and materials shall be the current production and quality of the manufacturers indicated.

C. Where "approved equal" or "approved alternate" is stated, the equipment shall be equivalent in every way to that of the equipment specified, subject to approval by the Owner.

D. The design, specifications and drawings reflect an engineered, integrated system. Details of any variances, whether betterments or shortcomings, to the specifications shall be fully disclosed and the Consultant must indicate acceptance prior to bid proposals being considered valid. Mitigation for shortcomings, in the judgment of the Consultant, will be required prior to

acceptance of any variances. If a variance has not been approved, the Integrator must remove the shortcoming and provide the specified feature or function.

1.11 QUALIFICATIONS

A. Installer Qualifications:

1. The EACS Installer shall meet all applicable regulations. The Contractor shall be a firm normally employed in the EACS or Security industry.
2. The Contractor must be certified by the manufacturer of the products, adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels.
3. The Contractor shall be certified by the manufacturing company in all aspects of design, installation and testing of the products described herein. Each Contractor shall furnish with their submittal a letter from the manufacturer indicating they are a dealer in good standing.
4. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of the specified systems and have personnel who are adequately trained in the use of such tools and equipment.
5. A resume of qualifications shall be submitted with the Contractor’s proposal indicating the following:
    a. A list of three (3) recently completed projects using the product proposed of similar type and size with contact names and telephone numbers for each.
    b. A technical resume of experience for the Contractor’s Project Manager and on-site Installation Supervisor who shall be assigned to this project.
    c. A list of technical product training attended by the Contractor’s personnel that shall install the EACS shall be submitted.

PART 2 - PRODUCTS

2.1 GENERAL

A. All products provided by Contractor shall be new and unused, and shall be of manufacturer's current and standard production.

B. Where two (2) or more equipment items of the same kind are provided, all shall be identical and provided by the same manufacturer.

C. Drawings and specifications indicate major system components, and may not show every component, connector, module or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory operation.

D. All equipment and materials used shall be standard components, regularly manufactured, regularly utilized in the manufacturer’s system.

E. Product Availability

1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed contract time.
2. Certain products specified may only be available through factory authorized dealers and distributors. Contractor shall verify his ability to procure the products specified prior to submitting a proposal.

2.2 CENTRAL SYSTEM COMPONENTS

A. System Management Software

1. The System Management Software (SMS) shall provide an intuitive GUI for performing all the necessary administrative and user tasks needed to for an operational EACS.
2. The SMS shall be loaded on a dedicated, manufacturer approved server or personal computer and meet the following minimum requirements:
    a. Open architecture system with options for integration
    b. Distributed intelligence, with controllers able to operate independently of one another
    c. Windows XP/Vista compatible
    d. Client/server or web client architecture
    e. Video badging software (as an option)
    f. Visitor management software (as an option)
    g. Comprehensive alarm handling software
    h. Dynamic, interactive site map
    i. Unrestricted cardholder capacity
    j. Wide range of non-proprietary reader support, including:
        1) Proximity
        2) Weigand
        3) Smart Card
        4) Mag Stripe
        5) Biometrics
3. Approved manufacturers:
    a. Andover. No other manufacturers will be approved.

B. Server Computer

1. There shall be one server computer located on-site as shown on the drawings. This computer shall have one (1) 17" monitor.
2. The computer shall meet the SMS Manufacturer's specified minimum requirements.
3. Approved manufacturers:
    a. Dell
    b. Gateway
    c. HP
    d. or pre-approved equal

C. Door Controllers

1. The door controllers shall incorporate microprocessor-based, digital technology using high speed processing for maximum reliability.
2. The system shall use distributed intelligence architecture, with controllers able to operate independently of one another.
3. All controllers must integrate with existing Denver Public Library system components and databases.
4. Approved Manufacturers:
    a. Andover. No other manufacturers will be approved.

2.3 SYSTEM CONFIGURATION

A. The head-end shall support one (1) server computer that may optionally be used as a full functioning Client. The system shall have the ability to support a minimum of five (5) remote Client computers with full system functionality.

B. Host Computer to Controller Communication Protocols.

C. The system shall utilize TCP/IP for communicating over dedicated or shared Ethernet networks. For 10/100/1000 Ethernet communications to the controller, install an Encrypted communications interface board in each controller.

D. Host Computer to Controller Communication Transmission Methods/Hardware

1. Communications between the computer and the controller shall be able to use any or all of the following methods:
    a. Hardwired
    b. Fiber Optic
    c. Ethernet 10/100/1000
    d. Dial-Up modem

2.4 DEVICES AND OPERATION

A. Contractor shall provide all necessary hardware and software interlocks to accomplish the following sequence of operation:

1. Normal Operation: When an authorized card is presented to a reader the EACS shall unlock the door, allow ingress and record the event. Free egress shall be allowed through all doors part of egress pathways.
2. Alarm Mode: If the doors are forced open or a conventional key is used, the EACS will record the event as a “Forced Door” alarm. If the door(s) are held open for longer than the programmed interval, the EACS will record the event as a “Door Held Open” alarm. The alarm mode will also apply to all designated non-card access exterior doors for intrusion detection. The system will output an alarm that will alert security personnel on site and at the Dispatch Center.

B. Door Security Devices

1. Card Reader:
    a. All card readers shall be of the proximity type.

b. Approved Manufacturers:
   1) Andover
   2) HID
   3) or pre-approved equal

2. Request To Exit
   a. All REX devices shall be passive infrared.
   b. Surface mounted
   c. Approved Manufacturers:
      1) Bosch; i.e.; (DSI60i)
      2) or approved equal

3. Door Position Switch
   a. All DPS shall have the ability to be supervised.
   b. The preferred DPS for man doors is a flush mounted unit.
   c. DPS for bay doors shall be rail mounted. Floor mounted DPS shall not be accepted.
   d. Approved Manufacturers:
      1) Sentrol
      2) or pre-approved equal

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall be performed by skilled technicians under the direction of experienced supervisors, all of whom shall be properly trained and qualified for this work.

B. Andover Security Project Manager may visit the job site and inspect the EACS installation at any time during the project.

C. Penetrations:

1. Attempt to avoid work in finished areas. Holes drilled in finished surfaces shall be patched and repaired so that there is no noticeable defect in the surface.
2. Do not drill any structural beams, columns or walls without the permission of the Architect.
3. Do not modify any UL fire-rated door or frame in any way.
4. Seal conduit penetrations through exterior walls.
5. Fire caulk (where required) the interior and exterior of conduit sleeves after all wiring has been placed and the system has been tested.

3.2 EXAMINATION

A. Examine pathway elements intended for cable. Check raceways, cables trays and other elements for compliance with space allocations, installation tolerances, hazards to cable installation and other conditions affecting installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 COLLABORATION

A. The Integrator shall collaborate with the Owner and technology consultant to plan the precise function and security schema. Further, the authentication levels and assignments, as well as, the access control policies and procedures and all other options shall be designed in conjunction with the Owner's needs.

B. The SC shall present the plan for the Owner and Consultant's approval prior to implementation.

3.4 INSTALLATION

A. Outdoor Installation: Comply with ANSI C2, "National Electrical Safety Code."

B. Install surge suppressors where ac-power-operated devices are not protected against voltage transients by integral surge suppressors specified in UL 1449. Install surge suppressors at the devices' power-line terminals.

C. Low-Voltage and COMM/DATA Equipment

1. Install EACS equipment according to manufacturer's recommendations.
2. All electronic equipment/systems utilizing cord, plug or hardwired connectors shall be bonded to the building electrical system ground, building frame or driven ground rod and shall be provided with a multi-stage suppression system.
3. Contractor must properly match EACS equipment to equipment being protected, including wire sizes, operating voltages, currents and number of conductors.
4. Contractor must coordinate with providers of all equipment being protected and provide EACS equipment which meets these specifications.
5. Equipment shall be installed following manufacturer's recommendations and guide-lines in compliance with NEC Articles for grounding and bonding, and NEC Articles for over-current protection.
6. Provide required enclosures (indoor or outdoor) for equipment.

D. Where shown on the plans, or as required by the specifications, ensure that the power source for each system is from the facility UPS units or SC provided UPS.

E. Wiring Method: Install cables in conduit and basket tray. Cable shall be run in conduit, stubbed up into open ceiling space and then shall route to appropriate telecom room via low-voltage cable tray.

F. Wiring Method: Install cables concealed in accessible ceilings, walls and floors where possible. All cabling shall be routed in a clean and efficient manner. There shall be no exposed cable outside of the device.

G. Wiring within Enclosures: Bundle, lace and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

H. Pulling Cable: Do not exceed manufacturer's recommended pulling tensions. Do not install bruised, kinked, scored, deformed or abraded cable. Do not splice cable between termination, tap or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

I. Exposed Cable: Install parallel to building lines, follow surface contours and support the cable according to manufacturer's written instructions. Do not run adjacent and parallel to power or data cables.

J. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL486A and UL486B.

K. Grounding: Provide independent signal circuit grounding recommended by manufacturer.

L. Collection Boxes: Provide one (1) 8”x8” collection box for each access controlled door. Locate collection boxes above the corresponding door and always on the secured side of the door. All collection boxes shall be equipped with a tamper switch.

3.5 LABELING

A. Label all cables using approved scheme. Label horizontal cables at the device and equipment chassis within 12” of termination. Affix labels in a visible location. All labels must be machine made and permanently attached. Label access control interface cables on both ends with door number. Label all equipment chassis per approved labeling scheme.

3.6 FIELD QUALITY CONTROL

A. Inspection: Verify that units and controls are properly installed, connected and labeled and that interconnecting wires and terminals are identified.

B. Test Schedule: Schedule tests after pretesting has successfully been completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days notice of test schedule.

C. Operational Tests: Perform operational system tests to verify that system complies with specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.

3.7 OPERATIONAL INSTRUCTION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain EACS equipment.

B. Train Owner's maintenance personnel on procedures and schedules for troubleshooting, servicing and maintaining equipment.

C. Demonstrate methods of determining optimum alignment and adjustment of components and settings for system controls.

D. Schedule training with Owner, through Architect, with at least seven days advance notice.

3.8 ON-SITE ASSISTANCE

A. Occupancy Adjustments: When requested by Owner within one year of date of substantial completion, provide on-site assistance in tuning and adjusting the system to suit actual occupied conditions and to optimize performance. Provide up to two adjustments at project site for this purpose, without additional cost.

END OF SECTION 281300

SECTION 281600 - INTRUSION DETECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

B. Division 26 - Electrical.

1.2 GENERAL REQUIREMENTS

A. Programming and Configuration

1. All intrusion points and panic alarms shall report to the intrusion panel located on the IT Room.
2. Configure panel to dial to central monitoring station, coordinate with owner.
3. Program three user codes for Owner use. Coordinate exact codes with Owner. Program one service code. Delete or disable all factory default codes. Provide Owner with written description of all programmed codes.
4. On as-builts clearly show device point identifier(s) and any zoning. Submit device numbering scheme for approval prior to installation.
5. Coordinate contact and response information with Owner.

B. EEPROM Memory: Alarm panel shall be equipped with EEPROM memory to retain all program information even if all AC and battery power is lost and shall have integral static and lightning protection circuitry.

C. Communications Bus: System shall be complete with a 4 wire unshielded (QUAD) communications bus (KEYBUS) that allows system expansion modules for features, zones, and outputs to be added anywhere on the bus up to 1,000 feet (305m) per leg from the main control panel.

D. Alarm Communications: Alarm panel shall be complete with integrated digital communicator capable of being programmed to transmit to three phone numbers or locations with two account numbers. System communicator shall be capable of communicating in all major formats including SIA and Contact ID. Events transmitted shall be programmable to include: fire alarms, burglar alarms, trouble alarms, supervisory conditions, alarm restore codes, opening (disarming) and closing (arming) codes, partial closing codes, and opening after alarm codes. System shall be capable of paging personnel on occurrence of any preceding events selected by Owner.

1. Communicator shall be capable of supervising the telephone line and support and supervise LINKS cellular and long range radio communication with three telephone numbers for backup or sole communications to monitoring stations and for upload download operations.

2. System shall support and supervise dual telephone lines.
3. System shall be capable of DVACS communication.
4. System shall be capable of transmitting a test code to the monitoring station(s) on a programmable daily, weekly or monthly frequency at a regular time of day.

E. Alarm Zone Types

1. System shall be complete with a multi-zone alarm system with a capacity for 32 burglar or Class B fire zones in any combination from up to 32 standard hardwired zones, 8 keypad zones, and 32 wireless zones. All zones shall be supervised and be programmable as 1 of 27 zone types. System shall also accommodate 2 Class A supervisory water flow zones and 1 ground fault detection zone as part of the 32 zone capacity.
2. System shall allow 'stay/away' zone programming and 'stay' arming to allow the user to remain on the premises while the system is armed. A quick-arm feature shall allow users without access codes to arm the system and exit. A door chime feature shall cause the keypad to beep when a selected door in a partition is opened or secured.

F. Partitions: System shall allow up to four partitions, each acting as a separate alarm system with its own zones, user codes, and keypads for programming, arming and disarming. Each partition shall be programmable to Auto-Arm at different times on every day of the week.

G. Auxiliary Power: System shall be capable of providing up to 1.55 amps of 12.5 VDC auxiliary power for modules and alarm devices.

H. Programmable Outputs: System shall have a capacity for 9 low current 50mA programmable outputs; and 5 high current 300mA programmable outputs of which one may be fully supervised for an additional siren. All outputs shall be programmable to activate for 1 of 24 options.

I. Audible Alarm Output: Main alarm panel shall include a 700mA, PTC protected, supervised bell/siren circuit that will drive a bell/siren until reset or silenced. Siren output shall be programmable as steady, temporal pattern, CA pattern, pulsed or strobe fire output for each zone. An additional 700mA alarm output shall be provided by using one of the systems high current programmable outputs.

J. System Supervision: System shall continuously monitor the following trouble conditions:

1. AC power failure
2. Trouble by zone
3. Telephone line trouble
4. Low battery
5. Bell output trouble
6. Loss of internal clock
7. Tamper by zone
8. Fail to communicate
9. Aux power supply fault

K. False Alarm Prevention: Alarm panel shall include the following false alarm prevention features:

1. Audible exit delay
2. Audible exit fault

3. Quick exit
4. Urgency on entry delay
5. Swinger shutdown
6. Cross zone alarm
7. Recent closing transmission
8. Burglary verified timer
9. Double hit timer
10. Communication delay
11. Rotating key press buffer
12. Arm/disarm bell squawk

L. Access Codes: System shall allow 38 - 4 or 6 digit - access codes composed of 1 system master code, 2 partition master codes, 2 duress codes, and 1 maintenance code.

M. Hardwired Keypads: Provide keypads as indicated herein and the drawings. System shall support any combination of up to 8 LCD and LED type keypads, each with an alarm zone input to allow an alarm zone to use keypad wiring for connection to the alarm panel. Keypads shall be surface mounted and capable of fully programming and operating the system. Each keypad shall be assignable to operate the entire system or an individual partition.

1. Provide LCD keypads. LCD keypads shall be complete with 32 character liquid crystal display (LCD) to provide plain language programming instructions, operating instructions and display of all alarms and supervisory conditions. In addition they shall be multi-language, capable of toggling between languages by pressing a key combination on keypad. Languages shall be specified at time of order.
2. All keypads shall have 5 programmable function keys with 25 program options.
3. All keypad keys and displays shall be backlit and include backlighting boost to provide extra high key lighting when any key is pressed.
4. All keypads shall have rotating keypress buffer to reduce access code entry false alarms. Keypads shall be programmable to lock out if a series of incorrect access code entries are made.
5. All keypads shall have keypad activated emergency alarms for panic, auxiliary, fire, and duress; LED indicators for Ready, Armed, and Trouble or Status; and shall be equipped with a Piezo Buzzer to provide audible feedback for correct key entries, pre-alert, and trouble.

N. Upload/ Download: System shall be uploadable/downloadable to allow programming and operation from a directly connected local computer or from a remote computer over a telephone line or LINKS cellular communications equipment. Remote access shall be controlled by Owner to prevent unauthorized access.

O. Approvals: System shall meet UL and ULC standards as required for type of application.

1.3 INTENT OF DRAWINGS

A. The drawings are diagrammatic unless detailed dimensions are included. Drawings show close approximate locations of equipment and devices. Exact locations are subject to the approval of Owner and Owner’s representative.

B. Anything mentioned in the specifications and not shown in the drawings, or shown in the drawings and not mentioned in the specifications, shall be of like effect as if shown and mentioned in both. In case of differences between the specifications and drawings, the stricter provision, as determined by the project coordinator, shall govern. Omissions from the drawings or specifications, or the incorrect description of details of work which are evidently necessary to carry out the intent of the drawings and specifications, shall not relieve the contractor from performing such work.

1.4 SUBMITTALS

A. Submittals shall include product data literature and adequate descriptive literature, catalog cut sheets, and other data necessary for the Technology Designer and Architect/Engineer to ascertain that the proposed equipment and materials comply with the specification requirements.

B. Product data submittals shall consist of technical data sheets, manufacturers' specifications, illustrations, standard schedules, performance charts, instructions, brochures, diagrams and test data furnished to illustrate a product, material or system for the work to be performed. Product data literature is required on all items of material and equipment and shall be clearly marked, identifying specific items proposed.

C. Clearly indicate on each submittal set the items being submitted by marking or highlighting each item to clearly indicate to the reviewer items being submitted.

D. Provide submittals in quantities requested by the architect, engineer or general contractor. Provide submittals with bid responses if so requested.

E. Prior to assembling or installing the work, shop drawings shall be submitted for review and approval.

F. The Security Contractor shall not purchase any materials or equipment for incorporation into the project prior to receipt of reviewed Submittals from the Technology Designer and/or Architect/Engineer.

G. Review of product data shall not relieve the Security Contractor from responsibility for deviations from the drawings or specifications, unless the Contractor has, in writing, called attentions to such deviations at the time of submission and secured written approval.

H. The Security Contractor shall develop and submit complete Submittals and do so in a timely manner. By failing to do so, the contractor agrees to be fully responsible for any and all damages, which might be incurred through the failure to do so.

I. Samples may be requested; which shall be physical examples, which represent materials, equipment or workmanship and establish standards by which the work will be judged.

J. Provide line item pricing to include; manufacturer, model number/part number, unit price and extended price. Provide break out of all labor costs and detail all miscellaneous costs to include tax and permits.

1.5 QUALITY ASSURANCE

A. All equipment shall equal or exceed the minimum requirements of NEMA, ASME, ANSI and Underwriters Laboratories.

B. All material and equipment furnished shall be new, unused and free from defects. Equipment shall be clean and free of damage and corrosion, and shall be of the best quality obtainable for the purpose intended.

C. Where more than one of any specified item of equipment or material is required, such items shall be the product of one manufacturer throughout the facility.

D. All materials used shall bear labels attesting to Underwriters Laboratory approval, provided a standard is established for the material in question.

E. All materials shall conform strictly to the standards and specifications set forth in this document. Unless otherwise specified, all products furnished shall be designed, built and installed in accordance with the latest and best practice of the electrical and telecommunications industry, and shall conform to the standards of the NEMA, ANSI, TIA/EIA, ICEA, IEEE, NEC and this Specification wherever they apply.

1.6 PROTECTION OF MATERIALS AND EQUIPMENT

A. Materials and equipment shall be protected from damage during shipment, storage at the site and throughout the construction period. No damaged items shall be installed and immediate steps shall be taken to obtain replacement so as not to interrupt construction schedule.

B. Coordinate site storage of materials and equipment with the General Contractor or Owner.

C. If required by the General Contractor, provide a lockable container for material and equipment storage.

1.7 SITE SAFETY AND ACCESS

A. Determine from General Contractor all job site requirements such as site access, parking and material storage areas.

B. All technicians working on the job site must follow all safety rules set by the General Contractor. All technicians must furnish their own safety equipment including, but not limited to, hard hats, safety glasses, proper footwear (confirm if steel toed boots/shoes are required), fall arrest equipment and safety vests. All safety equipment must be in good working order.

C. Attend all safety orientations and meetings as required by General Contractor.

D. Provide to General Contractor an up to date MSDS binder listing materials planned for use on the job site that require MSDS information. Provide the number of copies requested.

PART 2 - PRODUCTS

2.1 GENERAL

A. All material shall be new and UL listed and free from damage or defects. The Security Contractor shall furnish all materials as required. The Security Contractor is responsible for furnishing any appropriate material needed for proper installation of the systems. Refer to the specification drawings for further information and requirements.

2.2 PRODUCTS

A. System shall be based on products manufactured by Bosch or approved equal. System shall include a Bosch D7412G Control Communicator panel, associated zone control modules, Command Center (Keypad), UL listed power supplies, Popits, and all additional material needed to form a complete system. Provide auxiliary power supplies including but not limited to D8132 power extender(s) for keypads, and 12VDC power supplies for detection devices. Power supplies must support 200% of the actual anticipated load.

B. The popit module shall be Bosch D91 27U or approved equal.

C. Cabling shall be provided and installed in accordance with manufacturer's specifications and recommendations. Unless otherwise indicated all cable shall be plenum rated.

D. Modem shall operate at 9600 baud and shall be approved for use in this application.

E. System shall be partitioned to allow individual zone, multiple zones, and global zone arming and disarming. Coordinate zone requirements with Owner.

F. The ceiling mounted passive infrared motion detectors shall be Intellisense IS-280 CM series or approved equal.

G. Glass break detectors shall be Bosch DS1100i series or approved equal.

H. Under desk panic button shall be Potter Hub series hold – up button approved equivalent or better.
   1. Button shall be colored red and be momentary.
   2. Switch rating shall be 3amps at 28V DC/AC and .05amps at 125VDC resistive.
   3. Enclosure shall be ABS plastic.
   4. Temperature Range shall be 0-60 C.
   5. Button assembly shall be UL and ULC rated.
   6. Clearly label each button.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide a complete and functional Intrusion Detection System as described within these specifications and drawings. Systems shall be installed utilizing good wiring and grounding practices, in accordance with local and national codes and acceptable to Architect. Local and national life safety and fire codes shall be strictly followed where applicable. Provide system using skilled workmanship.

B. Provide all miscellaneous conduit and power wiring required for a complete installation. Refer to drawings for further installation notes and requirements.

C. Provide system start-up, testing and programming. Provide programming to meet Owner and Architect's requirements.

D. Securely fasten and anchor all components at locations indicated on drawings. Provide coordination with other trades and wall finishes.

E. Prior to system installation, submit detailed configuration and programming plan for review and approval by Owner and Architect.

3.2 SYSTEMS ACCEPTANCE

A. Final Systems Acceptance will require:

1. Completion of all contracted work
2. Submission of all system documentation including, but not limited to, user manuals, completed warranty registration documents, hard and electronic copy as-builts, hard and electronic copy test results correction/re-test reports and other documents as required in Division 1 and other applicable areas.
3. Completion of the training requirements.

END OF SECTION 281600

SECTION 282300 - VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Head-End Equipment and Components

B. Peripheral Devices

C. Infrastructure

D. Raceway and Boxes

1.2 RELATED DOCUMENTS

A. Drawings, General and Special Conditions, and other Technical Specifications that apply to work of this Section.

1.3 RELATED SECTIONS

A. Division l - General Requirements

B. Division 26 - Electrical Specifications

1.4 REFERENCE STANDARDS

A. Materials and workmanship shall conform to the latest issue of all industry standards, publications or regulations referenced in this section and with the following references as applicable.

1. NEC - National Electrical Code
2. NFPA 101 - National Life Safety Code
3. NFPA 72 – National Fire Alarm Code
4. IEEE
5. NTSC

1.5 OVERVIEW

A. Video surveillance cameras and network video recording (NVR) is required in select areas where hallways and specific rooms require monitoring in the facility. The system must be able to communicate with the access control system to react to alarm and other selected events. This section outlines the minimum requirements for a complete video surveillance and recording system.

1.6 SUMMARY OF WORK

A. The video surveillance camera monitoring and recording system (hereinafter referred to as the VSS) shall be designed, engineered, furnished, delivered, installed and tested to ensure it is fully operating and free of engineering, installation, system operation and Original Equipment Manufacturer (OEM) defects that provides a complete working "turnkey" installation.

B. The system shall allow for the addition of future VSS cameras and monitors by adding appropriate transmission lines and equipment at each location.

C. All patch cords, installation, termination, grounding testing, labeling and documentation are included in the work. The NVR equipment will be mounted in 19” inch racks and should be configured accordingly.

D. NVR servers will be provided and configured by the SC.

E. Client PC and monitor will be supplied by Denver Public Library and configured by the SC.

F. Category 6 UTP cable will connect the cameras to the NVR

G. Cameras shall be powered by Power over Ethernet (PoE) with the exception of PTZ cameras. Low voltage power cables will be allowed to be routed in the same conduit as the respective camera video cable.

H. The Electrical Contractor (EC) is responsible for furnishing and installing all conduit, junction boxes and standard back-boxes, as required for both low voltage power and video wiring of the entire VSS.

I. The EC is responsible for furnishing and installing all 120 VAC circuits where required.

J. The Structured Cable Contractor (SCC) is responsible for furnishing and installing all VSS low voltage, control and communications wiring. The responsibility matrix shown on the T Drawings shall be the final determination of system and installation responsibility.

K. The Security Contractor (SC) is responsible for furnishing, installing and terminating all VSS electronics equipment and patch cords.

L. The SC shall provide all final programming, testing and commissioning of the VSS. The SC shall provide all other equipment and components to make a complete, functional and operating VSS, as described by this Section.

1.7 QUALITY ASSURANCE

A. A usable video signal must be available at the NVR under all lighting conditions expected.

B. All equipment shall equal or exceed the minimum requirements of NEMA, ASME, ANSI and Underwriters Laboratories.

C. All material and equipment furnished shall be new and unused and free from defects. Equipment shall be clean and free of damage or corrosion, and shall be of the best quality obtainable for the purpose intended.

D. Where more than one of any specified item of equipment or material is required, such items shall be the product of one manufacturer throughout the facility.

E. All materials used shall bear labels attesting to Underwriters Laboratory approval, provided a standard is established for the material in question.

F. All materials shall conform strictly to the standards and specifications set forth in this document. Unless otherwise specified, all products furnished shall be designed, built and installed in accordance with the latest and best practice of the electrical industry, and shall conform to the standards of the NEMA, ANSI, TIA/EIA, ICEA, IEEE, and NEC, and this Specification wherever they apply.

G. Contractor personnel shall be qualified to perform the work and be knowledgeable in the following standards, skills, and activities, as applicable:

1. TIA/EIA 568B, 569B, 606A and 607A Standards.
2. Bonding and grounding where required.
3. Testing conductors for electrical continuity.
4. Testing copper and fiber circuits for performance compliance.
5. Cable terminations for specified connectors and terminations for copper and fiber cables.

H. Contractor personnel will be required to provide and use the proper tools in the performance of each activity. The tools must be in good working order. The Owner reserves the right to review the tool lists and tool maintenance procedures of the Contractor.

1.8 WARRANTY AND SERVICE AGREEMENT

A. All equipment, materials and labor shall be guaranteed for a period of 24 months from the date of final acceptance by the Owner.

B. Provide any software maintenance updates or upgrades at no additional cost to the Owner for this period.

C. Perform two (2) scheduled preventative maintenance site visits per year during the warranty period.

D. Response Times – Normal business hours shall be 7 AM to 5 PM Monday through Friday. Calls for service before noon shall be responded to on-site before the end of the day. Calls after noon shall be responded to on-site by noon the following business day.

E. Provide extra costs for time outside of normal business hours if the Owner requires emergency service.

F. Submit an all-inclusive Annual Maintenance Agreement cost for years 3 and 4.

G. Submit normal and after hours labor costs and typical costs for equipment for items not covered under the Warranty, like: Acts of God, vandalism AND MISUSE.

1.9 SUBMITTALS

A. Pre-approval of systems and products for bid proposal:

1. Provide data for each type of product indicated. Data shall include marked-up catalog and specification sheets.
2. Provide system descriptions and manufacturer contact data.
3. Provide system and sub-system one-line drawings and simplified operating features and functions.

B. Project bid response:

1. Provide data for each type of product indicated. Data shall include marked-up catalog and specification sheets.
2. Provide complete system-by-system material list, including software and hardware/firmware software modifications.
3. Provide system and sub-system descriptions, one-line and rack drawings, including applicable detail sheets.
4. Provide complete information on each sub-system. Information shall include system descriptions, operating manuals, programming manuals and system diagrams.
5. Provide pricing, including options, according to the Technology Systems' spreadsheet form.
6. Provide complete manufacturer/integrator/contractor information:
    a. Manufacturer's acceptance/approval of Integrator's proposed systems.
    b. Manufacturer's certification of the approved vendor status of the bidder.
    c. Copies of certifications of Integrator's staff.
    d. Copy of applicable licensure.
    e. Basic and escalation contact information of vendor.
    f. Information required under qualifications in the related documents.

1.10 APPROVALS

A. All Submittal Documents shall be provided as indicated for review by the Design Engineer and the Owner.

B. Obtain all necessary approvals for materials to be supplied, location of devices, and methods of installation as required herein, prior to beginning any work under this Specification Section.

1.11 PROJECT RECORD DOCUMENTS

A. As-Built Drawings indicating final and accurate locations for all devices, conduit routing, junction boxes, wiring, splices, etc. Include wire color-coding and their uses.

B. Written descriptions of all Power Supplies and what they serve. Permanently label all Power Supplies as identified on Record Documents.

C. Operation and Maintenance Manuals for all furnished equipment and components.

1.12 DELIVERY, STORAGE. AND HANDLING

A. Deliver, store and protect all products under provisions of Division 1.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials and installation techniques used shall be per industry standards.

B. All systems and components shall have been thoroughly tested and proven in actual use.

C. Specifications of equipment as set forth herein are minimum requirements, unless otherwise stated, and shall not be construed as limiting the overall quality, quantity, or performance characteristics of items furnished in the system. When the Contractor furnishes an item of equipment for which there is a specification contained herein, the item of equipment shall meet or exceed the specification for that item of equipment included in this section.

D. Product Substitutions

1. No deviations from the Specified Manufacturer's Products will be allowed.
2. Contractor(s) may submit requests for approval of equal products or materials. Written requests shall be submitted to the Owner and Design Engineer for review within the specified time before the Bid with the exception of the network video management software.
3. No requests for substitutions will be considered after the Bid Opening.

2.2 CAMERAS

A. Provide IP cameras with the following characteristics:

1. Cameras shall have the ability to provide multi-stream video outputs and the recording stream shall be selectable to use either MPEG-4 or H.264. H.264 being preferred for indoor use.
2. Cameras shall be able to produce at a minimum 640x480 resolution at 10 ips when using H.264 compression.
3. Cameras shall be of the day/night type.
4. Certain cameras as shown on the drawings shall be of Wide or Super Dynamic Range type.
5. Fixed cameras shall be vandal resistant mini-domes.
6. Cameras shall have vari-focal lenses.
7. Components shall meet the requirements of all appropriate codes and listing agencies (i.e. FCC, UL, NEC).
8. Cameras shall provide purpose-built, secure mounting hardware for suspended ceiling installations and for other ceiling and wall condition as may be found. Coordinate blocking requirements with the General Contractor.
9. Exterior mini-dome cameras shall be pendent mounted unless otherwise noted.

10. SC shall coordinate all Device locations, mounting heights and wire installation requirements with the EC, TC, GC and the Owner.

B. Manufacturer:

1. Pelco
2. Sony
3. Panasonic
4. Axis
5. or approve equal

2.3 NVR HARDWARE

A. SC shall provide the NVR server with the following hardware characteristics:

1. The NVR shall incorporate the server functions and storage elements into a single, purpose-built chassis.
2. The NVR shall use RAID 6 parity across the storage drives to protect recorded data against a hard disk drive failure.
3. The NVR chassis shall be designed for video surveillance recording applications and encompass redundancy at all vital points:
   a. Redundant, hot swappable power supply modules
   b. Redundant, hot swappable system fans
   c. Hot swappable O/S drive
   d. Hot swappable rear chassis fans
4. The NVR shall be Linux based.
5. The NVR shall support a guaranteed recording throughput of 250 Mbps per storage device with a minimum of 64 Mbps of read throughput. This throughput shall be guaranteed under normal and error (RAID rebuild) conditions.
6. The NVR shall support the recording of MPEG-4 and H.264 baseline, main, and high profile streams from standard resolution and megapixel cameras.
7.
8. The hard disk array on the system must provide a minimum of 30 days of video retention.
9. Video storage will be 7.5 FPS at 4 CIF.
10. Calculations must be provided to show justification of amount of disk storage proposed.
11. The system shall be rack mountable in a standard 19” rack.
12. The system shall be connected to Denver Public Library’s LAN/WAN.

B. Manufacturer:

1. Pelco

2.4 NVR CONTROL SOFTWARE

A. Provide NVR Control Software with the following characteristics:

1. EnduraXpress by Pelco

2.5 UPS FOR NVR

A. There will be a centralized UPS supplying power to all rack mounted equipment by others.

2.6 VSS MONITOR

A. 22” wide screen format

B. Connect composite video input to the local UTP Receiver, for video signal reception from the NVRs monitor output

C. Manufacturer:

1. Pelco

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall be performed by skilled technicians under the direction of experienced supervisors, all of whom shall be properly trained and qualified for this work.

B. GC Security Project Manager may visit the job site and inspect the VSS installation at any time during the project.

C. Penetrations:

1. Attempt to avoid work in finished areas. Holes drilled in finished surfaces shall be patched and repaired so that there is no noticeable defect in the surface.
2. Do not drill any structural beams, columns or walls without the permission of the Architect.
3. Do not modify any UL fire-rated door or frame in any way.
4. Seal conduit penetrations through exterior walls.
5. Fire caulk (where required) the interior and exterior of conduit sleeves after all wiring has been placed and the system has been tested.

3.2 CONDUIT AND RACEWAY

A. All wiring shall be concealed. Surface raceways should only be used in finished spaces.

B. The EC is responsible for furnishing and installing conduit, junction boxes, pull boxes, etc. where required to conceal all cabling for both power and video circuits of the entire System. All conduit installed shall be minimum ¾” unless otherwise specified.

C. All conduits shall be installed with pull boxes at a minimum of every 100 feet. Multiple VSS cables and wiring may be run in the same conduit.

D. All boxes shall be fitted with removable covers, including any unused boxes. Identify all VSS Junction and Pull Boxes with a blue letter "S" in permanent marker, centered on the cover.

E. Where wiring is installed exposed in classrooms, offices, and all other finished areas, provide Panduit raceways with compatible fittings.

F. Comply with all requirements of Division-26 Specifications.

3.3 WIRING

A. The EC is responsible for furnishing and installing all 120VAC circuits where required. The EC shall furnish and install all 120VAC hard wired connections and duplex outlets as necessary to provide a complete Power System for the VSS.

B. The TC is responsible for furnishing and installing all VSS wiring for both low voltage power and video circuits.

C. Conductors within enclosures shall be carefully cabled and laced. All cables shall be identified with printed wire markers.

D. Visually inspect wire and cable for faulty insulation before installation. Protect cable ends at all times with acceptable end caps except during actual termination. Protect wire and cable from kinks. Provide grommets and strain relief material where necessary, to avoid abrasions or excess tension on wire and cable.

E. All wiring shall be concealed. Surface raceways should only be used in finished spaces if required. Use plenum-rated cable in all accessible ceiling spaces. Plenum wiring may be installed in accessible areas where not exposed to view or subject to physical damage. Plenum-rated cable should be used throughout the system, regardless of routing.

F. Plenum wiring will not be spliced outside of control devices unless absolutely necessary. If plenum wire splicing is approved, then it must be done within an approved enclosure containing wire nut connections located in an accessible area. Identify boxes with a blue letter "S" painted, stenciled or with permanent marker, centered on cover.

G. Identification and Tagging

1. All cables and wires shall be properly identified on both ends.
2. Provide temporary stickers or tags on ceiling grid to indicate where devices are to be installed later for the VSS.
3. Label all cables using owner approved scheme. Label horizontal cables at the device and equipment chassis within 12” of termination. Affix labels in a visible location. All labels must be machine made and permanently attached. Label video surveillance cables on both ends with room/door number. Label all equipment chassis per owner approved labeling scheme. Installer/contractor name or advertising labels are prohibited on any devices in public view.

H. Wiring Protection & Splicing: TC and EC shall comply with all Division-26 requirements.

I. Wiring shall not be attached to wiring of other systems, sprinkler pipes, or other objects that may cause interference, life safety problems or inconvenience to other trades.

J. VSS wiring shall be supported directly from the building structure or permanent walls using appropriate hangers.

K. VSS wiring shall be separated a minimum of 6" from line voltage electrical wiring, telephone wire, data wiring, etc. Plenum cable shall be routed no closer than 12" (300 mu) from any fluorescent or high discharge electrical lighting, and 4'-0" from voltages and transformers greater than 600 volts.

L. Grounding:

1. Grounding shall be per manufacturer's written recommendations, and shall also be fully coordinated with the Owner.

M. Wiring requirements:

1. Provide the following:
   a. Provide one CAT-6 plenum-rated cable from each Camera to the local Tele-Com LAN Patch Panel Equipment, located in the MDF and IDF room(s), as indicated on the drawings. Connect from patch panel to network POE switch.
   b. Provide any additional wiring as indicated on the drawings.

N. Comply with all requirements of Division-26 Specifications.

3.4 EQUIPMENT & DEVICES

A. All final device locations and back-box requirements shall be verified in the field prior to rough-in.

B. SC shall provide and install all other miscellaneous Equipment and Components to make a complete VSS, as described by this Section.

3.5 COMMISSIONING

A. The SC shall perform all final System programming, testing and commissioning.

B. Demonstrate integration and interoperability with the Access Control System

3.6 WARRANTY

A. Provide a minimum 2 year warranty on the entire installation.

B. Provide copies of all manufacturer warranties.

C. Provide documentation detailing how to obtain warranty service. Provide names, phone numbers, email addresses, response time information, after hours support policies and other relevant information.

3.7 TESTING AND REPORTS

A. When work under this Specification Section is complete, TC shall test continuity of all wiring to verify point to point labeling. Provide written documentation of test results which indicate that all wiring is free of shorts, opens, and grounds on any conductor and/or shield.

B. TC shall repair or replace any cable or wiring failing any test.

END OF SECTION 282300

SECTION 282600 - ELECTRONIC PERSONAL PROTECTION SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. System Description

B. Contractor Requirements

C. Control Equipment and Components

D. Peripheral Devices

E. Infrastructure

F. Raceway and Boxes

G. System Acceptance

1.2 RELATED DOCUMENTS

A. Drawings, General and Special Conditions, and other Technical Specifications that apply to work of this Section.

B. Division 26 - Electrical Specifications.

1.3 SUMMARY

A. This section includes the technical specifications for an Electronic Personal Protection System (EPPS), as shown on the design drawings. The work under this section consists of furnishing materials and equipment, and performing the required labor necessary for the installation of a complete EPPS.

1.4 REFERENCE STANDARDS

A. Materials and workmanship shall conform to the latest issue of all industry standards, publications, or regulations referenced in this section and with the following references as applicable.

1. Local Building Code
2. Local Electrical Code
3. NEC - National Electrical Code
4. UL – Underwriter’s Laboratories
5. ANSI – American National Standards Institute
6. NFPA – National Fire Protection Association

7. IEEE – Institute of Electrical and Electronics Engineers
8. TIA – Telecommunications Industry Association
9. EIA – Electronic Industries Alliance
10. NTSC – National Television System Committee
11. ADA – Americans with Disabilities Act

B. Codes and Conflicts: If the requirements of these specifications or the Project Governing Drawings exceed those of the governing codes, regulations, and manufacturer installation requirements, then the requirements of these specifications and the drawings shall govern. However, nothing in the drawings or specifications shall be construed to permit work not conforming to all governing codes, regulations, and manufacturer installation requirements.

1.5 SYSTEM DESCRIPTION

A. EPPS will communicate via a wireless repeater network. The Security Contractor (SC) is responsible for an RF survey and final location of all repeaters in order to provide essential system communication for the site.

B. The SC is responsible for all materials and labor required for a complete and functional system with exception to high-voltage electrical work, which shall be provided as necessary by the Electrical Contractor (EC).

C. All panic buttons shall be addressable so that the system annunciates the name and location of the activated button.

D. All major system components shall utilize battery back-up so that the system will remain completely operational for a minimum of thirty (30) minutes in the event of total power loss.

1.6 WORK INCLUDED

A. Provide all labor, materials, and equipment for the complete installation of work called for in the Contract Documents.

1.7 SUBMITTALS

A. Pre-approval of systems and products for bid proposal:

1. Provide data for each type of product indicated. Data shall include marked-up catalog and specification sheets.
2. Provide system descriptions and manufacturer contact data.
3. Provide shop drawings to include floor plans with all device locations and complete system one-line drawings.

B. Post-construction documents:

1. Provide a complete set of as-builts, to include wiring diagrams and floor plans with final device locations for all system components.
2. Provide warranty information for all main system components, cabling and workmanship.

3. Provide a complete O&M manual to include datasheets for all installed components, system operations manual, and troubleshooting guide.

1.8 QUALITY ASSURANCE:

A. All equipment shall be installed in a neat and workmanlike manner.

B. Equipment and materials shall be the current production and quality of the Manufacturers indicated.

C. The intent is to establish a standard of quality, function and features. It is the responsibility of the bidder to insure that the proposed product meets or exceeds every standard set forth in these specifications.

1.9 QUALIFICATIONS:

A. Installer Qualifications:

1. The EPPS installer shall meet all applicable regulations. The SC shall be a firm normally employed in the physical security industry.
2. The SC shall be certified by the manufacturing company in all aspects of design, installation and testing of the products described herein. Each contractor shall furnish with their submittal a letter from the manufacturer indicating they are a dealer in good standing.
3. The SC shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The contractor shall own and maintain tools and equipment necessary for successful installation and testing of video surveillance distribution systems and have personnel who are adequately trained in the use of such tools and equipment.
4. A resume of qualifications shall be submitted with the Contractor's proposal indicating the following:
    a. A list of three recently completed projects of similar type and size with contact names and telephone numbers for each.
    b. A technical resume of experience for the contractor's Project Manager and on-site installation supervisor who shall be assigned to this project.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS

A. All system components shall be

B. All materials and installation techniques used shall be per industry standards.

C. Product Substitutions

1. Product substitutions for system components shall not be allowed for this project unless otherwise noted.

2. No requests for substitutions will be considered after the Bid Opening.

2.2 DURESS NOTIFICATION EQUIPMENT

A. Functional Requirements

1. Security Desk
   a. All duress notifications will be directed to the security desk and to the Central Alarm Monitoring Station.

B. Technical Specifications

1. The system shall support hardware provided either by the EPPS manufacturer or by an approved third-party manufacturer. Third-party hardware shall be manufacturer independent and shall meet the minimum specifications provided below.
2. Secondary Components
   a. Alarm Transmitters
      1) 900 MHz spread spectrum
      2) Supervised
      3) Tamper switch
      4) Approved manufacturers
         a) Inovonics
         b) Actall
   b. Repeaters
      1) 900 MHz spread spectrum
      2) Supervised
      3) 1.2 Ah minimum battery back-up
      4) Tamper switch
      5) Approved manufacturers
         a) Inovonics
         b) Actall
   c. Panic Buttons, Furniture Mounted
      1) Single, latching hold-up variety
      2) Connected to Inovonics transmitter
      3) Approved manufacturers
         a) United Security Products (model Hub2 or equivalent)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cable. Check raceways, cables trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

B. Check all cables for defects before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected and the GC has been consulted.

3.2 INSTALLATION

A. Wiring: Install cables in raceways, except in accessible indoor ceiling spaces and attics, in hollow gypsum board partitions, and as otherwise indicated. Conceal raceways and wiring except in unfinished spaces.

B. Wiring: Install cables concealed in accessible ceilings, walls, and floors where possible. All cabling shall be routed in a clean and efficient manner. There shall be no exposed cable outside of the camera or mount.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

D. Pulling Cable: Do not exceed manufacturer's recommended pulling tensions. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

E. Exposed Cable: Install parallel to building lines, follow surface contours, and support the cable according to manufacturer's written instructions. Do not run adjacent and parallel to power or data cables.

F. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

G. Grounding: Provide independent signal circuit grounding recommended by manufacturer.

3.3 LABELING

A. Label all cables using owner approved scheme. Label horizontal cables at the device and equipment chassis within 12” of termination. Affix labels in a visible location. All labels must be machine made and permanently attached. Label EPPS cables on both ends with device number.

B. Label all equipment chassis per owner approved labeling scheme.

C. Installer/contractor name or advertising labels are prohibited on any devices in public view.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation and supervise pre-testing, testing, and adjusting of television equipment.

B. Inspection: Verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.

C. Test Schedule: Schedule tests after pre-testing has successfully been completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.

D. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.

3.5 OPERATIONAL TRAINING

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the EPPS equipment.

1. Train Owner's maintenance personnel on procedures and schedules for troubleshooting, servicing, and maintaining equipment.
2. Demonstrate methods of determining optimum alignment and adjustment of components and settings for system controls.
3. Schedule training with Owner, through the design/build Contractor, with at least seven days' advance notice.

3.6 ON-SITE ASSISTANCE

A. Occupancy Adjustments: When requested by owner within one year of date of substantial completion, provide on-site assistance in tuning and adjusting the system to suit actual occupied conditions and to optimize performance.

END OF SECTION 282600

SECTION 283100 - FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes fire alarm systems.

B. Related Sections include the following:
   1. Division 08 Section "Door Hardware" for door closers and holders with associated smoke detectors, electric door locks, and release devices that interface with the fire alarm system.

1.2 DEFINITIONS

A. FACP: Fire alarm control panel.

B. LED: Light-emitting diode.

C. NICET: National Institute for Certification in Engineering Technologies.

D. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

1.3 SYSTEM DESCRIPTION

A. Noncoded, addressable system; multiplexed signal transmission dedicated to fire alarm service only.

1.4 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 72.

B. Premises protection includes Building Type 5B and Occupancy Type A-3.

C. Fire alarm signal initiation shall be by one or more of the following devices:
   1. Manual stations.
   2. Heat detectors.
   3. Smoke detectors.
   4. Verified automatic alarm operation of smoke detectors.
   5. Automatic sprinkler system water flow.
   6. Fire extinguishing system operation.
   7. Fire standpipe system.

D. Fire alarm signal shall initiate the following actions:
   1. Alarm notification appliances shall operate continuously.
   2. Identify alarm at the FACP.

3. De-energize electromagnetic door holders.
4. Transmit an alarm signal to the remote alarm receiving station.
5. Unlock electric door locks in designated egress paths.
6. Release fire and smoke doors held open by magnetic door holders.
7. Activate voice/alarm communication system.
8. Switch heating, ventilating, and air-conditioning equipment controls to fire alarm mode.
9. Close smoke dampers in air ducts of system serving zone where alarm was initiated.
10. Record events in the system memory.
11. Record events by the system printer.

E. Supervisory signal initiation shall be by one or more of the following devices or actions:
1. Operation of a fire-protection system valve tamper.

F. System trouble signal initiation shall be by one or more of the following devices or actions:
1. Open circuits, shorts and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
2. Opening, tampering, or removal of alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at the FACP.
4. Ground or a single break in FACP internal circuits.
5. Abnormal ac voltage at the FACP.
6. A break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at the FACP or annunciator.

G. System Trouble and Supervisory Signal Actions: Ring trouble bell and annunciate at the FACP and remote annunciators. Record the event on system printer.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:
1. Shop Drawings shall be prepared by persons with the following qualifications:
a. Trained and certified by manufacturer in fire alarm system design.
b. Fire alarm certified by NICET, minimum Level III.

2. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
3. Device Address List: Coordinate with final system programming.
4. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
5. Wiring Diagrams: Power, signal, and control wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Show wiring color code.
6. Batteries: Size calculations.

7. Duct Smoke Detectors: Performance parameters and installation details for each detector, verifying that each detector is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
8. Ductwork Coordination Drawings: Plans, sections, and elevations of ducts, drawn to scale and coordinating the installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, the detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
9. Voice/Alarm Signaling Service: Equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
10. Floor Plans: Indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

C. Qualification Data: For Installer.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For fire alarm system to include in emergency, operation, and maintenance manuals. Comply with NFPA 72, Appendix A, recommendations for Owner's manual. Include abbreviated operating instructions for mounting at the FACP.

F. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in Division 01 Section "Submittals," make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.

G. Documentation:
1. Approval and Acceptance: Provide the "Record of Completion" form according to NFPA 72 to Owner.
2. Record of Completion Documents: Provide the "Permanent Records" according to NFPA 72 to Owner. Format of the written sequence of operation shall be the optional input/output matrix.
    a. Hard copies on paper to Owner.
    b. Electronic media may be provided to Architect.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Work of this Section be performed by a UL-listed company.

C. Installer Qualifications: Personnel certified by NICET as Fire Alarm Level III.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.7 SEQUENCING AND SCHEDULING

A. Equipment Removal: After acceptance of the new fire alarm system, remove existing disconnected fire alarm equipment.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but not less than 1 unit.
   2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but not less than 1 unit.
   3. Smoke, Fire, and Flame Detectors: Quantity equal to 10 percent of amount of each type installed, but not less than 1 unit of each type.
   4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than 1 unit of each type.
   5. Keys and Tools: One extra set for access to locked and tamperproofed components.
   6. Audible and Visual Notification Appliances: One of each type installed.
   7. Fuses: Two of each type installed in the system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following: (Must be approved by the Denver Fire and Life Safety Division)
   1. FACP and Equipment:
      a. Fire-Lite Alarms; a GE-Honeywell Company.
      b. NOTIFIER; a GE-Honeywell Company.
      c. Silent Knight; a GE-Honeywell Company.

2.2 FACP

A. General Description:
   1. Modular, power-limited design with electronic modules, UL 864 listed.
   2. Addressable initiation devices that communicate device identity and status.
      a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at the FACP.
      b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
   3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

C. Smoke-Alarm Verification:
   1. Initiate audible and visible indication of an "alarm verification" signal at the FACP.
   2. Activate a listed and approved "alarm verification" sequence at the FACP and the detector.
   3. Record events by the system printer.
   4. Sound general alarm if the alarm is verified.
   5. Cancel FACP indication and system reset if the alarm is not verified.

D. Notification-Appliance Circuit: Operation shall sound in a temporal pattern, complying with ANSI S3.41.

E. Power Supply for Supervision Equipment: Supply for audible and visual equipment for supervision of the ac power shall be from a dedicated dc power supply, and power for the dc component shall be from the ac supply.

F. Alarm Silencing, Trouble, and Supervisory Alarm Reset: Manual reset at the FACP after initiating devices are restored to normal.
   1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
   2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
   3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.

G. Walk Test: A test mode to allow one person to test alarm and supervisory features of initiating devices. Enabling of this mode shall require the entry of a password. The FACP and annunciators shall display a test indication while the test is underway. If testing ceases while in walk-test mode, after a preset delay, the system shall automatically return to normal.

H. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and control of changes in those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and make a print-out of the final adjusted values on the system printer.

I. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, trouble, and supervisory signals to a remote alarm station through a digital alarm communicator transmitter and telephone lines and radio alarm transmitter.

J. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signal, supervisory signal supervisory and digital alarm communicator transmitter and digital alarm radio transmitter shall be powered by the 24-V dc source.
   1. The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the power-supply module rating.
   2. Power supply shall have a dedicated fused safety switch for this connection at the service entrance equipment. Paint the switch box red and identify it with "FIRE ALARM SYSTEM POWER."

K. Secondary Power: 24-V dc supply system with batteries and automatic battery charger and an automatic transfer switch.
   1. Batteries: Sealed lead calcium.
   2. Battery and Charger Capacity: Comply with NFPA 72.

L. Surge Protection:
   1. Install surge protection on normal ac power for the FACP and its accessories. Comply with Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits" for auxiliary panel suppressors.
   2. Install surge protectors recommended by FACP manufacturer. Install on all system wiring external to the building housing the FACP.

M. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.3 MANUAL FIRE ALARM BOXES

A. Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mounted on recessed outlet box; if indicated as surface mounted, provide manufacturer's surface back box.
   1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type. With integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.
   2. Station Reset: Key- or wrench-operated switch.
   3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
   4. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm.

2.4 SYSTEM SMOKE DETECTORS

A. Photoelectric Smoke Detectors:
   1. Sensor: LED or infrared light source with matching silicon-cell receiver.
   2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.

B. Duct Smoke Detectors:
   1. Ionization Smoke Detectors:
      a. Sensor: Responsive to both visible and invisible products of combustion. Self-compensating for changes in environmental conditions.
      b. Detector Sensitivity: Between 0.5 and 1.7 percent/foot (0.0016 and 0.0056 percent/mm) smoke obscuration when tested according to UL 268A.
   2. UL 268A listed, operating at 24-V dc, nominal.
   3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.
   a. Weatherproof Duct Housing Enclosure: UL listed for use with the supplied detector. The enclosure shall comply with NEMA 250 requirements for Type 4X.
5. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status. Provide remote status and alarm indicator and test station where indicated.
7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
8. Each sensor shall have multiple levels of detection sensitivity.
9. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.

2.5 HEAT DETECTORS

A. General: UL 521 listed.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or rate-of-rise of temperature that exceeds 15 deg F (8 deg C) per minute, unless otherwise indicated.
   1. Mounting: Adapter plate for outlet box mounting Plug-in base, interchangeable with smoke-detector bases.
   2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

2.6 NOTIFICATION APPLIANCES

A. Description: Equipped for mounting as indicated and with screw terminals for system connections.
   1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.

B. Bells: Electric-vibrating, 24-V dc, under-dome type; with provision for housing the operating mechanism behind the bell. Bells shall produce a sound-pressure level of 94 dBA, measured 10 feet (3 m) from the bell. 10-inch (254-mm) size, unless otherwise indicated. Bells are weatherproof where indicated.

C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn.

D. Visible Alarm Devices: Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
   1. Rated Light Output: Per drawings.

2. Strobe Leads: Factory connected to screw terminals.

2.7 SPRINKLER SYSTEM REMOTE INDICATORS

A. Remote status and alarm indicator and test stations, with LED indicating lights. Light is connected to flash when the associated device is in an alarm or trouble mode. Lamp is flush mounted in a single-gang wall plate. A red, laminated, phenolic-resin identification plate at the indicating light identifies, in engraved white letters, device initiating the signal and room where the smoke detector or valve is located. For water-flow switches, the identification plate also designates protected spaces downstream from the water-flow switch.

2.8 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching door plate.
   1. Electromagnet: Requires no more than 3 W to develop 25-lbf (111-N) holding force.
   2. Wall-Mounted Units: Flush mounted, unless otherwise indicated.
   3. Rating: 120-V ac.

B. Material and Finish: Match door hardware.

2.9 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Listed and labeled according to UL 632.

B. Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising 2 lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.

C. Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.

D. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.10 RADIO ALARM TRANSMITTER

A. Listed and labeled according to NFPA 1221. Comply with 47 CFR 90.

B. Description: Manufacturer's standard commercial product; factory assembled, wired, and tested; and ready for installation and operation.
   1. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.

2. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
3. Normal Power Input: 120-V ac.
4. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.
5. Antenna: Omnidirectional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of antenna and mounting hardware and supports shall withstand 100 mph (160 km/h) with a gust factor of 1.3 without failure.
6. Antenna Cable: Coaxial cable with impedance matched to the transmitter output impedance.
7. Antenna-Cable Connectors: Weatherproof.
8. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.

C. Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP or from its own internal sensors or controls, and automatically transmits signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages correspond to standard designations for the fire-reporting system to which the signal is being transmitted and include separately designated messages in response to the following events or conditions:
1. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
2. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
3. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
4. Local Fire Alarm System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
5. Local Fire Alarm System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.
6. Local Alarm System Supervisory Alarm Message: Actuated when the building alarm system indicates a supervisory alarm.

2.11 GUARDS FOR PHYSICAL PROTECTION

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
1. Factory fabricated and furnished by manufacturer of the device.
2. Finish: Paint of color to match the protected device.

2.12 WIRE AND CABLE

A. Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.

B. Signaling Line Circuits: Twisted, shielded pair, not less than No. 16 AWG.
   1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70 Article 760, Classification CI, for power-limited fire alarm signal service. UL listed as Type FPL, and complying with requirements in UL 1424 and in UL 2196 for a 2-hour rating.

C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
   1. Low-Voltage Circuits: No. 16 AWG, minimum.
   2. Line-Voltage Circuits: No. 12 AWG, minimum.
   3. Multiconductor Armored Cable: NFPA 70 Type MC, copper conductors, TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, UL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Smoke or Heat Detector Spacing:
   1. Smooth ceiling spacing shall not exceed the rating of the detector.
   2. Spacing of heat detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas, shall be determined according to Appendix A in NFPA 72.
   3. Spacing of heat detectors shall be determined based on guidelines and recommendations in NFPA 72.

B. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.

C. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of the duct.

D. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

E. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

F. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling.

G. Device Location-Indicating Lights: Locate in public space near the device they monitor.

H. FACP: Surface mount with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

I. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.

J. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that will resist 100-mph (160-km/h) wind load with a 1.3 gust factor without damage.

3.2 WIRING INSTALLATION

A. Install wiring according to the following:
   1. NECA 1.
   2. TIA/EIA 568-A.

B. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceway and Boxes for Electrical Systems."
   1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.

C. Wiring Method:
   1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
   2. Fire-Rated Cables: Use of 2-hour fire-rated fire alarm cables, NFPA 70 Types MI and CI, is permitted.
   3. Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as signaling line circuits.

D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

G. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Identification for Electrical Systems."

B. Install instructions frame in a location visible from the FACP.

C. Paint power-supply disconnect switch red and label "FIRE ALARM."

3.4 GROUNDING

A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.

B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

C. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

D. Perform the following field tests and inspections and prepare test reports:
   1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.
   2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a NICET technician certified under the Fire Alarm Systems program at Level III.
      a. Include the existing system in tests and inspections.
   3. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.
   4. Testing: Follow procedure and record results complying with requirements in NFPA 72.
      a. Detectors that are outside their marked sensitivity range shall be replaced.
   5. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.

B. Follow-Up Tests and Inspections: After date of Substantial Completion, test the fire alarm system complying with testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for three monthly, and one quarterly, periods.

C. Semiannual Test and Inspection: Six months after date of Substantial Completion, test the fire alarm system complying with the testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

D. Annual Test and Inspection: One year after date of Substantial Completion, test the fire alarm system complying with the testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for monthly, quarterly, semiannual, and annual periods. Use forms developed for initial tests and inspections.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 283100

SECTION 311000 – CLEARING

PART 1 GENERAL

1.01 DESCRIPTION

A. Work included: Clearing, grubbing, removing and disposing of all vegetation and debris within work limits, and such other areas as required, removal of existing sidewalks, and/or any asphalt or concrete flatwork except objects designated to remain or to be removed. Also includes preservation from injury or defacement of all vegetation and objects designated to remain.

B. Related Work:

1. Section 31 20 00 - Earthwork: Site Grading. Refer to this Section for additional information and requirements.

1.02 SUBMITTALS

A. Permits: If required, furnish copies of permits.

1 . Fugitive Dust

2 . Over-lot Grading

3 . Other applicable permits, as necessary

1.03 JOB CONDITIONS

A. Protection:

1. Protect trees, shrubs and planted areas to remain from damage or from unnecessary vehicular traffic, in manner acceptable to Engineer. Protect benchmarks, staking, existing structures, roads, sidewalks, paving, and curbs from damage. Maintain designated temporary roadways, walkways, and detours. Burning is not permitted.

2. Contractor shall coordinate and protect in place all existing and new utilities by others on the Library Project site or on adjacent site(s).

B. All excavation equipment must be kept clean and free of weeds.

PART 2 PRODUCTS

2.01 TREE WOUND PAINT

A. Asphaltum-based paint prepared for tree surgery.

PART 3 EXECUTION

3.01 CLEARING

A. Clear and/or grub all surface objects and all trees, stumps, roots, and other protruding obstructions, not designated to remain. Includes mowing, as required. Leave undisturbed stumps and roots and nonperishable solid objects in areas where topsoil is not required to be removed. When authorized, leave stumps and nonperishable solid objects, provided they do not extend more than 6" above ground line or low water level, except in areas to be rounded at top of back slopes.

B. Paint cut or scarred surfaces of trees or shrubs selected for retention with tree wound paint.

3.02 DISPOSAL

A. Deposit all waste material in designated waste areas. Grade and shape disposal site. Complete topsoil and reseed site if required.

B. All exported soil shall be delivered to Denver Arapahoe Disposal Site (DADS)

END OF SECTION 311000

SECTION 312000 - EARTHWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

Excavation, proofrolling, filling and backfilling, compacting, and grading indicated or required for site improvements and structures.

1.02 RELATED WORK

A. Section 013300 – Submittals

B. Section 014000 – Quality Requirements

C Section 033000 – Cast in Place Concrete

C. Division 33 - Site Utilities: refer to this section for requirements of Underground Utility installation.

1.03 SITE CONDITIONS

A. Prior excavations and soil testing : Environmental remediation of soils has recently occurred on the library property. A Report of Environmental Remediation, completed by Casey Resources Inc., (CRI) titled Summary Report Petroleum Excavation Activities Conducted On The Library Parcel At The Mile High Vista Development, dated December 2011 will be provided to the General Contractor upon request.
   1. Environmental remediation was conducted on the Library site as described in CRI's report.
   2. If the General Contractor encounters any suspicious material or soils, the General Contractor shall notify the Owner immediately. The Owner will be responsible for investigating and remediating any suspicious material and/or soil, if appropriate.

B. Geotechnical Investigations Report: A Geotechnical Engineering report has been prepared by Acura Engineering for the proposed Work, dated August 8, 2011, Project No. C11-0021G. The report includes three addendum dated September 16, 2011, September 29, 2011, and December 14, 2011. The report is available for information and is attached hereto in the appendix. This report is not to be considered part of the Contract Documents. The Owner may have additional Geotechnical Investigation report(s) recording the recent soil work on the library property. A copy of any/all of these reports will be provided to the General Contractor upon request.

   1. The data indicated in the Subsurface Investigations are not intended as representations or warranties of accuracy or continuity of such conditions between soil explorations. It is expressly understood the Owner will not be responsible for interpretations or conclusions drawn therefrom by the Contractor. The data is made available for the convenience of the Contractor.

   2. Additional test borings and other subsurface explorations may be made by the Contractor at no additional cost to the Owner.

C. Deed Restrictions : All excavation activity on the site must follow the established permitting requirements for the property.

   1. Ground Water
      a. Ground Water cannot be removed from the library property nor used for any purpose.

   2. .Voluntary Clean Up Plan (VCUP) for the Property.

a. VCUP : A Voluntary cleanup Plan Application for the New Avondale Development, completed by Casey Resources Inc., titled Lot A1 at Festival Plaza, Southeast Corner of West Colfax Avenue and Irving Street, Denver, Colorado 80204, dated 2011. This plan was prepared for the Urban Land Conservancy, 305 Park Avenue West, Denver, Colorado 80205, and was used to guide the aforementioned environmental remediation of the site. A copy of this plan will be provided to the General Contractor upon request.

D. Utilities.

1. Contractor shall be responsible for locating all existing utilities (including depth), both public and private, that may conflict with the proposed construction. **Utility Notification of Colorado 1-800-922-1987**.

2. If utilities are to remain in place, provide adequate means of protection during excavation operations, this includes all shoring, bracing, etc. Cooperate with the Owner and public and private utility companies in keeping their respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility owner.

3. Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, except when permitted in writing by Owner's Representative and then only after acceptable temporary utility services have been provided.

4. Contractor shall stop excavation upon encountering any unexpected subsurface utilities during excavation or trenching; in addition, all work shall cease and the Architect shall be notified immediately. Work shall not resume until the Architect has issued a directive.

5. Demolish and completely remove from the site existing underground utilities indicated to be removed. Coordinate with local utility companies for shut-off services in lines that are active.

6. Contractor shall coordinate and protect in place all existing and new utilities by others on the Library Project site or on adjacent site(s).

E. Excavation Safety:

1. The Contractor shall be solely responsible for making all excavations in a safe manner in accordance with applicable regulations including OSHA.

2. Barricade open excavations and post with warning lights. Operate warning lights as recommended by authorities having jurisdiction. Protect structures, utilities, sidewalks, pavement, and other facilities immediately adjacent to excavations, from damages caused by settlement, lateral movement, undermining, washout and other hazards.

F. Protection:

1. Protect trees and other features remaining as a portion of the final landscaping.

2. Protect bench marks, utilities, sidewalks, paving and curbs from equipment, vehicular traffic and general construction activities.

3. Protect above and below grade utilities which are to remain.

4. Notify Owner's Representative of unexpected conditions subsurface conditions and discontinue affected work in the area until notified to resume operations.

5. Protect and maintain prepared subgrades, including those areas prepared for building pads, pavements, foundation, or other areas prepared for the project. Prevent water from collecting on surface. Do not allow

equipment or other traffic to disturb the surface. Repair or replace disturbed subgrades as directed by Owner's Representative at no additional cost to the Owner.

G. Shoring:

1. Provide any necessary shoring if proposed excavation slopes exceed OSHA required lay back slope.

1.04 SUBMITTALS

A. General: Submit the following in accordance with the Conditions of Contract, Section 013300 – Submittal Procedures

B. Contractor shall provide testing and documentation for all import materials in accordance with the Geotechnical Report.
1. Submittal shall include relevant data such as exact location and source for such materials.
2. Provide laboratory analysis of each soil material proposed for fill and backfill from on-site and borrow sources.
3. One optimum moisture-maximum density curve for each soil material.
4. Report of actual unconfined compressive strength and/or results of bearing tests of each stratum tested.

C. Alternate Geo-textile or Geo-grid material, not conforming to Geotechnical Engineers recommendations, require written approval from Testing Consultant prior to use.
1. Contractor shall submit qualifications of the testing consultant(s), used for testing purposes on his own behalf.

D. Shoring drawings and calculations stamped and sealed by a Professional Engineer registered in the State of Colorado

1.05 QUALITY CONTROL

A. Testing and Inspection Service: Owner will employ a qualified independent geotechnical engineering testing agency to conduct compaction testing and to classify proposed on-site and structural fill soils to verify that soils comply with specified requirements and to perform required field and laboratory testing. Contractor shall coordinate inspections and testing with the Owner and the Owner's Geotechnical Engineer.

B. Work involving structural borrow fill material shall not commence until the Owner's Geotechnical Engineer has issued written acceptance of proposed import material.

1. Contractor shall bear the cost for testing and verification of off-site materials to be used as structural fill.

2. Related excerpt from the MMP : **5.5 IMPORTED SOILS ACTION LEVELS**
"All soils imported for use on the Property shall be certified by the generator of the soil to be"clean" soil. Clean is defined as meeting the CDPHE's proposed soil cleanup values for residential development (Appendix D). This certification shall be made in writing by the Contractor supplying the soil or the source generator along with the appropriate analytical datafor the imported material. An "Import Soils Protocol" is provided in Appendix C." This import soils protocol document will be provided to the General Contractor upon request.

2. The Contractor shall provide access to the borrow site to permit the Owner's Geotechnical Engineer to observe the site conditions and remove samples of the proposed structural borrow fill material as required by the A/E.

C. Before any soils are removed from the site, Contractor shall identify soils and notify Owner.

D. **ENGINEERING CONTROLS –** During excavation, engineering controls shall be used to prevent the spread of impacted soils and to protect the health and welfare of workers and the general public. In particular, it is likely that any excavation or earthwork will generate dust. Dust suppression utilizing water shall be used as necessary.

1.06 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
1. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

F. Fill: Soil materials used to raise existing grades.

G. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

H. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

I. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

A. General Backfill Quality

1. Free of brush, sod, organic material, vegetable matter, frozen matter and other deleterious substances.

2. Shall not contain rocks, debris or lumps having a diameter of more than three (3) inches.

3. Hazardous Materials.

a. Environmental remediation of soils has recently occurred on the Library property. A Report of Environmental Remediation, completed by Casey Resources Inc., (CRI) titled Summary Report Petroleum Excavation Activities Conducted On The Library Parcel At The Mile High Vista Development, dated December 2011 will be provided to the General Contractor upon request.

1) Environmental remediation was conducted on the Library site as described in CRI's report.
2) If the General Contractor encounters any suspicious material or soils, the General Contractor shall notify the Owner immediately. The Owner will be responsible for investigating and remediating any suspicious material and/or soil, if appropriate.

b. Contractor is responsible for testing of off-site soils for hazardous materials prior to import.
(1) Contractor shall use Hazardous Materials Specialist for testing of import materials.
(2) Contractor shall consult with Project Manager and Hazardous Materials Specialist to determine frequency of tests to avoid over-testing and/or under-testing.

4. Contractor is responsible for his own testing to assure compliance with Contract Documents. Division 1 covers this requirement in general.

B. Structural Fill. Clean, granular material free of organics, debris and other deleterious materials with no individual particles larger than 3 inches in maximum dimension. In addition, this material shall have a liquid limit less than 30 and a plasticity index of 15 or less. Structural fill should also have a percent fine between 15 to 30 percent passing the No. 200 sieve. Structural fill should be moisture conditioned to within 2 percent of OMC and compacted at least 95 percent of Standard Proctor (ASTM D698) dry density. Structural fill materials shall be approved by the Geotechnical Engineer prior to importing to the site.

C. Non-Structural Fill.

1. Non-structural fill material includes all fill not supporting structures or site paving and approved by the Owner's Testing Consultant.

2. Granular, non-expansive material suitable for specified compaction, as approved by the Geotechnical Engineer.

3. Native soils may be used for non-structural fill. Native soils include any onsite soil materials free of organic matter, containing no particles larger than 3 inches, capable of compaction as specified, and approved by the Geotechnical Engineer prior to use.

2.02 Geo-textile fabrics or Geo-grid materials

A. All geosynthetic fabrics shall be reviewed and approved by the Geotechnical Engineer.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Quality Assurance. The Owner will retain the services of a Testing Consultant for observation and testing for Quality Assurance of work in this Section.

1. Contractor will be provided with all test and report information provided by the Owner's Geotechnical Engineer or Materials Testing Consultant.

2. Information provided by Owner's testing consultant is not represented as sufficient to guarantee compliance with the requirements of the contract and these specifications.

C. Sequencing and Scheduling

1. The Contractor shall notify the Owner's Project Manager at least five (5) working days prior to the following occurrences:

   a. Commencement of excavation.

   b. Inspection of Sub-grade.

   c. Commencement of compaction.

   d. Completion of compaction.

2. The Contractor shall notify the Owner's Project Manager at least ten (10) working days prior to the following occurrences:

   a. Import of borrow-fill material.

   b. Commencement of backfilling.

3. The General Contractor shall coordinate Work on site with the Owner's Project Manager.

   a. The Contractor shall coordinate the testing schedule with Testing Consultant and Hazardous Materials Specialist.

   b. The Contractor shall supply location and elevation reference points for the use of the Testing Consultant to locate the test points.

D. Testing.

1. General.

   a. Testing shall be performed by an approved commercial testing laboratory or company.

   b. When test results indicate, as determined by the Owner, Engineer or Quality Assurance testing, that compaction is not as specified, the material shall be removed, replaced and recompacted to meet specification requirements.

   c. Tests on recompacted areas shall be performed to determine conformance with specification requirements.

   d. Inspections and test results shall be certified by a registered professional civil engineer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

2 Density. Field in-place density shall be determined in accordance with ASTM 6938

   a. Quality Control Testing frequency shall, at a minimum meet the requirements of the following table.

Material Type	**Location of Material**	**Test Frequency**
Undisturbed native soil	Structures	Two random tests in building footings and two tests on subgrade within building line.

Fills and backfills	Structures (adjacent to)	One test per structure per 1,000 square feet (sf), taken 12 inches (in) below finished grade.
Subgrades	Site	One test per lift per 1,000 sf per lift
Embankments or borrow	Any	One test per lift per 1,000 sf placed.
Native soil subgrade other than structures and parking	Any	One test or one test per 10,000 sf, whichever is greater.
Borrow	Any	One test per lift per 1,000 sf placed

b. Check Tests on In-Place Densities

3. Fill and Backfill Material Gradation. One test per 5,000 cubic yards stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with [ASTM C 136] [ASTM D 422] [ASTM D 1140].

4. Optimum Moisture and Laboratory Maximum Density. Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 10,000 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

5. Tolerance Tests for Subgrades. Continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION shall be made during construction of the subgrades.

3.02 DEWATERING:

Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area. Do not allow water to accumulate in excavations. Remove water as necessary to prevent detrimental soil changes to stability of subgrades and foundations.

A. Provide and maintain pumps, well points, sumps, suction and discharge lines and other dewatering system components necessary to convey water away from excavations.

B. Convey water removed from excavations and rainwater to collection or run-off areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do **not** use trench excavations as temporary drainage ditches.

C. Acquire and comply with permit(s) applicable to the dewatering operation.

D. Groundwater cannot be removed from the Library property, nor used for any purpose.

3.03 TOPSOIL REMOVAL and REPLACEMENT

1. Where indicated or directed, topsoil shall be stripped to a depth of six (6) inches.

2. Topsoil shall be spread on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified.

3. Topsoil shall be kept separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inches in diameter, and other materials that would interfere with planting and maintenance operations.

4. Any surplus of topsoil from excavations and grading shall be stockpiled in locations indicated or, if directed, removed from the site.

3.04 EXCAVATION

A. General

1. The Contractor shall perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified.

2. Grading.

a. shall be in conformity with the typical sections shown and the tolerances specified in these specifications.

b. The contours shown on the drawings indicate finish grade and the contractor shall provide grade control as necessary to ensure excavations, subgrades, paving and landscaping are completed to the proper elevations. Should any discrepancies be found; the Contractor is to contact the Owner for clarification.

3. Satisfactory excavated materials shall be transported to and placed in fill or embankment within the limits of the work. Surplus satisfactory excavated material not required for fill or embankment shall be disposed in areas approved for surplus material storage or designated waste areas.

4. Unsatisfactory materials encountered within the limits of the work shall be excavated below grade and replaced with satisfactory materials as directed. Such excavated material and the satisfactory material ordered as replacement shall be included in excavation. Unsatisfactory excavated material shall be disposed in designated waste or spoil areas.

5. During construction, excavation and fill shall be done in a manner and sequence that will provide proper drainage at all times.

6. Material required for fill or embankment in excess of that produced by excavation within the grading limits shall be excavated from the borrow areas indicated, from other approved areas selected by the Contractor, or as specified.

7. Proofrolling: Building or pavement subgrade areas which are stripped or excavated to design subgrade elevations, or that are to receive structural fill, shall be proofrolled with a loaded 10-cubic yard dump truck or equivalently loaded rubber-tired vehicle under the observation of the Engineer. Any loose, soft, or otherwise unsatisfactory soil materials identified during the proofroll shall be scarified and recompacted, or removed as directed by the Engineer and replaced with satisfactory soil material or structural fill material. Proofrolling may be waived by the Owner or the Engineer when, in their opinion, such proofrolling will not be of benefit or could result in disturbance of the subgrade.

B. Excavation Tolerances

1. Removal of materials beyond indicated sub-grade elevations and the following tolerances shall constitute unauthorized excavation. Unauthorized excavation and remedial work shall be at the Contractor's expense.

2. Tolerance for building excavations shall be 0.10 feet from specified dimensions.

3. Minimum cover depths for all utilities shall be within 0.10 feet below finish grade.

4. Trenching tolerances shall be within 0.10 feet of required plus the additional allowance for required minimum bedding depth and pipe wall thickness. Piping installed on specified slopes shall meet the specified tolerances for the size and type of pipe specified

C. Excavation for utility trenches

1. Excavate utility trenches to indicated slopes, lines, depths, and invert elevations of uniform widths to provide a maximum 12 inches of working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than the top of pipe or conduit.

2. Excavate and shape trench subgrade to provide uniform bearing and continuous support for pipe and conduit. Where encountering rock or other unyielding bearing surface, carry trench excavation 6 inches below invert elevation to receive bedding course.

3.05 SUBGRADE PREPARATION FOR EXTERIOR CONCRETE FLATWORK

A. Ground surface on which fill is to be placed first shall be stripped of live, dead, or decayed vegetation, rubbish, debris, and other unsatisfactory material; and brought to proper grade and elevation.

B. The ground surface then shall be plowed, disked, or otherwise broken up to a depth of eight (8) inches, pulverized; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 95 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials.

C. As necessary, the prepared ground surface shall be scarified and moistened or aerated as required just prior to placement of embankment materials to assure adequate bond between embankment material and the prepared ground surface.

D. Owners Testing Consultant or Engineer must inspect and approve the sub-grade prior to backfilling.

3.06 BACKFILL

A. General

1. Backfill only with materials excavated from construction area, once accepted by Testing Consultant, or other material tested and accepted in writing by Testing Consultant, and only after the Engineer's acceptance of below grade construction.

2. Lift thickness of backfill shall not exceed 6 inches uncompacted depth where equipment weighing less than ¾-ton is used for compaction. Lift thickness shall not exceed 8 inches uncompacted thickness for all other fill placement.

3. Subsurface drainage backfill
   a. Place and compact drainage backfill of filtering material in width indicated, to within 12 inches of final subgrade

4. Utility trench backfill
   a. Place, compact, and shape bedding course to provide continuous support for pipes and conduits over rock and other unyielding bearing surfaces and to fill unauthorized excavations

b. Place and compact initial backfill of satisfactory soil material or subbase material, free of particles larger than one inch, to a height of twelve inches over the utility pipe or conduit. Place and compact final backfill of satisfactory soil material to final subgrade
c. Coordinate backfilling with utilities testing
d. Install warning tape directly above utilities, twelve inches below finished grade, except six inches below subgrade under pavements and slabs

5. Backfill excavations promptly, but not before completing the following;
   a. Acceptance of construction below finish grade including dampproofing, drainage mats, and perimeter insulation.
   b. Surveying locations of underground utilities for record documents.
   c. Testing, inspecting, and approval of underground utilities.
   d. Concrete formwork removal.
   e. Removal of trash and debris from excavation.
   f. Removal of temporary shoring and bracing, and sheeting.
   g. Installing permanent or temporary horizontal bracing on horizontally supported walls

B. Cold Weather.

1. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

2. Embankment shall not be placed on a foundation which contains frozen material, or which has been subjected to freeze-thaw action. This prohibition encompasses all foundation types, including the natural ground, all prepared subgrades (whether in an excavation or on an embankment) and all layers of previously placed and compacted earth fill which become the foundations for successive layers of earth fill.

3. All material that freezes or has been subjected to freeze-thaw action during the construction work, or during periods of temporary shutdowns, such as, but not limited to, nights, holidays, weekends, winter shutdowns, or earthwork operations, shall be removed to a depth that is acceptable to the Owner or the Engineer, and replaced with new material. Alternatively, the material will be thawed, dried, reworked, and recompacted to the specified criteria before additional material is placed.

4. The Owner or Engineer will determine when placement of fill shall cease due to cold weather. The Owner or Engineer may elect to use average daily air temperatures, and/or physical observation of the soils for their determination.

5. Embankment material shall not contain snow, ice, or frozen clumps of soil.

3.07 COMPACTION

A. General.

1. Perform compaction of “satisfactory soil materials”, “native soils”, and “imported soil materials” using mechanical soil compaction equipment suitable to type and size of materials to be compacted.

2. The Contractor shall track test locations to verify that each lift has been compacted and tested in accordance with these specifications.

3. Specify the degree of compaction required, moisture requirements from optimum, as recommended in the Geotechnical Engineer’s Certified soils report.

4. Frequency of testing (including subgrade under curb and gutter, trenches, footings, slabs-on-grade and other bearing surfaces), testing methods (include one sand cone for every ten nuclear tests for correlation)

and by which method shall be developed in conjunction with the Testing Consultant and approved by the Project Manager prior to inclusion into this specification section.

5. Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

B. Percentage of Maximum Density: Maximum dry density is defined as the American Society of Testing and Materials (ASTM) test designation ASTM D-1557 test procedure (modified proctor). Provide not less than percentages of maximum dry density required for the following applications:

	Relative Compaction Specification ASTM D-1557	
Application	Imported Granular Fill Materials	Native or Satisfactory Soil Materials
Building Pad Aggregate Base	N/A	N/A
Beneath Slabs-on Grade		
10 ≤ 0 ft of Finished Grade	95%	95%
Beneath Pavements		
10 ≤ 0 ft of Finished Grade	95%	95%
Utilities		
10 ≤ 0 ft of Finished Grade	95%	N/A
Landscaped Areas Above Pipe Zone	90%	85%
Retaining Wall Backfill	95%	92%
Landscaping Berms	90%	90%
Fill in Landscaping Areas	90%	85%
Any Fill > 10 ft below Finish Grade	97% (ASTM 1557)	100% Stnd (ASTM 698)

C. Moisture Control. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material. Prevent free water appearing on surface during or subsequent to compaction operations.

1. Remove and replace, or scarify and air dry, soil material too wet to permit compaction to specified density.

2. Soil material removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to satisfactory value.

D. Landscaped or Lawn Areas. Compaction under landscaped or lawn areas shall be not less than 80% nor greater than 90% Standard Proctor. The Contractor shall water or use other means of insuring that areas to receive landscaping and lawns achieve the specified compaction within the top 18 inches and have completed any initial settlement before final installation

3.08 PROTECTION

A. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, compact to required density and provide other corrective work as specified, prior to further construction. Contractor shall pay for required testing.

END OF SECTION 312000

SECTION 312333 – TRENCHING BACKFILLING, COMPACTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1-Specification sections, apply to work of this Section.

1.02 SECTION INCLUDES

A. Trenching, backfilling and compacting in connection with the construction of underground utilities and appurtenances shown on the drawings for work outside of building lines.

B. Pavement removal and replacement.

1.03 RELATED SECTIONS:

A. The following Sections contain requirements that relate to this Section:

1. Section 31 20 00 - Earthwork

2. Section 33 10 00 - Water Distribution

3. Section 33 30 00 - Sanitary Sewer Systems

1.04 SUBMITTALS

A. Test Reports:

1. Submit laboratory gradation tests for bedding and trench stabilization materials.

1.05 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Perform excavation work in conformance to the requirements of authorities having jurisdiction. Supply, install, and remove all shoring as may be required to comply with all safety regulations and to maintain earth banks until backfill is placed.

B. Testing and Inspection:

1. Conform testing and inspection of backfill to the requirements of Section 02200. Make in

place density tests at intervals and locations as directed by the Architect.

1.06 PROJECT/SITE CONDITIONS

A. Protection:

1. Protect existing utilities, adjacent property, and utility excavations, including hand excavation, in accordance with the requirements of Section 02200.

B. Site Information:

1. Soil Investigation and test reports are available for examination as set forth in Section 02010.

2. Additional test borings and other exploratory operations may be made by the Contractor at no cost to the Owner.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

A. Fill Materials:

1. Approved earth, loam, sandy clay, sand and gravel, soft shale, or other acceptable materials, free from organic matter and large clods of earth or stone, and of a proper moisture content which will facilitate backfilling.

B. Select Backfill:

1. Suitable material with no stones greater than 1" diameter for concrete pipe and 0.75" diameter for all other pipe. Excavated material which meets the grading requirement may be used for select backfill.

C. Bedding Materials:

1. The pipe shall be carefully bedded as shown in the bedding details.

2. Provide Class “B” minimum bedding for PVC sanitary sewer pipe and Class “C” minimum bedding for all other pipe except as indicated otherwise.

a) Class B Bedding (Granular Foundation): Class B bedding is defined as that method of bedding in which the pipe is set on compacted granular material supporting the lower 1/2 of the pipe barrel.

i) Compacted Granular Material: Compacted granular material shall be a well graded gravelly material meeting the following requirements and compacted to 90% of maximum dry density as determined by ASTM D698.

Square Mesh Sieve Size	Total Passing by Sizes (%) by Weight
1"	100
3/4"	90 to 100
3/8"	20 to 55
#4	0 to 10
#8	0 to 5

b) Class C Bedding (Granular Foundation): Class C bedding is defined as that method of bedding in which the pipe is set on compacted granular material supporting the lower quadrant of the pipe barrel using uniform graded material as described under Class B bedding.

c) Ductile Iron Pipe Bedding: Excavated material from work with no stones larger than 2" diameter, free from organic materials, chunks of soil, frozen material, debris or other unsuitable materials.

d) Trench Stabilizing Material: Trench stabilizing material shall consist of 1/5" diameter washed rock.

D. Unsuitable Material:

1. Highly organic soil; ASTM D2487 Group PT, topsoil, roots, vegetable matter, trash and debris.

PART 3 EXECUTION

3.01 EXCAVATION

A. General:

1. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

a) For Class “B” and “C” bedding, excavate to a depth below pipe invert equal to 1/8 of outside pipe diameter but not less than 6".

2. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

B. Excavation Classifications:

1. All excavation is to be considered as “unclassified.”

C. Shoring and Bracing:

1. Provide materials for shoring and bracing, such as sheet piling, up rights, stringers and cross-braces, in good serviceable condition. Provide shoring as required for safety and by governing authorities.

2. Establish requirements for trench shoring and bracing to comply with local codes and

authorities having jurisdiction.

3. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses. Arrange shoring and bracing so as not to place stress on completed work.

4. Exercise care in removal of shoring and bracing to prevent collapse or caving of excavation faces.

D. Dewatering:

1. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding areas.

2. Do not allow water to accumulate in excavations. Remove water to prevent softening of trench bottoms, and soil changes detrimental to stability of subgrades and foundations.

3. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

4. Convey water removed from excavations and rain water to collecting or run-off areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure.

5. Do not use pipe or pipe trench excavations as temporary drainage ditches.

E. Cold Weather Protection:

1. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees Fahrenheit.

F. Material Storage:

1. Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

2. Locate and retain soil materials away from edge of excavations by at least two feet.

G. Trenching:

1. Excavate trenches through all materials encountered to depths shown on drawings. Dispose of excavated materials not suitable for backfill as directed by Architect. From a point 1' above the top of pipe to the bottom of the trench, limit maximum trench width to the outside barrel diameter, plus 2’. Maintain minimum trench width to not be less than the outside barrel diameter, plus 1'.

2. Excavate for manholes, vaults and other appurtenances with clearances between 12" and 24" on all sides.

3. Do not excavate below required levels unless necessary due to wet trench conditions, as determined by the Architect. Backfill unnecessary excavation below the required level with granular bedding material as directed by the Architect and thoroughly tamp.

H. Bedding:

1. Bed pipe as shown in the bedding details. Provide Class “C” bedding except for PVC sanitary sewer pipe provide Class “B” bedding unless otherwise required by the Architect.

    a) Class B Bedding (Granular Foundation): Set pipe on compacted granular material supporting the lower 1/2 of the pipe barrel.

    b) Class C Bedding (Granular Foundation): Set pipe on compacted granular material supporting the lower quadrant of the pipe barrel.

    c) Class B Bedding over and around the sides of the pipe to a minimum of at least 6".

3.02 CONTROLLED FILL

A. After pipe bedding has been completed in accordance with applicable pipeline sections, carefully backfill trenches using approved excavated materials. Carefully hand tamp around the pipe and up to 24" above the top of the pipe, in lifts not to exceed 6" loose thickness.

B. Use care to place and tamp this course without disturbing joints, alignment, or grade of the piping. Fill remainder of trench in layers not exceeding 8" loose depth where pneumatic, vibratory or other hand tamping equipment is used.

C. Where crane operated or hydraulic drop hammers are used to compact the remainder of the backfill, limit loose depth of each lift to 3'.

D. Use care in backfilling and compacting operations to avoid disturbing pipe. Replace misaligned, crushed or otherwise disturbed main piping.

E. Exercise extreme care in removing cribbing, shoring or sheeting so as not to disturb foundation, bedding and initial backfill. Where necessary to drive sheet piling or shoring below top of pipe, cut off sheet piling or shoring 1' above top of pipe and leave in place.

F. Where groundwater or wet trench conditions occur, provide additional bedding below and over the pipe consisting of granular bedding material, as defined in pipe line sections, to a depth as required. If used, payment for the bedding materials shall be only for the additional amount in excess of the standard bedding requirements specified.

G. Re-open trenches improperly backfilled, or where settlement occurs, to the depth required for proper compacting, then refill and compact, restoring the surface to the required grade, compaction, and smoothness.

H. Pooling or water flooding for consolidating the backfill will not be permitted, and the addition of water is limited to that needed for obtaining the desired moisture content specified.

3.03 PAVEMENT REMOVAL AND REPLACEMENT

A. Score existing surface with a cutting wheel to create clean break line. Remove and dispose of existing surface and aggregate base course. Leave 6" undisturbed subgrade lip on each side of trench. After trench has been backfilled and properly compacted, place aggregate base course in accordance with permit requirements or minimum thickness specified. Compact aggregate base course to 95% AASHTO T180. Replace pavement in accordance with permit requirements or minimum thickness specified. Compact asphalt to 95% ASTM D1559.

3.04 FIELD QUALITY CONTROL

A. Soil Compaction Tests:

1. Determine maximum density and optimum moisture content of backfill material in accordance with ASTM D698.

2. Moisture Content: Adjust and maintain moisture content of the soil within ±2% of optimum moisture content.

B. Compaction Requirements:

1. Compact backfill under paved areas or areas to be paved to not less than 95% maximum density from the top of the granular bedding to pavement base or subgrade.

2. Compact backfill outside a traveled right-of-way to not less than 90% of maximum density from the top of the granular bedding to the ground surface or grade as set by the Architect.

3. Replace disturbed surface materials with material matching existing and adjacent materials.

END SECTION 312333

SECTION 31 23 43 - TOPSOIL

PART 1: GENERAL

1.1 SUMMARY:

A. Work Includes: Furnishing, stockpiling and placing topsoil on a previously prepared subgrade.

B. Related Work:
   1. Soil Preparation: Section 329113
   2. Sodding: Section 329200
   3. Planting: Section 329000

1.2 SUBMITTALS

A. Soil Analysis: submit soil analysis report for imported topsoil from the State University Agricultural Extension Service or other approved soil testing laboratory. Report shall cover soil textural classification (percentages of sand, silt, and clay), pH, % organic matter, and soluble salts (electric conductivity in millimos/centimeter), and shall include additive recommendations. Testing will be at the expense of the Contractor.

B. Manufacturers Product Data for planter soil.

1.3 LEED SUBMITTALS:

A. Local/Regional Materials: Provide a statement from the manufacturer stating that materials provided were manufactured within a 500 mile radius of the project. Include location of the manufacturing facility including name, address and distance between manufacturing facility and the project site. Provide manufacturer's documentation indicating location where the base materials were extracted, mined, harvested, etc. and distance between manufacturing facility and the project site (Applies to LEED MRc5.1 and MRc5.2: Regional Materials).
   1. Include material costs (excluding cost of installation).

1.4 DELIVERY, STORAGE AND HANDLING:

Do not deliver or place topsoil in frozen, wet, or muddy condition.

PART 2: PRODUCTS

2.1 IMPORTED TOPSOIL:

All topsoil shall be a loam or sandy loam. At least 10 days prior to topsoil delivery, notify Project Manager of the source(s) form which topsoil is to be furnished. Topsoil shall be furnished by the Contractor and shall be a natural, friable soil representative of productive soils in the vicinity. It shall be obtained from the top 12" of well drained areas. Topsoil shall be free from weeds, sod, clods and stones larger than 1-inch, toxic substances, litter or other deleterious material.

A. Fertile, friable, loamy soil, reasonably free from subsoil, refuse, roots, heavy or stiff clay, stones larger than 1 inch, coarse sand, noxious seeds, sticks, brush, litter, and other deleterious substances; suitable for the germination of seeds and the support of vegetative growth. The pH value shall be between 7.0 and 8.0.

B. Soil Texture: Sand, 30 to 50 percent; silt, 30 to 50 percent; clay, 5 to 30 percent.

C. Additives: As determined by soil fertility tests.

D. % Organic Content: 2.9% minimum.

E. Soluble Salts: Electric conductivity shall be less than 3.3 mmhos/cm for dryland areas and less than 5.1 mmhos/cm for irrigated lands.

2.2 PLANTER SOIL (all raised planters): Planter soil shall be a Earthgro by ScottsMiracle-Gro Company earthgro.com; or approved equivalent.

PART 3: EXECUTION

3.1 STOCKING TOPSOIL

A. Stockpile slopes shall not be steeper than 3 horizontal to 1 vertical and stockpiles shall be protected from wind and water erosion, unnecessary compaction, and contaminants. Topsoil stockpiles shall be separate from each other and from other excess and unsuitable material piles.

B. Stockpiles shall be watered down periodically by the Contractor as necessary to mitigate the formation of windblown dust.

C. Contractor shall be responsible for maintaining a weed free stockpile. Stockpiles that are anticipated to remain for over 4 weeks should be seeded with Regreen.

3.2 CONSTRUCTION WASTE MANAGEMENT AND RECYCLING

A. All project construction waste and recycled materials shall be managed in accordance with Division 1. The Contractor shall submit documentation satisfying the requirements of that section.

3.3 PLACING TOPSOIL

A. Scarify compacted subgrade to an 8-inch depth to bond topsoil to subsoil. Place topsoil to a minimum depth of 8-inches (eight) after settlement. Topsoil depth may be reduced around existing trees. Stocked topsoil shall be placed at a location approved by the Project Manager. No topsoil shall be removed from the site. Spread evenly and grade to elevations and slopes shown. Hand rake areas inaccessible to machine grading.

B. Utilize salvaged topsoil as the top layer to the extent available. If sufficient onsite material is not available, the Contractor shall furnish and install imported topsoil in the manner described above.

C. LEED Requirements:
   1. Local/Regional Materials: Preference shall be given to products and materials which have been manufactured, harvested, extracted mined quarried, etc. within a 500 mile radius of the project site.

3.1 PLACING PLANTER SOIL:

A. Place soil in 6” lifts, compacting to minimize settlement of soil after completion. Place soil at least 30 days prior to planting operations. Settlement of soil in planters is the responsibility of the Contractor. If settlement occurs (> 2”) Contractor shall remove plants and mulch, add soil, finish grade and replant and remulch at no additional cost to the contract.

END OF SECTION 31 23 43

SECTION 312500 – EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Temporary measures needed to control erosion and water pollution by use of berms, sediment basin and /or traps, hay bales, silt fences, surface roughing, mats and nets, curb socks, aggregate, riprap, vehicle tracking control, mulch, grasses, slope drains, and other approved measures at the locations necessary to control erosion and water pollution.

B. Related Work:

1. Clearing: Section 31 10 00

2. Earthwork: Section 31 20 00

~~3. Environmental Protection: Section 01355~~

4. ~~NDPES Permit Requirements: Section 01565~~

1.02 REFERENCES

A. “Urban Drainage and Flood Control Manual, Volume 3, Best Management Practices”, Urban Drainage and Flood Control District.

1.03 SUBMITTALS

A. Schedule: Prepare schedules for accomplishing all required temporary and permanent erosion control work and submit them for acceptance at the pre-construction conference. Include all construction activities within the project, haul roads, borrow pits, storage and plate sites, and the plan for disposal of waste material. Do not start work until temporary erosion control schedules have been accepted.

B. Permits: Obtain all necessary permits as set forth in Section 01565. Submit any proposed changes to the permits for approval prior to doing the work.

1.04 QUALITY ASSURANCE

A. Pre-construction Conference: Contractor to assign an Erosion Control/ Water Quality Supervisor whose responsibility will be to fulfill the obligations listed below.

1. Have authority over all necessary labor and equipment to direct and channel new drainages which may develop on a daily basis into a suitable temporary pollution and erosion control features wherever necessary during unforeseen or emergency situations, and of dismantling those features when their purpose has been fulfilled unless the C.O. directs that the facility be left in place as a permanent control feature. If removed, the area in which these features were constructed shall be returned to a condition reasonably similar to that which existed prior to its disturbance.

2. Be immediately available upon the C.O.'s request to implement necessary actions to reduce any anticipated or presently existing water quality or erosion problems resulting from construction activities. The criteria by which the C.O. initiates this action may be based on water quality data derived from monitoring operations or by anticipated conditions which the C.O. believes could lead to unsuitable water quality situations.

3. Give high priority to actions deemed necessary by the C.O. to control adverse water quality impacts. The erosion control/water quality supervisor, must make immediately available all personnel and equipment judged appropriate by the C.O. to maintain suitable erosion control features. These actions requested by the C.O. take precedence over any other aspect of the project construction which has need of the same manpower and equipment.

4. Sample water and provide the appropriate reports of analytical test results on the water sampled, or hire a qualified firm approved by the C.O. to perform the sampling and testing of water samples at the locations and time schedule required by the permits.

5. Obtain permits as required by authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Erosion Bales: Hay, straw, or other approved material containing approximately 5 cubic feet of material and weighing not less than 35 pounds. Bales shall be weed free and bound with wire.

B. Anchor Stakes: No. 4 reinforcing steel bars approximately 4 feet long or 2" x 2" x 3' wood stakes.

C. Silt Fence: Plastic fiber cloth manufactured especially for erosion control applications consisting of either polyvinylidene chloride nylon/polypropylene, or polypropylene monofilament yarns, with the following requirements:

1. Cloth: Provide insect, rodent, mildew, and rot resistant cloth.

TEST	MIN REQUIREMENTS
Thickness (ASTM D1910)	15 Mils
Grab Tensile Strength and Wrap (ASTM D1682)	100 lbs
Grab Elongation (ASTM D1682)	30%
Toughness (grab tensile strength x grab elongation)	5000 lbs. X %
Trapezoid Tear (ASTM D2263)	60 lbs.
Coefficient of Friction (CFMC FFET-5)	0.4
Flow Rate (head change from 30 cm to 10 cm)	220 Gal/min/sq. ft.
Pore Size (CFMC FFET-1)	0.15 mm (maximum)

2. Wire Mesh: Standard woven wire field fence, 832-6-11 (32" height), approximately 0.65 lbs./ft or 4" x 4" wire "V" mesh (34" height), approximately 75 lbs./ft.

3. Posts: Metal or wood with a minimum length of 5 ft. Furnish metal posts "studded tee" or "U" type with minimum weight of 1.28 lbs./lin. ft. with fin anchors sufficient to resist post movement or wood posts with a minimum diameter of 4 inches.

4. Wire Ties: 14 gage minimum.

5. Staples for wood posts: No. 9 wire minimum at least 1.5 inches long.

6. Sediment Traps: Construct from soil which is reasonably fine textured and well graded to minimize seepage. Do not use organic material.

F. Vehicle Tracking Gravel: Provide minimum 6" thickness or granular material consisting of 1 1/2" to 3" aggregate over 1/2" to 3/4" thick aggregate filter base.

PART 3 EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

A. General: General Erosion Control Sheets have been incorporated into the plans. Implement, operate, and maintain in a safe manner all permanent or temporary erosion control features describes in this section and the plan sheets. It is the Contractor's responsibility to conduct the construction work in such a manner to prevent contamination of adjacent waters.

1. Include temporary erosion control in construction work areas outside the project site where necessary for borrow pits, haul roads, and equipment storage sites.

2. Incorporate all permanent erosion control features into the project at the earliest possible time as outlines in the accepted schedule. Maintain erosion control features until project is accepted.

3. Comply with provisions contained within the necessary permits.

B. Temporary Controls: Provide temporary erosion and sediment control measures for the purpose of correcting conditions that develop during construction not foreseen by the design of the project, or during an emergency situation. Measures proposed by the Contractor must be reviewed by the C.O. and approved prior to installation.

C. Slopes: Stabilize all cut and fill slopes with landscaping according to the Landscaping Sheets or other seeding and mulching within a period of 14 calendar days where slopes exceed 3:1 (horizontal to vertical).

D. Silt Fences: Set stakes; excavate 4” x 4” trench upslope of stakes, place filter fabric, backfill and compact trench.

E. Straw Bales: Excavate 4” depth trench the width of bale. Place bales in trench with tight abutting ends. Stake each bale with two stakes.

F. Conflicts: In the event of conflicts between these requirements and water quality control laws, rules, or regulations of other Federal, State or local agencies, the more restrictive of the two shall apply.

3.02 WATER QUALITY MANAGEMENT REQUIREMENTS

A. Compliance: Take all reasonable steps to comply with the Erosion Control and Water Quality Plan and the Erosion Control Sheets, and other applicable standards, permit conditions, and regulations of appropriate agencies.

B. Start of work: Install permanent erosion and sediment control measures at the earliest possible time. As one of the first construction activities, place permanent and temporary erosion and sediment control measures around the perimeter of the project or the initial work area.

C. Coordination: Coordinate temporary erosion control measures with permanent measures to ensure economical, effective, and continuous control throughout the construction phase.

D. Disposal: Pollutant byproducts of construction, solids, sludges, pollutants removed in the course of treatment of wastewater, excavation, or excess fill material, and material from sediment traps shall be handles, stockpiles, or disposed of in such a manner so entry into any waterbodies or wetlands within or outside the project boundaries is prevented.

3.03 MAINTENANCE

A. Continuously maintain all erosion and sediment control measures so that they perform their intended function during the construction of the project.

B. Remove and replace sediment laden and ineffective bales with new straw bales.

C. Remove and replace damaged or ineffective silt fences.

END OF SECTION 312500

SECTION 32 01 90 - TREE PROTECTION

PART ONE – GENERAL

1.1 SUMMARY

A. This work consists of retaining and protecting trees during the construction of the project.

1.2 RELATED WORK

A. Related Documents: Construction Documents, General and Special Conditions of the Contract apply to work of this section.

1.3 QUALITY ASSURANCE

A. General Requirements: Provide daily supervision of field crews by Project Consulting Arborist during the critical phases of the project: for example, demolition of existing asphalt and concrete; blasting; root pruning; or construction of pavements within tree protection areas.

B. If it appears that the completion of the construction may cause damage to the branches of any tree, the Contractor shall contact Owner prior to work commencement.

C. To prevent or minimize soil compaction, designated routes for equipment and foot traffic by work crews shall be determined prior to commencing construction activities, and shall be indicated in the tree protection plan to be submitted by Contractor. These routes shall be marked at the site, prior to commencement of construction, with tree protection fencing and signage as specified.

D. Motorized equipment and trailers, including tractors, Bobcats, bulldozers, trackhoes, trucks, cars, and carts shall not be allowed access within tree protection areas.

E. Materials and supplies shall not be stockpiled or stored within the tree protection area. Should temporary storage be necessary within designated tree protection areas, the existing grade shall be covered with double, overlapping sheets of ¾ " thick plywood, or six (6) to eight (8) inches of wood mulch to help distribute the weight of materials or supplies and to minimize soil compaction.

F. Under no circumstances shall any objects or materials be leaned against or supported by a tree's trunk, branches, or exposed roots. The attachment or installation to trees of any sign, cable, wire, nail, swing, or any other material that is not needed to help support the natural structure of the tree is prohibited. Standard arboricultural techniques such as bracing or cabling that are performed by professional arborists are acceptable upon approval by the Owner.

1.4 LEED REQUIREMENTS:

A. Local/Regional Materials: Preference shall be given to products and materials which have been manufactured, harvested, extracted mined quarried, etc. within a 500 mile radius of the project site.

1.5 REFERENCE STANDARDS AND GUIDELINES

A. Contractor shall comply with applicable requirements and recommendations of the most current versions of the following standards and guidelines. Where these conflict with other specified requirements, the more restrictive requirements shall govern.

1. ANSI Z133.1-1988
   American National Standard for Tree Care Operations
2. ANSI A300-1994
   Standard Practices for Trees, Shrubs and Other Woody Plant Maintenance
3. NATIONAL ARBORIST ASSOCIATION STANDARDS
   Pruning, Cabling and Bracing, Fertilization
4. GUIDE FOR PLANT APPRAISAL-8TH EDITION
   Authored by the Council of Tree and Landscape Appraisers; published by the International Society of Arboriculture.

1.6 DEFINITIONS

A. Tree Protection Area: Generally, a tree protection area should consist of the ground encompassing from 1.5 (minimum) to 2.0 times the distance between the trunk and dripline, or one linear foot away from the trunk base for every inch diameter of the trunk, whichever is greater. Areas of ground covered by pavement, buildings, or other permanent structures where the presence of roots is minimal or negligible are excluded. The area under or within the tree's dripline is also referred to as the "Critical Root Zone" (see below).

With groups of trees or where an array effect is present, there may be discontinuous (non-overlapping) perimeters of tree protection areas that result in difficult to maintain or ineffective tree protection fencing. In these cases, even though tree protection areas do not overlap, they should be treated as though they do if the distance between the perimeters of such areas is less than thirty (30) feet. In effect, this will artificially enlarge the area of tree protection, but will result in a more clearly defined, manageable area.

B. Dripline: The outermost edge of the tree's canopy or branch spread. The area within a tree's dripline is all the ground under the total branch spread.

C. Critical Root Zone: Generally, all of the ground area included in the dripline.

D. Diameter (Caliper): The size (in inches) of a tree's trunk is measured at:
[1]-six (6) inches above grade for trunk diameters up to and including four (4) inches.
[2]-twelve (12) inches above grade for trunk diameters from four (4) inches up to and including eight (8) inches.
[3]-four and a half (4½) feet above grade for trunk diameters greater than

eight (8) inches

All work shall be done in accordance with guidelines established in the "Guide for Plant Appraisal". All measurements should be rounded to the nearest inch.

E. High-Value Shrub: Any specimen shrub with an appraised value of $100.00 or more.

F. Project Consulting Arborist: An independent consultant with a degree in a field related to arboriculture, and at least five years field experience in tree preservation or on-site monitoring of public works or construction projects involving tree retention and protection. The consultant should be an active member in the American Society of Consulting Arborists and International Society of Arboriculture.

1.7 PROJECT SITE MONITORING

A. As determined by Owner, a Project Consulting Arborist should be retained to enforce and monitor the Tree Retention and Protection objectives. The project site should be monitored a minimum of two (2) times weekly-more frequently at the start of the project until all procedures and specifications are understood and properly executed by all parties. Specific monitoring schedules should be developed at preconstruction meetings and modified as deemed necessary by the appropriate parties.

1.8 SUBMITTALS

A. Proposed methods and schedule for effectuating tree and other plant protection shall be submitted for approval. Contractor shall submit construction schedule that includes a time frame for work near existing plants. Approval of such shall be obtained from the Owner prior to commencement of construction near tree protection areas.

B. Proposed methods, materials, and schedule for root pruning, branch pruning, and other tree maintenance shall be submitted for approval. Owner and Project Consulting Arborist shall mark the location of root pruning lines in the field prior to the operation. If possible, root pruning should occur between autumnal leaf fall and spring foliation. Root pruning during the growing season shall require approval of Owner and Project Consulting Arborist.

C. LEED SUBMITTALS:

1. Local/Regional Materials: Provide a statement from the manufacturer stating that materials provided were manufactured within a 500 mile radius of the project. Include location of the manufacturing facility including name, address and distance between manufacturing facility and the project site. Provide manufacturer’s documentation indicating location where the base materials were extracted, mined, harvested, etc. and distance between manufacturing facility and the project site (Applies to LEED MRc5.1 and MRc5.2: Regional Materials).

a. Include material costs (excluding cost of installation).

PART 2 - MATERIALS

2.1 TREE PROTECTION FENCING

A. Tree protection fences should be constructed as follows:
1. Orange safety fence 48” in height, with 1/2”x1-1/2” wood slats. Posts shall be steel t-posts, 5-1/2’ in length. Install on ten- (10) foot centers (maximum), at a depth of 18” minimum. Installation of post shall not result in injury to surface roots or root flares of trees.

PART 3 – EXECUTION

3.1 TREE PROTECTION FENCING

A. Tree protection areas shall be as designated on construction documents, and fencing locations should be staked for approval by Owner or Project Consulting Arborist.

B. Fencing should be installed to completely surround the limits of tree protection areas, and should extend up to the designated construction limits.

C. Tree protection fencing shall be installed prior to any site activity and shall remain until its removal is authorized by Owner.

3.2 CONSTRUCTION WASTE MANAGEMENT AND RECYCLING

A. All project construction waste and recycled materials shall be managed in accordance with Division 1. The Contractor shall submit documentation satisfying the requirements of that section.

3.3 DEMOLITION OF EXISTING ASPHALT OR CONCRETE

A. Caution should be used during removal of existing rock, paving, curb, gutter, sidewalk, drain inlets, and other concrete demolition, to minimize injury to tree root systems. The following procedures should be used when removing existing concrete.

B. Breaking of the existing concrete for removal should be done in a manner that will minimize ground disturbance and vibration.

C. Concrete or stone within designated tree protection areas and critical root zones shall be removed by hand. When removing existing sidewalks and curbs, care should be taken to avoid injury to roots located under, over, or adjacent to paved surfaces.

D. Roots and root-trunk flares growing over curbs should not be injured during breaking of curbs and removal of debris. Wood and bark tissues shall not be injured by striking tissues with equipment.

E. During the removal of concrete, all root systems and soil areas exposed shall not be disturbed.

F. Motorized equipment and trailers, including tractors, Bobcats, bulldozers, track-hoes, trucks, cars, and carts are to be limited to access on the existing paved street only. Access is not allowed behind the curb within tree protection areas.

G. Should access be necessary within designated tree protection areas, the existing grade shall be covered with double, overlapping sheets of ¾ " thick plywood, or six (6) to eight (8) inches of wood mulch to help distribute the weight of equipment and to minimize soil compaction and rutting. Plywood and/or mulch shall not be acceptable bridging material for driving over exposed tree roots. Exposed tree roots shall not be driven over. Owner or Project Consulting Arborist shall be notified and shall approve of the access and driving surface prior to its use.

3.4 CONSTRUCTION OF PAVEMENTS, CURBS AND STRUCTURES

A. The following procedures shall be used when constructing hard surface improvements.

B. Keep all materials and equipment within the area bounded by existing pavement.

C. Protect exposed roots from contamination by stabilization materials and concrete.

D. Locate concrete washout areas away from roots and tree protection areas.

E. When excavating for the construction of inlets, excavated soil shall be deposited in trucks and hauled off or deposited temporarily on ¾ inch thick plywood outside the critical root zone. Excavated and fill soil shall not be deposited, even temporarily, on unprotected natural grade.

F. After proper pruning, as needed, cover exposed roots within thirty (30) minutes to minimize desiccation. Roots may be covered with soil, mulch, or moistened burlap (7 ounce or equivalent), and shall be kept moist during the period until the final grade is established.

G. Where possible paving should be raised, narrowed, curved, or relocated to prevent cutting and removing major roots (e.g. roots greater than three inches in diameter).

H. Place a sheet of six (6) mil or thicker plastic over the grade within affected portions of tree protection areas prior to pouring concrete sidewalks, curbs, inlets, ramps, and driveway approaches. The plastic will assist in providing a non-leaching barrier between the concrete, soil and roots.

I. Limit grading to a maximum of two (2) inches fill over natural grade within critical root zones. Fill should consist of sandy loam topsoil. Clay soils shall not be used as fill. When using fill soil, the existing surface to receive fill should be scarified prior to filling. Any filling operation should not occur during water saturated soil conditions.

J. Existing soil may be used as a form for back of curb and gutter, with or without the use of a thin masonite-type form, although a masonite form is preferred. This will minimize excavation in the critical root zone and prevent undue injury to the roots. This method is unnecessary in areas outside the critical root zone. Place a layer of root restricting barriers between the curb and tree roots to help inhibit root growth that may exploit small cracks in the curb. Where appropriate, use curbs with discontinuous footings to maintain natural grade near the base of trees adjacent to the curbing, and to minimize injury to roots and root flares.

K. In areas where roots have to be removed for construction, roots shall be severed prior to excavation to eliminate unnecessary tearing of roots by equipment.
1. Excavate soil by hand at the construction cut limit to a depth of thirty (30) inches or to the depth of the required root cut, whichever is less.
2. Prune roots as specified.
3. Protect exposed roots as specified.

L. Concrete or chemicals spilled within tree protection areas should be completely removed. Contaminated soil shall be completely removed at the time of the spill and removed by hand without disturbance to root systems. Appropriate soil should be added as necessary to restore the grade.

3.5 PROTECTION DURING UTILITY INSTALLATION

A. PROTECTION OF TREES AND HIGH-VALUE SHRUBS:

1. Contractor shall protect all trees and high-value shrubs from injury due to utility related work. All injuries to trees and high-value shrubs shall be mitigated to the satisfaction of the Owner, and, if appropriate in accordance with guidelines established in the "Guide for Plant Appraisal". All costs of such mitigation shall be charged to and paid by the Contractor.
2. All utility lines shall be indicated on construction plans and pre-approved by the Owner. Unless absolutely necessary, no utility lines shall be located within 10 feet of any existing tree trunk.

B. EXISTING TREES

1. Owner shall be notified prior to any trenching or excavation known or suspected to involve cutting of more than:
[1]- two roots, three inches or more in diameter.
2]-four roots between two (2) and three (3) inches in diameter.
Owner shall be notified immediately in the event that roots in excess of that described above are cut, torn, ripped, or otherwise injured.
2. All trenching or other work under the dripline of any tree shall be done by hand or by other methods that will prevent breakage or other injury to branches and roots.
3. Where it is necessary to excavate within the critical root zone of existing trees, Contractor shall use all possible care to avoid injury to trees and tree roots. Excavation, in areas where two (2) inch diameter and larger roots occur, shall be done by hand with approved hand tools. Where possible, tree roots two (2) inches or larger in diameter shall be tunneled

or bored under and shall be covered with moistened burlap to prevent excessive drying.

4. Wherever a trenching machine exposes roots smaller than two (2) inches in diameter, such roots extending through the trench wall shall be hand pruned. All trenches within critical root zones shall be closed within twelve- (12) hours-if this is not possible, the trench walls shall be covered with burlap and kept moistened. Prior to backfilling, Contractor shall contact Owner to inspect the condition and treatment of roots larger than two (2) inches in diameter injured by trenching.
5. Horizontal directional boring (auger tunneling), rather than open trenching, shall be used for irrigation line or other utility installation within one half (½) foot linear distance from the trunk base for every inch of trunk diameter, if root disruption or utility installation occurs on no more than one side of the tree. If trenching or utility installation occurs on two or more sides of a tree trunk (e.g. N,S,E, or W), then horizontal directional boring shall be used if line installation is within one (1) foot linear distance from the trunk base for every inch of trunk diameter.

3.6 ROOT PRUNING

A. Tree roots shall not be pruned or cut unless their removal is unavoidable or absolutely necessary. Owner shall be notified prior to any operation known or suspected to involve cutting of more than:
[1]- two roots, three (3) inches or more in diameter; and/or
[2]- four (4) roots between two (2) and three (3) inches in diameter.
Owner shall be notified immediately in the event that roots in excess of that described above are cut, torn, ripped, or otherwise injured.

B. Upon approval by Owner, prior to any excavation, removal of sidewalk, or other activity that will result in removal of soil and tree roots, all tree roots within a designated area will be pruned to a depth of fourteen (14) inches. Pruning shall occur with a Dosko Root Pruner, or equivalent, in accessible areas, and by hand in areas inaccessible to the root pruning machine. All other root pruning shall be done by hand with approved tools.

C. Removal of roots greater than one (1) inch diameter or parts of roots that are injured or diseased should be performed as follows:
   1. Preserve the root bark ridge (similar in structure and function to a branch bark ridge). Directional root pruning is the recommended technique and should be used during hand excavation around tree roots. Roots are similar to branches in their response to pruning practices. With directional root pruning, objectionable and severely injured roots are properly cut to a lateral root, if possible, that is growing downward or in a favorable direction.
   2. All roots needing to be pruned or removed shall be cut cleanly with sharp hand tools, with oversight by Owner or Project Consulting Arborist. No wound dressings shall be used.
   3. Recommended root pruning tools: Scissor-type lopper, Scissor-type pruner, Large and small hand saws, Wound scriber, Trowel or small shovel, Garden Fork, Hand broom.

3.7 ROOT PRUNING NEAR SIDEWALKS

A. Root pruning shall be done by hand to achieve the objective of reducing future sidewalk problems as well as preserving the trees. Removing anchoring roots or causing injuries in anchoring roots and root flares can cause future decay and windthrow hazards. Indiscriminate cutting of vigorous roots results in their re-sprouting so that several more new roots may grow from the cut end, back under the sidewalk, thereby reducing the time between sidewalk repairs. Roots can be managed in the ground without significant harm to trees, if care is taken to avoid injuries that lead to root and trunk decay.

B. Directional root pruning is recommended because it considers the tree's response to root pruning and decay. With directional root pruning, roots are cut to a large lateral, if possible, that is growing downward or in a more favorable direction. The pruned root ends will be less likely to resprout, since a large lateral can assume the new terminal role of the root. roper removal of selected roots or parts of roots can direct roots away from sidewalks in the future. Procedures for root pruning directly next to sidewalks are as follows:

1. Hand dig six (6) to eight (8) inches in depth at the edge of the planting strip and sidewalk.
2. Remove all roots less than two (2) inches in diameter in this trench back to a desirable lateral root, preserving the root bark ridge. If careful excavation does not reveal a desirable lateral root within twelve (12) inches of the exposed root in question, then the exposed root shall be pruned properly so that a minimal amount of root is removed.
3. Small root bundles, the source of future sidewalk problems, shall also be removed at this time.

C. All roots between two (2) and four (4) inches in diameter should be examined by Owner or Project Consulting Arborist in terms of their role in anchoring the tree.

1. All roots that contribute significantly to anchorage should be preserved. Remove all other roots in this size range to sound, downward growing lateral roots that are at least one half (½) the size of the root being removed.
2. All roots larger than four (4) inches in diameter are to be preserved unless their removal is absolutely necessary. Preservation of large roots may require:
   [1]- reducing the sidewalk width near the root flare; and/or [2]- ramping or bridging the sidewalk over the roots to allow for root growth.
3. Tree guying subsequent to root pruning:

D. Upon review of on-site root pruning and constructing grading limits, Owner or Project Consulting Arborist shall determine if existing trees subject to root pruning should be guyed or otherwise stabilized. Contractor shall retain a qualified tree service company to complete tree guying and stabilization in accordance with National Arborist Association standards.

3.8 TREE PROTECTION SIGNAGE

A. A sign shall be mounted on tree protection fencing at fifty (50) foot intervals warning constructing personnel and the public to keep out of the tree protection areas.

3.9 INJURIES TO EXISTING PLANTS - DAMAGE PENALTIES.

A. TREE AND HIGH-VALUE SHRUB APPRAISAL:

All trees and high-value shrubs will be evaluated and appraised by Owner and a list of all tree values for the project will be on file with Owner. Any tree or other plant requiring retention or protection that is not on the list shall be appraised by Owner as necessary to comply with this damage penalty.

Documentation for appraisals will consist of: [1]-measurement of plant size; [2]-identification by common and botanical names; [3]-current condition (overall health, injuries, overt hazard status, etc.) and [4]-location factors as described in the "Guide for Plant Appraisal". Photographs may be taken of certain trees and shrubs to document debilitating condition factors.

The threshold level for plants to be appraised shall be $100.00; only those trees and shrubs estimated to have a monetary value greater than $100.00 shall be appraised.

B. Trees and other plants designated as requiring retention or protection shall be identified and located on construction plans. Loss of, or partial injury to, any of these plants due to Contractor neglect or improper construction activities will result in liquidated damages for the assessed value of the tree as determined by Owner.

C. Trees determined as requiring "general protection" or "special protection" in the construction areas and in other key locations should be clearly identified by Owner or Project Consulting Arborist. Loss or partial injury to any of these trees due to Contractor neglect or improper construction activities will result in liquidated damages for the assessed value of the trees as determined by Owner. Injury to a portion of these trees will be assessed by Owner and a corresponding portion of the liquidated damages will be assessed to the Contractor.

D. A fine of one thousand dollars ($1,000.00) will be levied against the Contractor for each incident of construction damage (including construction traffic) within designated tree protection areas. Any fine shall be independent of any applicable liquidated damages for the assessed value of the tree or tree part.

E. Trees or roots visibly and unnecessarily injured will cause the Owner to withhold from the Contractor an assessed amount conforming to the requirements stipulated above, for a period of one full year. After that period the impact of the injury to any tree will be assessed by Owner.

F. If any trees or shrubs designated to be retained or protected are injured and replacement is justified, a number and equivalent diameter inches of trees or shrubs of same or similar species shall be furnished and planted by the Contractor. The total inch diameter of the replacement plant(s) shall equal the diameter of the plant(s) to be replaced, in accordance with the "Guide for Plant Appraisal".

END OF SECTION 32 01 90

SECTION 321216 - HOT-MIX ASPHALT PAVING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The General Contract Conditions, Drawings and other Division 1 Specification sections apply to Work of this section.

B. Metropolitan Government Pavement Engineers Council (MGPEC) Uniform Specification for Mixture Design, Field Control and Construction of Hot Asphalt Pavements, Latest Edition.

1.02 SUMMARY

A. This Section includes the following:

1. Hot-mix asphalt patching.

B. Related Sections include the following:

1. Division 2 Section "Earthwork" for aggregate sub-base and base courses and aggregate pavement shoulders.

2. Division 7 Section "Sealants and Caulking" for joint sealants and fillers at paving terminations.

3. Division 2 Section “Pavement Marking”.

1.03 SUBMITTALS

A. Product Data: For each product specified. Include technical data and tested physical and performance properties.

C. Job-Mix Designs: The Contractor shall submit each job mix proposed for the Work to the Engineer for approval at least two weeks prior to being required on the site. The design mix shall show all components, sieve size, and percent by volume.

D. Samples: 12 by 12 inches minimum, of paving fabric if used.

E. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Engineers and Owners, and other information specified.

F. Material Test Reports: Indicate and interpret test results for compliance of materials with requirements indicated.

G. Material Certificates: Certificates signed by manufacturers certifying that each material complies

with requirements.

H. Qualification Certificates: Certificates demonstrating conformance with the requirements of paragraph 1.5.

I. Recycled Content (MRc4):

a) Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).

b) Include information on Material Tracking Worksheets.

J. Material Source (MRc5):

a) Submit product data or other published information verifying the location of manufacturing facility including name, address, and distance between manufacturing facility and the project site. Provide manufacturer's documentation indicating location where the base materials were extracted, mined, quarried, harvested, etc. and the distance between this location and the project site. Also include material costs (excluding costs of installation).

b) Include information on Material Tracking Worksheets.

1.04 QUALITY ASSURANCE

A. Specification Conformance: Follow guidelines for specification conformance in accordance with MGPEC 401.2.6 Guidelines.

B. Installer Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

C. Manufacturer Qualifications: Engage a firm experienced in manufacturing hot-mix asphalt similar to that indicated for this Project and with a record of successful in-service performance.

1. Firm shall be a registered and approved paving mix manufacturer with the City and County of Denver.

D. Testing Agency Qualifications: Demonstrate to Engineer's satisfaction, based on Engineer's evaluation of criteria conforming to ASTM D 3666, that the independent testing agency has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

E. Regulatory Requirements: Conform to applicable standards of authorities having jurisdiction for asphalt paving work on public property.

F. Asphalt-Paving Publication: Comply with AI's "The Asphalt Handbook," except where more stringent requirements are indicated.

G. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings" Review methods and procedures related to asphalt paving including, but not limited to, the following:

1. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.

2. Review condition of substrate and preparatory work performed by other trades.

3. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

4. Review and finalize construction schedule for paving and related work. Verify availability of materials, paving Installer's personnel, and equipment required to execute the Work without delays.

5. Review inspection and testing requirements, governing regulations, and proposed installation procedures.

6. Review forecasted weather conditions and procedures for coping with unfavorable conditions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location and within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if substrate is wet or excessively damp or if the conditions specified in the MGPEC Uniform Specifications are not met.

PART 2 PRODUCTS

2.01 GENERAL

A. The asphaltic concrete pavement should consist of a bituminous plant mix composed of a mixture of aggregate and bituminous material should be Grade S, PG 28-28 (SuperPave N = 76) conform to the requirements of AASHTO 226. Grading G (or SG) may be used for the lower lifts.

2.02 AGGREGATES

A. Job Mix Formula: A proposed job mix formula (JMF) prepared by a qualified engineer for each mixture shall comply with the appropriate section of the MGPEC Uniform Specification.

2.03 ASPHALT MATERIALS

A. Asphalt Materials shall conform to the appropriate section of the MGPEC Uniform Specification.

2.04 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by Environmental Protection Agency (EPA). Provide granular, liquid, or wettable powder form.

B. Sand: ASTM D 1073, Grade Nos. 2 or 3.

C. Paving Geotextile: Pavement fabric will be used under all asphalt overlay areas. Fabric shall be “Petro Mat” as produced by Phillips Fibers, Greenville, South Carolina (4.3 ounce per sq. ft. minimum). Geotextiles shall only be used under other circumstances with written permission of the Engineer.

2.05 MIXES

A. Hot-Mix Asphalt: Conform to the appropriate section of the MGPEC Uniform Specification.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

C. Notify Engineer in writing of any unsatisfactory conditions. Do not begin paving installation until these conditions have been satisfactorily corrected.

3.02 PATCHING AND REPAIRS

A. Patching: Saw cut perimeter of patch and excavate existing pavement section to sound base. Recompact new subgrade. Excavate rectangular or trapezoidal patches, extending 12 inches) into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically.

1. Tack coat faces of excavation and allow curing before paving.

2. Fill excavation with dense-graded, hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.

3. Partially fill excavation with dense-graded, hot-mix asphalt base mix and compact while still hot. Cover asphalt base course with compacted, hot-mix surface layer finished flush with

adjacent surfaces.

B. Leveling Course: Install and compact leveling course consisting of dense-graded, hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

C. Crack and Joint Filling: Remove existing filler material from cracks or joints to a depth of ¼ inch. Refill with asphalt joint-filling material to restore watertight condition. Remove excess filler that has accumulated near cracks or joints.

D. Tack Coat: Apply uniformly to existing surfaces of previously constructed asphalt or Portland cement concrete paving and to surfaces abutting or projecting into new, hot-mix asphalt pavement. Apply at a uniform rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m) of surface.

1. Allow tack coat to cure undisturbed before paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.03 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted aggregate base before applying paving materials.

1. Mix herbicide with prime coat when formulated by manufacturer for that purpose.

C. Prime Coat: Apply uniformly over surface of compacted-aggregate base at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure for 72 hrs minimum.

1. If prime coat is not entirely absorbed within 24 hrs after application, spread sand over surface to blot excess asphalt. Use just enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.

2. Protect primed substrate from damage until ready to receive paving.

3.04 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt mix on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness, when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.

2. Place hot-mix asphalt surface course in single lift.

3. Spread mix at minimum temperature of 250° F (121° C).

4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.

5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide, except where infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete asphalt base course for a section before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.05 JOINTS

A. Construct joints to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat.

2. Offset longitudinal joints in successive courses a minimum of 6 inches.

3. Offset transverse joints in successive courses a minimum of 24 inches.

4. Construct transverse joints by bulkhead method or sawed vertical face method as described in AI's "The Asphalt Handbook."

5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.

6. Compact asphalt at joints to a density within 2% of specified course density.

3.06 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185° F (85° C).

B. Breakdown Rolling: Accomplish breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Repair surfaces by loosening displaced material, filling with hot-mix asphalt, and rerolling to required elevations.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling, while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 96% of reference laboratory density according to ASTM D 1559, but not less than 94% nor greater than 100%.

2. Average Density: 92% of reference maximum theoretical density according to ASTM D 2041, but not less than 90% nor greater than 96%.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials. Remove paving course over area affected and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.07 INSTALLATION TOLERANCES

A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.

2. Surface Course: Plus 1/4 inch, no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 0.05 ft tolerance within 10’ straightedge.

2. Surface Course: 0.10 ft tolerance within 10’ straightedge.

3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

3.08 SURFACE TREATMENTS

A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. (0.45 to 0.70 L/sq. m) to existing asphalt pavement and allow to cure. Lightly dust areas receiving excess fog seal with a fine sand.

3.09 FIELD QUALITY CONTROL

A. In accordance with the requirements of Section 01400. If a discrepancy exists between this section and 01400, section 01400 will supercede.

B. Testing Agency: Owner will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

D. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

E. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

F. In-Place Density: Samples of uncompacted paving mixtures and compacted pavement will be secured by testing agency according to ASTM D 979.

1. Reference laboratory density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 1559, and compacted according to job-mix specifications.

2. Reference maximum theoretical density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.

3. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.

a) One core sample will be taken for every 1000 sq. yd. or less of installed pavement, but in no case will fewer than 3 cores be taken.

b) Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

G. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION 321216

SECTION 321313 - EXTERIOR CONCRETE FLATWORK

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1-Specification sections, apply to work of this Section.

1.02 SECTION INCLUDES

A. Exterior concrete flatwork as shown on the drawings for the following:

1. Curbs
2. Gutters
3. Cross pans
4. Sidewalks
5. Ramps
6. Stairs

1.03 RELATED SECTIONS

A. The following Sections contain requirements that relate to this Section.

1. Section 31 20 00 – Earthwork

1.04 SUBMITTALS

A. Submit concrete test reports.

B. Recycled Content (MRc4):

a. Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).

b. Include information on Material Tracking Worksheets.

C. Material Source (MRc5):
   a. Submit product data or other published information verifying the location of manufacturing facility including name, address, and distance between manufacturing facility and the project site. Provide manufacturer's documentation indicating location where the base materials were extracted, mined, quarried, harvested, etc. and the distance between this location and the project site. Also include material costs (excluding costs of installation).

   b. Include information on Material Tracking Worksheets.

D. Mix Design: Prior to pouring any concrete, submit concrete mixes for approval in accordance with standards. Separate mix designs shall be submitted for each type of concrete to be used in the project.

1.05 QUALITY ASSURANCE

A. Codes and Standards:

1. For work on public rights-of-way, conform to requirements of authorities having jurisdiction to the extent that they are more stringent than specified herein. Obtain required permits and inspections for work on rights-of-way.

2. Except as otherwise specified or required by authorities having jurisdiction, conform to requirements of ACI 301.

B. Concrete Staining Sample Panes: Prepare one sample finished panels, divided into three sections using specified poured in place concrete materials. Each sample section shall be a minimum of 1 foot square. Sample sections shall each contain one stain sample (three different stains) as selected by Owner.

1.06 PROJECT/SITE CONDITIONS

A. Cold Weather Protection:

1. Protect all concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures in compliance with the requirements of ACI 306.

B. Hot Weather Placing:

1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305.

PART 2 PRODUCTS

2.01 MATERIALS

A. Forms:

1. Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

   a) Use flexible spring steel forms or laminated boards to form radius bends as required.

2. Coat forms with a non-staining form release agent that will not discolor or deface surface of concrete.

B. Portland Cement Concrete:

1. Conform to requirements of Section 03310 including fibrous reinforcing.

C. Reinforcing Steel:

1. Conform to requirements of Section 03310.

2. Recycled content (MRc4):

   Building materials in this section must have post- and/or pre-consumer recycled content by weight of total product.

D. Curing Materials:

1. Conform to requirements of Section 03310.

E. Recycled Content (MRc4):
Building materials in this section must have post- and/or pre-consumer recycled content by weight of total product.

F. Regional Material Source (MRc5):
Building materials in this section must be extracted, harvested, or recovered, and manufactured and assembled within five hundred (500) miles of the jobsite.

G. Concrete Protective Coating:

1. Following requirements of Section 03310.

H. Expansion Joint Material:

1. 0.5" thick, closed cell polyethylene foam, Texmastic "Vinyltex 3600", Sonneborn "Sonoflex F", or approved equal.

I. Fibermesh Reinforcement:

Concrete Engineered Reinforcing Fibers shall be one hundred percent (100%) virgin polypropylene, collated, fibrillated fibers from Fibermesh Company, 4019 Industry Drive, Chattanooga, TN, 37416. Fibermesh fibers shall only be used in areas indicated on the Drawings and in strict accordance with the manufacturer's recommendations as to type and amount. The fiber manufacturer or approved distributor shall provide the services of a qualified employee for a pre-job meeting and initial job start-up. Only fibrillated fibers designed and manufactured specifically for use in concrete from one hundred percent (100%) virgin polypropylene and so certified by the manufacture shall be acceptable.

J. CONCRETE STAIN

Concrete staining shall be Bomanite Con-Color system or approved equivalent. Color shall be as indicated on the Drawings or as selected by Owner. Seal recessed stained surfaces with Colorcure Concrete Sealer. Apply stain and sealer as per manufacturer’s recommendations. Contractor shall submit manufacturer samples (up to three) (12”x12”) of colored, stained concrete in addition to on-site test panel. Colors will be selected by Owner from Con-Color Exotic color palette.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify subgrades to ensure adequacy of compaction and suitability to receive exterior concrete flatwork. Start of work under this section constitutes acceptance of subgrade as suitable for exterior concrete flatwork.

3.02 PREPARATION

A. Staking of Lines and Grades;

1. Provide line and grade stakes for exterior flatwork for alignment and levels.

B. Excavation:

1. Excavate to the required depth and to a width that will permit the installation and bracing of the forms. Shape and compact subgrade to a firm even surface. Remove and replace all soft and yielding material with acceptable material.

3.03 FORMING

A. Forms:

1. Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

a) Check completed formwork for grade and alignment to following tolerances:

i) Top of forms not more than 0.125" in 10'.

ii) Vertical face on longitudinal axis, not more than 0.25" in 10'.

2. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

3.04 REINFORCEMENT

A. Locate, place and support reinforcement as specified in Division -3 sections, unless otherwise indicated.

3.05 MIXING AND PLACING CONCRETE

A. Follow requirements of Section 312000 earthwork requirements pertaining exterior concrete flatwork.

B. Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required to provide a uniform dampened condition a time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

C. Curbs and Gutters:

1. Automatic machine may be used for curb and gutter placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results which meet or exceed minimum specified. Machine placement must produce curbs and gutters to required cross-section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified.

D. Concrete placement:

1. Inspection: Before placing concrete in the public right-of-way, Contractor shall call City of Denver Public Improvements Permits Office at 303-446-3469 twenty-four (24) hours to schedule a City inspection of the complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

2. Remove snow, ice, or frost from subbase surface and reinforcing before placing concrete. Do not place concrete on surfaces that are frozen.

3. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

4. Comply with requirements and with ACI 304R for measuring, mixing, transporting, and placing concrete.

5. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

a) When concrete placing is interrupted for more than ½ hour, place a construction joint.

6. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete complying with ACI 309R.

7. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. DO not further disturb concrete surfaces prior to beginning finishing operations.

8. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed the surface.
   a) Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.

9. Cold-Weather Placement: Comply with provisions of ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Contractor shall provide sufficient protection such as blankets, framework enclosures, and heating apparatus to enclose and protect the concrete and maintain the temperature of the concrete at no less that 50° deg F (10° C) until at least 60% of the 28-day design strength has been attained.
   a) When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50° F (10 deg C) and not more than 90 deg F (32 deg C) at point of placement.
   b) Do not use frozen materials or materials containing ice or snow.
   c) Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix design.

10. Hot-Weather Placement: Place concrete complying with ACI 305R and as specified when hot weather conditions exist.
    a) Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
    b) Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.

    c. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

11. Truck Washout: Concrete truck wash water discharges shall be treated as pollution, and therefore it is the Contractor's responsibility to clean and prevent contamination of downstream waters. If a site washout area is provided it must be fully contained and cleaned up in accordance with NPDES regulations and construction best management practices.

3.06 FINISHING

A. Flatwork Concrete Finishing

1. Exposed horizontal surfaces shall be finished as indicated on the Drawings.

2. After striking off and consolidating concrete, smooth surface by screeding and floating. Adjust floating to compact surface and produce uniform texture.

3. After floating, test surface for trueness with a 10 foot straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

4. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2-inch radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

5. After completion of floating and when excess moisture or surface sheen has disappeared, complete troweling and finish surface as follows:

6. Broom finish as indicated on the Drawings. Repeat operation if required to provide a texture acceptable to Owner.

7. ~~Sandblast areas indicated on Drawings.~~

8. On inclined slab surfaces, provide a coarse, non-slop finish by scoring surface with a stiff-bristled broom, perpendicular to line of traffic.

9. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Owner.

B. Flatwork Graphic Bands Finish

1. Light broom finish perpendicular to band. Allow concrete to cure for 10 days.

2. Prior to staining, the cured concrete surface of the graphic band shall be light sand blasted with hard, sharp sand to produce an even fine-grained uniform surface in which the mortar has been cut away. An exposed aggregate finish will not be required. Sand blast areas indicated on the Drawings. Contractor shall provide test panels for Owner's review to determine extent of sandblasting and final concrete texture. Clean up all spoils from sand blasting work.

3. Concrete Stain - After pouring, finishing and curing (28 days) of cast – in – place concrete, sandblast all areas to receive concrete stain. Apply multiple coatings of stain with spray application. Seal with specified sealant once all coats have been applied.

C. Form Removal:

1. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Architect.

3.07 JOINTS

A. Curb and Gutter Expansion Joints:

1. Form expansion joints at intervals shown on the plans using a preformed expansion joint filler having a thickness of 0.5". When the curb is constructed adjacent to or on concrete pavement, locate expansion joints opposite or at expansion joints in the pavement.

2. Install expansion joints between concrete curb and any fixed structure or sidewalk. Extend expansion joint material for full depth of contact surface. Where joint sealer is indicated, stop expansion joint material not less than 0.5" and no more than 1" below finished surface. Protect top edge with metal cap.

B. Concrete Jointing:

1. Divide the paving into sections indicated on the Drawings by contraction joints formed by sawcutting. Contraction joints shall be formed with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/4-inch/wide beveled joints into concrete that has hardened sufficiently that cutting action will not tear, abrade, or otherwise damage surface, but before development of random contraction cracks. Saw cut joints shall be spaced at a distance equal to the width of the walk, but not over 10 feet unless approved by the Project Manager. Extend contraction joints into the concrete for at least 1/3 of the depth .Provide expansion joints where indicated.

2. Curb and Gutter Contraction (Control) Joints: Space curb and gutter joints not more than 12 feet 6 inches on center, and align them with sidewalk joints. Contraction joints shall be tooled. Form plane of weakness by inserting and later removing a metal divider, finish with an edger or groover, or by saw cutting a previously tooled joint.

3. Provide construction joints around all appurtenances such as manholes, utility poles, and other penetrations, extending into and through sidewalks. Install 0.5" thick preformed expansion in these joints. Install expansion joint filler between concrete sidewalks and any fixed structure such as a building. Extend expansion joint material for full depth of concrete except stop 0.5" below finish surface. Protect top edge of joint filler with removable material or metal cap.

3.08 CURING

A. Immediately upon completion of the finishing, moisten concrete and keep moist for three days, or cure concrete by use of membrane forming curing compounds as specified in Section 03310.

B. During the curing period exclude all traffic, both pedestrian and vehicular.

C. For surfaces to receive protective coating, cure by use of absorptive cover.

D. Apply protective concrete coating specified in Section 03310 to exterior pedestrian paving, ramps, sidewalks and terrace surfaces which are subject to de-icing salts. Apply after concrete is cured and surfaces are clean and dry. Apply proprietary materials in accordance with manufacturer's recommendations. Protect surfaces from vehicular or pedestrian traffic until dry.

3.09 CLEANING

A. Sweep concrete and wash free of stains, discolorations, dirt or other foreign material prior to final inspection.

END SECTION 321313

SECTION 321723 - PAVEMENT MARKING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1-Specification sections, apply to work of this Section.

1.02 SECTION INCLUDES

A. Layout and paint lines, direction arrows and signs on asphalt paving.

1.03 RELATED SECTIONS

A. The following Sections contain requirements that relate to this Section.

1. Section 32 12 16 - Asphaltic Concrete Paving.

1.04 SUBMITTALS

A. Product Data:

1. Submit Technical Data sheets indicating compliance with the tests specified in Table II of Federal Specification TT-P-115 F.

B. Samples:

1. Submit sample color chip and standard color chip of Federal Specification 595 for white paint.

1.05 QUALITY ASSURANCE

A. Installer Qualifications:

1. Perform pavement markings by installer regularly engaged in this type of work and with proper equipment for striping a project of this size.

B. Material Compatibility:

1. Verify compatibility of striping paint with sealers, joint sealants, and all other surface treatments specified in Division 7.

C. Paint Materials:

1. Paint markings shall not fade, crack, flake, or peel within the warranty period.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store, mix and prepare paints only in areas designated for that purpose.

B. Furnish clean cans and buckets required for mixing paints and for receiving rags and other waste materials associated with painting. Clean buckets regularly. At the close of each day's work remove used rags and other waste materials associated with painting.

C. Take precautions to prevent fire in or around painting materials. Furnish and maintain hand fire extinguisher near paint storage and mixing area.

1.07 PROJECT CONDITIONS

A. Do not apply pavement markings in wet weather or when the ambient or receiving material temperature is below 40 degrees F.

PART 2 PRODUCTS

2.1 MATERIALS

A. Paint: Alkyd-resin type, ready-mixed complying with AASHTO M248, Type I.

1. Color: White.

B. Drying Time:

1. Furnish paint with a no-pick-up maximum drying time of 20 minutes, when tested according to ASTM D711 using a wet film thickness of 0.015" and when applied and tested at 77 degrees F.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to which paint will be applied and report immediately in writing to the Architect any conditions detrimental to the proper execution of this work.

B. Do not proceed until unsatisfactory conditions are acceptably remedied.

3.02 PREPARATION

A. Verify that surfaced to be painted are in proper condition to receive painting materials, that surfaces are clean, dry, smooth and at proper temperature as recommended by paint manufacturer.

B. Paint over existing striping and markings where indicated in a paint color matching existing surfacing. Use paint intended for that purpose prior to proceeding with new striping and markings.

C. Do not paint or finish any surface which is wet or damp.

D. Clean all surfaces free of adhering foreign matter, dirt and dust.

E. Lay out all striping per drawings. Report any discrepancies, interferences or changes in striping due to field conditions to Architect prior to painting. Paint Installer shall be required to remove paint, repair surface treatment and repaint stripes not applied in strict accordance with the drawings.

3.03 MIXING

A. Do not intermix materials of different character or different manufacturer.

B. Do not thin material except as recommended by manufacturer.

3.04 APPLICATION

A. Apply painting and finishing materials in accordance with the manufacturer's directions. Use applicators and techniques best suited for the material and surfaces to which applied.

B. Fire Lanes: Paint 6" wide stripes spaced 20' o.c. in red / white / yellow color as indicated. Include the words "Fire Lane" and "No Parking" painted alternately at 25' intervals in white letters 6" high and 1" stroke width.

C. Handicap Parking: No painted symbols required.

D. Other Painted Text: Paint white letters for the words “One Way” or “Bus Lane” in accordance with the MUTCD latest revision.

E. Apply paint with mechanical equipment to produce uniform straight edges. Apply at manufacturer's recommended rates.

F. Minimum wet film thickness shall be 0.015". Apply in 4" line widths.

3.05 PROTECTION

A. Provide protections to ensure that work will be without damage or deterioration until final acceptance.

END SECTION 321723

SECTION 32 40 00 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide site furnishings, including: tree grate, trash receptacle, ash urn, pipe bollard and bike rack.

1.2 RELATED WORK

A. Related Documents: Construction Drawings, General and Special Conditions of the Contract apply to work of this section.

1.3 SUBMITTALS

A. Samples and Product Certification: Submit manufacturer's technical data and installation instruction for all site furnishings. Submit to Owner not less than 14 calendar days prior to scheduled delivery of materials.

B. LEED Submittals:

1. Recycled Content: Provide a statement from the manufacturer including the recycled content percentage, by weight, and whether the recycled content is post-consumer or post-industrial (Applies to LEED MRc4.1 and MRc4.2: Recycled Content).

1.4 QUALITY ASSURANCE

A. Contractor Qualifications: Install work using skilled persons, proficient in the trades required, in a neat, orderly and responsible manner with recognized standards of workmanship. Contractor shall have not less than 5 years successful experience with installation of similar work. Submit lists of three projects completed in the last two years of similar complexity to this project number including owner’s name and telephone number, name of project, Landscape Architect and telephone number.

Provide site furnishings as complete units produced by a single manufacturer including necessary erection accessories, fittings and fastenings.

1.5 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Deliver, handle and store materials in manner to prevent damage or deterioration. Deliver and store packaged materials in original, unopened, labeled containers. Wet, moldy, opened or broken packages will not be accepted. The Contractor is responsible for damage and subsequent repairs or replacement.

1.6 GUARANTEE

A. Guarantee all materials for length of manufacturer's warranty or as stated in the General Contract Conditions, which ever is greater.

PART 2 - PRODUCTS

SEE DRAWINGS FOR LOCATION OF FURNISHINGS

2.01 TRASH RECEPTACLE

A. Manufacturer: Landscape Forms
Provide Model No.: Chase Park; 24” x 39”; side opening; without logo band; powder coat – Ivy color; surface mount. See drawings for further information.

2.02 ASH URN

A. Manufacturer: Landscape Forms (*landscapeforms.com*)
Provide Model No.: Chase Park; 24” x 39”; top opening; without logo band; powder coat – Ivy color; surface mount. See drawings for further information.

2.03 BIKE RACK

A. Manufacturer: Belson Outdoors (*belson.com*)
Provide Model No.: BRBC-10; 73.4” x 32”; powder coat – Forest Green; surface mount. See drawings for further information.

2.04 TREE GRATE

A. Manufacturer: Neenah (*nfco.com*)
Provide Model No.: Avenue Series, R-8712; 60”x60”. See drawings for further information.

2.05 BOLLARD

A. Manufacturer: Patterson-Williams
Manufacturer’s Rep: Recreation Plus, 303-278-1455
Model No.: 1100-04-LK Metal Bollard, 4-1/2” DIA. Embedment (permanent) Mount
Color: Federal Green

2.06 CONCRETE ANCHORING

A. Concrete Anchors:

All Items must be anchored to concrete using a steel drop-in anchor. The steel drop-in anchor is an all steel, machine bolt anchor available in carbon steel and two types of stainless steel. The steel drop-in anchor is an internally threaded expansion anchor, complete with a pre-assembled integral expander plug. The anchor is expanded with a matching setting tool, designed to protect the internal threads while driving the pre-fitted plug to the end of the anchor. The tapered plug is precisely matched to the internal configuration of the anchor body to develop maximum expansion against the walls of the hole. Each steel anchor has

4 slots on the leading end, which allows it to expand. During installation, as the steel plug is driven into the bottom of the anchor, the steel shell is forced outward in four directions compressing against the walls of the anchor hole.

2.06 LEED REQUIREMENTS:

A. Recycled Content: Provide indication that materials/products contain the maximum amount of recycled content permitted in order for material or product to retain its integrity.

PART 3 - EXECUTION

3.01 INSPECTION

Inspection of the work to determine the completion of contract, exclusive of the possible repair and replacement of equipment under the guarantee of the project, will be made by the Owner upon written notice requesting such inspection submitted by the Contractor at least ten (10) days prior to the anticipated date.

3.02 INSTALLATION

A. The manufactured and fabricated accessories specified herein shall be installed in accordance with the manufacturers' instruction and/or Contract Drawings and shall include anchor bolts and bases necessary for a complete installation as shown on the Drawings or as otherwise noted by the Owner.

B. All accessories shall be installed at the locations shown on the Drawings or as otherwise noted by the Owner.

3.03 CONCRETE ANCHOR INSTALLATION

A. Drill a hole into the concrete to the depth of embedment required. The tolerances of the drill bit should meet the requirements of ANSI Standard B272/75. Do not over-drill the hole. Blow the hole clean of dust and other materials.
Insert the anchor into the hole, and make the top flush with the surface. Using a power awl setting tool, set the anchor by driving the tool into the anchor until the shoulder of the tool is sealed against the anchor.

B. Anchoring Requirements – Each Item is required to be anchored to the concrete. Use a minimum of two anchors, placed diagonally to each other. The minimum size anchor allowed is ¼" diameter. The drill bit diameter associated with that anchor is 3/8"; and a minimum depth of 1" must be drilled. The maximum size anchor allowed is ½" diameter. In no case will ¾" or greater holes be allowed in concrete areas or pads on public rights-of-way. All anchors must be placed flush with the surface as stated above. A bolt with a fender washer that resists rusting must be used to anchor the Item. The Engineer must approve variations of this requirement.

3.04 CONSTRUCTION WASTE MANAGEMENT AND RECYCLING

A. All project construction waste and recycled materials shall be managed in accordance with Division 1 Section 01690 – "Construction Waste Management and

Recycling." The Contractor shall submit documentation satisfying the requirements of that section.

END OF SECTION 32 40 00

SECTION 32 84 00 - UNDERGROUND IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

The specifications set forth herein pertain to the installation of an underground irrigation system.

1.2 RELATED WORK

A. Construction Documents, General and Special Conditions of the Contract apply to work of this section.

1.3 SCOPE OF WORK

A. This work shall consist of installing a complete underground irrigation system as shown on the plans. The Contractor shall include all labor, materials, permits, licenses, inspection tools, facilities, transportation and equipment necessary for the installation of a complete system according to the construction plans and specifications. No substitutions of materials or the procedure shall be made concerning these documents without the written consent of an approved equal by the Owner. The work shall comply with the requirements of all legally constituted Authorities having jurisdiction.

B. All work in this section shall be coordinated with all utilities and trades responsible for their installation.

C. Work called for on the Drawings and Specifications shall be furnished and installed whether or not specifically mentioned in the specifications.

1.4 QUALITY ASSURANCE

A. Irrigation Construction Plans:
The irrigation Drawings are essentially diagrammatic. Due to the scale of the Drawings, all characteristics of the system (i.e., sleeving, fittings, etc.) may not be represented. The Contractor shall carefully inspect the site and plan his work accordingly, supplying any materials and equipment necessary to install said characteristics.

B. The Contractor shall notify the Owner of any discrepancies between site dimensions, grade differences, obstructions, etc. and those on the Drawings that might not have been known during preparation of irrigation Drawings. If such written notification is not made, Contractor shall assume all expenses and responsibility for any revisions necessary. Work called for on the construction plans by notes or on details shall be furnished and installed whether or not specifically mentioned in the specifications. Design locations of heads, valves and lines are approximate. Contractor shall make minor adjustments of locations to avoid conflicts with planting, buildings and other obstacles. All finish grades shall be approved prior to installation of the irrigation system.

C. Experience and Observation:

1. Work shall be performed in accordance with the best standards of practice relating to the various trades. The Contractor shall be highly skilled and proficient in the installation of irrigation systems of this magnitude.
2. No materials of any kind shall be installed on the project until they have been approved by the Owner. The Owner reserves the right to observe installation of the irrigation system at any time and to reject any and all materials or workmanship that do not meet project specifications and standards. Materials used without prior consent of the Owner may be rejected and removed at the Contractor's expense. Approval of materials is for design purposes only and shall indicate that materials visually meet specifications, but this acceptance shall not relieve Contractor of any guarantees. Contractor shall be responsible for the total performance of such substitution to equal or surpass the original design in every respect. Owner reserves the right to reject installed substitution if, in his opinion, it proves unsatisfactory. Contractor shall replace substitutions at his own expense.
3. Before final acceptance of the project, the Contractor shall show evidence to the Owner that all submittals, etc., have been received by the Owner.
4. Contractor shall give Owner 48-hour notice with request for inspection of staking or for field observation. Head and valve staking must be approved prior to commencement of installation. Contractor to verify site conditions before commencing work. Contractor to notify Owner in written form of any site irregularities prior to commencing work. Initiation of irrigation installation implies Contractor acceptance of existing conditions.

D. Ordinances and Regulations:

Contractor shall observe all state and local laws, ordinances, regulations and applicable codes concerning the materials and installation of the irrigation system. Should a conflict arise between ordinances, laws, codes, regulations and specifications, the most stringent requirement will prevail in any case.

1.5 SUBMITTALS

A. Material List:

1. A material list of all products and materials to be used on the project shall be submitted to the Owner 14 calendar days prior to installation of irrigation system.
2. Owner reserves the right to reject any and all materials that have been installed but have not been approved.
3. Manufacturer's warranties shall not relieve the Contractor of his liability for project guarantee. Such warranties shall only supplement the project guarantee.

B. Operation and Maintenance Manuals:

1. Contractor is to deliver to Owner the following before substantial completion acceptance of the irrigation system:
   a. Index sheet of Contractor's address and phone number.

b. List of materials and manufacturer's representatives with addresses and phone numbers.
c. Operating and maintenance instructions of all equipment with shutdown and start-up procedures for the irrigation system.

C. Additional Equipment:
1. Equipment to be furnished as part of this contract to the Owner at the completion of the project before final acceptance of irrigation system:
a. Two (2) manual drain valve keys of appropriate length.
b. Two (2) gate valve or stop and waste valve keys of appropriate length.
c. Three (3) quick coupler keys and two (2) matching hose swivels.
d. Two (2) sets of special tools used for maintaining and adjusting each type of sprinkler head and valve supplied.
e. Two (2) keys for each automatic controller.
f. Five (5) sprinkler heads and nozzles for each type used.

D. As-Built Drawing:
1. Before final acceptance of the irrigation system, Contractor shall supply Owner with a reproducible Mylar As-Built Drawing. Drawing shall include dimensioned locations of all equipment and piping as listed in the irrigation schedule on the plans. Drawing to include dimensioned changes in location of sprinkler heads, zoning changes, connection to existing water lines, and any other items as requested. As-Built Drawings are to be updated weekly throughout the length of the project and to be made available to the Owner. The Owner shall not approve any pay requests if the As-Built Drawings are not current.

E. Controller Chart:
1. Before final acceptance of the irrigation system the Contractor shall supply controller charts for each controller on the project. The charts shall indicate valve number, type of zone, total gpm. per valve, and recommended watering schedule for each zone for spring, fall and summer. Controller charts shall be legible and color coded to correspond between valve numbers and their respective zones on the reduced As-Built Drawing. Both the controller chart and reduced as built Drawing are to be hermetically sealed between two layers of 200 mil. plastic sheets and mounted inside of the controller.

F. LEED Submittals:

1. Local/Regional Materials: Provide a statement from the manufacturer stating that materials provided were manufactured within a 500 mile radius of the project. Include location of the manufacturing facility including name, address and distance between manufacturing facility and the project site. Provide manufacturer’s documentation indicating location where the base materials were extracted, mined, harvested, etc. and distance between manufacturing facility and the project site (Applies to LEED MRc5.1 and MRc5.2: Regional Materials).

a. Include material costs (excluding cost of installation).

1.6 PROTECTION OF PROPERTY AND SAFETY MEASURES

A. Property and Utilities:

1. All trees, shrubs, flowers, fences, buildings, walks, roadways, and other property shall be protected from damage. Any damage to said property shall be repaired or replaced to the Owner's satisfaction at the Contractor's expense. Open trenches left exposed shall be flared and barricaded as per O.S.H.A. regulations by the Contractor. Contractor shall restore all areas to their original condition. Contractor shall be responsible to contact utility companies for staked locations of all utilities on the property. If utilities are damaged by the Contractor, the utilities shall be repaired at the Contractor's expense.
2. All trenching and other work within three feet of existing trees shall be done by hand so as not to damage tree roots or limbs. All trenches shall be no less than one foot from the trunk of any tree.
3. Promptly notify Owner of unexpected sub-surface conditions.

1.7 MATERIAL HANDLING, STORAGE, AND CLEAN-UP

A. Material Handling and Storage: Contractor shall be cautious in handling and installing pipe and materials. Owner reserves the right to reject any and all materials that are damaged. Damaged and defective pipe and equipment is to be removed from the site.

B. Cleanup: Contractor shall endeavor to keep the site clean at all times. At the completion of the project, the contractor shall remove all construction equipment and surplus materials from the premises leaving the area in a clean and acceptable condition. Surplus materials shall include unsuitable excavated materials, rock, trash, and debris. Any equipment or debris which is not removed shall be removed at the expense of the Contractor. Clean-up shall also include the washing of all walks and streets adjacent to the site.

1.8 FLUSHING, TESTING AND COVERAGE

A. Flushing: All lines shall be thoroughly flushed to eliminate any foreign matter before sprinkler heads are installed.

B. Testing:

1. In the presence of the Owner, the Contractor shall conduct a pressure test on the mainline pipe at a pressure of 100 PSI for a period of two (2) hours. Any leaks or breaks during the test shall be repaired and the mainline will be tested until accepted. All test equipment and pumps shall be supplied by the Contractor as part of the Contract.
2. The Contractor is responsible for providing the proper amount of water on seed and plant material to establish and sustain optimum plant growth. The watering program is to be included on As-Built Drawings (see Landscape and Irrigation Maintenance Section 02970). The cost of water for irrigation will be paid by Jefferson County.

C. Coverage:

After the sprinkler heads have been installed and before installation of seed, the Contractor shall conduct a coverage test in the presence of the Owner to determine

if irrigated areas are receiving the proper amount of water. As directed by the Owner, the Contractor shall make adjustments for proper coverage at no additional expense. This shall include changing of nozzle patterns and degrees of arc. Contractor shall perform, at no additional expense, the required work to correct any coverage problems due to deviations from irrigation plans or to problems caused by installing according to plans when it is obvious that the plans are inadequate, without bringing it first to the attention of the Owner. No overspray is permitted on any structure.

Any areas which do not conform to the designed characteristics of the Drawings and unauthorized changes or poor installation practices shall be repaired or replaced by the contractor at his expense.

1.9 WINTERIZATION AND START-UP

A. Contractor shall be responsible for draining of the irrigation system at the close of the 1993 sprinkling season and for start-up of the system in the spring of 1994 without being requested by Owner. See Section 02970 -Landscape and Irrigation Maintenance.

1.10 GUARANTEE

A. It shall be the responsibility of the Contractor to ensure the satisfactory operation of the entire irrigation system and the workmanship and restoration of the project area. The entire system, including materials, shall be guaranteed in writing to be complete and remain operable in every detail by the Contractor for a period of one (1) year from date of Final Completion, and the Contractor agrees to make any adjustments or repair any defects occurring within the one-year guarantee period within seven (7) calendar days from receipt of notice of malfunction by the Owner. If Contractor neglects to perform these duties within the specified time, the County may make such repairs at the Contractor's expense; provided, however, that in the case of an emergency, where, in the judgment of the Owner, delay would cause serious loss or damage, repairs or replacement may be made by verbal communication and without notice being sent to the Contractor, and the Contractor shall pay the cost thereof.

B. Any settling of irrigation trenches/backfill material during the guarantee period shall be repaired at contractor's expense. Contract documents shall govern irrigation replacement the same as new work. Replacements are to be made at no cost to the County. Any vandalism to the irrigation system prior to final acceptance shall be repaired and/or replaced at Contractor's expense.

PART 2: PRODUCTS

2.01 MATERIALS

A. P.V.C. Pipe:
1. This specification describes the properties and performance required for polyvinyl chloride pipe. Pipe shall be suitable for use at maximum hydrostatic working pressure of 200 PSI or 160 PSI as noted on plans. Pipe shall be made from clean, virgin, NSF approved, type 1, grade 1 P.V.C., conforming to Astin Resin specification D1784-60 and project standard D2241 for P.V.C. 1120 SDR 26 or SDR 21. P.V.C. Pipe is to be belled end and solvent weld. Solvent cement and primer shall be of the type prescribed by manufacturer.
2. Marking and Declaration of Compliance: Marking shall show the size, series, identification, manufacturer's trade name at intervals of not more than 20 feet. Pipe shall include the seal of approval of the National Sanitation Foundation spaced at intervals required by NSF regulations.

B. P.V.C. Fittings: All pipe fittings to be schedule 40 P.V.C. (ASTM D2466 and D1784 unless specifically noted otherwise. Solvent cement to conform to ASTM D2564.

C. Brass Pipe and Fittings:
1. Brass pipe shall be 85% red brass, (ANSI) Schedule 40.
2. Fittings shall be medium brass, 125 pound class, screwed type.
3. Use a dielectric union wherever a copper based metal (copper, brass, bronze) is connected to an iron based metal (iron, galvanized and stainless steel).

D. Copper Pipe: Copper pipe shall have the requirements of Type K, ASTM B88. Fittings shall be copper or cast bronze. Silver solder shall be used for joints.

E. Sprinkler Heads: Sprinkler heads shall be of the type, and model as indicated on Drawings.

F. Backflow Preventer: Backflow preventer shall be of the type, model and size as indicated on Drawings.

G. Automatic Control Valves: Automatic control valves shall be of the make specified, designed to operate with the specified controller with size and model as listed on Drawings. Control valve shall be normally closed type and shall have manual bleed nut and manual flow control.

H. Quick Couplers: Quick coupler valves shall be of the type, size and style as indicated on the Drawings. Quick coupler valves shall be two piece with rubber locking cover.

I. Gate Valves: Gate valves up to 2-1/2" shall be brass with non-rising stem and I.P.S. threads. Gate valves shall be as shown on Drawings.

J. Automatic Controller: The automatic controller shall be furnished and located as shown on the plans. The controller shall be of the type, size and model number as

shown. Controller shall be equipped with primary line surge protector. Install valve output surge protection arresters for control wiring and common.

K. Control Valve Wiring: Irrigation control wiring shall be #14 gauge solid A.W.G. and shall be U.F., U.L. approved. Control wires to be red, common wires to be white.

L. Valve Boxes: Valve boxes shall be of the type, size and style as indicated on the plans. A Carson #910-12 box shall be used for control wire splices. Use one (1) valve box for each valve installed. Where multiple valve boxes occur, arrange in symmetric order and appearance. No valve box extensions will be accepted. On the underside of all control valve boxes shall be markings clearly indicating controller letter and station number. Letter and number size to be no smaller than 1" and no greater in size than 1-1/2", depth of branding to be no more than 1/8" and no less than 1/16" into valve box lid. Splice boxes shall be labeled with the words "low voltage electrical splice" in the same manner.

M. Drip Valve Assemblies: Drip valve assembly shall be of the type, size and style as indicated on the plans. Strainer shall have 120 mesh nylon screen with 1/2" blow-out. Pressure reducing valve shall have manual adjusting nut.

N. Drip Emitters and Tubing: Drip emitters shall be of the type, style an size as indicated on the plans. Drip tubing shall conform to ASTM D1248 and ASTM D3350. Capillary tubing shall have 1/8" i.d.

O. Drip Line Blow Out Stubs: Install drip line blow out stubs at all ends of drip tubing.

P. Water Meter: Water meter and equipment shall be of the type, model and size as specified on the plans.

Q. Backflow Preventer Cover: Shall be strongbox type, SBBC series of size, model number to match backflow preventer size, as manufactured by TSI, Inc., available locally from Westurf Distributors, including concrete mounting pad.

R. LEED Requirements:

1. Local/Regional Materials: Preference shall be given to products and materials which have been manufactured, harvested, extracted mined quarried, etc. within a 500 mile radius of the project site.

PART 3: EXECUTION

3.01 CONSTRUCTION WASTE MANAGEMENT AND RECYCLING

A. All project construction waste and recycled materials shall be managed in accordance with Division 1. The Contractor shall submit documentation satisfying the requirements of that section.

3.02 INSTALLATION

A. Trenching:
   1. Trenching and installation of irrigation system shall not commence until final grading has been completed and approved by the Owner.
   2. Trenches shall be cut to true line and grade, and shall be excavated so that the pipe shall drain uniformly toward the drain valves deemed necessary to properly drain the system. Minimum grade of piping to drain shall be sufficient for installation of pipe with a clearance of at least 4 inches horizontally on both sides of pipe within trench.
   3. Installation Depth of Piping:
      a. Depth of mainline from top of pipe is 24"
      b. Depth of lateral (rotor) from top of pipe is 18"
      c. Depth of lateral (pop-up) from top of pipe is 12"
      d. Depth of wiring - side of mainline

B. Plastic Pipe and Fittings:
   1. All pipe and fittings shall be installed as per manufacturer's recommendations. No pipe shall be installed in temperatures of 40^{o}F or less. No pipe shall be installed on non-compacted fill dirt. Plastic pipe shall be snaked horizontally in trench and square cut with burrs removed from inside of pipe. Provide for thermal expansion and contraction. For threaded connections use sealants that are recommended by the manufacturer for use with plastic. Do not use oil based pipe joint compounds. Assemble threaded connections by tightening 1 to 1-1/2 turns beyond finger tight. Keep piping clear of dirt and pipe scale. Keep open ends of assembled piping capped. Teflon tape is to be used on all plastic threaded joints.
   2. Solvent weld joints shall be made according to manufacturer's recommendations. Allow joints to set at least 24 hours before pressure is applied to the piping.

C. Backfilling:
   1. All backfilling shall be done with approved soil, free of debris including rock and debris 1" in diameter or larger, and shall be mechanically tamped to prevent settling. Backfilling shall not be done with frozen or caked soil. Excess debris encountered during backfill process shall be removed at the Contractor's expense. Backfill shall be compacted to 95% standard density (AASHTO T99). Any backfill soil removed due to unsuitability shall be replaced with new approved soil at the Contractor's expense. Any settling during the guarantee period of the backfill material shall be repaired at the Contractor's expense including any damage to other items affected by the settling.
   2. All lateral lines shall be installed in trenches with a minimum of 6" clearance.
   3. Do not install lateral lines within 2' of lines of other trades.

D. Installation of Piping Under Pavement:
   Contractor to coordinate installation of sleeving with other applicable trades. All piping that is to be located under areas where asphalt or concrete paving is to be installed shall be installed at a minimum 30" depth final grade. Piping is to be encased in sand 4" on all sides. Add backfill in 6" lifts and use mechanical tamping to reach 95% standard proctor density.

When trenches are cut to place sleeving under existing pavement that is not to be removed, those trenches shall be backfilled to within two inches of the existing grade with Class B concrete, or as directed. The remaining two inches shall be filled to match the existing surfacing materials within 48 hours.

Installation of piping under existing walks and/or curbs is to be done with jacking or boring. Any cracking or breaking of the walk and/or curbs is to be repaired at Contractor's expense. Contractor shall repair or replace to its original condition any damage caused by setting of sleeving during guarantee period.

E. Sprinkler Heads: All sprinkler heads located in turf areas shall be adjusted vertically to be flush with final finish grades. Install heads as per details with spacing according to plans. Install heads on double swing joint assemblies. Angle of nipples relative to lateral lines shall be no more than 45° and no less than 15°. Locate rotary sprinklers 6" (spray heads 3") away from walls, fences and paved areas. Under no circumstances shall the spacing exceed the maximum spacing recommended by the manufacturers.

F. Gate Valves: Installation of gate valves shall be as indicated on the plans.

G. Backflow Preventer: Installation of backflow preventer shall be as indicated on the plans. Install as per local and state codes. The most stringent requirement for backflow prevention shall prevail in case of a conflict.

H. Automatic Control Valves: Installation of automatic control valves shall be as indicated on the plans. All control valves shall be installed as close as possible to the locations as shown on plans.

I. Quick Coupling Valves: All quick coupling valves shall be installed as double swing joint assemblies of schedule 40 PVC. Angle of nipple relative to mainline shall be no more than 45° and no less than 15°.

J. Automatic Controller:
   1. Automatic controller shall be installed as per manufacturer's recommendations and/or irrigation plans. Each controller shall have its own separate ground wire. and reduced, laminated as-built Drawing installed in the door
   2. All work performed as electrical installation shall conform to applicable codes. All high voltage electrical work shall be performed by a licensed electrician. The Contractor shall be responsible for the electrical connection of the controller.
   3. Install one valve output surge protection arrestor on each control and common wire.
   4. Install a circuit breaker and electrical on/off switch for each controller.
   5. Controller shall have painted, in either black or white oil base enamel paint, the letter of that controller as indicated on the construction plans.

K. Control Wiring: Installation of control wires shall be strung as close as possible to the mainline with such wires to be located on one side of pipe. Wiring to be installed in separate trench if not along mainline. All underground electrical connections shall be made with 3M #DBY splice connectors. Any splices not within control valve boxes shall be installed in a Carson #910-12 valve box. The

Contractor shall leave a minimum loop of 4" at each control valve, each splice and every 100 feet of wiring. Wiring is to be bundled every 20 feet with one (1) control wire used for every control valve. Install four (4) spare #14-1 wires along complete entirety of mainline from controllers to farthest control valve on each and every branch of mainline. Color to be blue.

L. Drain Valves: Manual drain valves shall be installed as per plans. Contractor shall supply, locate and install drain valves so as to drain entire mainline.

M. Drip Valve Assemblies: Installation of drip valve assemblies shall be as indicated on the plans.

N. Drip Emitters and Tubing: Installation of drip emitters and tubing shall be as indicated on the plans. Drip tubing is to be installed at a depth of 4" below top of grade. In this case, top of grade does not include mulch or rock layer. Drip line blow out stubs are to be installed at all ends of drip tubing. Install drip tubing in turf areas as lateral piping.

O. Water Meter: Install as per plans. All work to be installed by a licensed plumber. Plumber must complete and sign the section of the Southwest Metro Water & Sanitation District Application for Water Supply License, titled "to be completed by plumber."

END OF SECTION 32 84 00

SECTION 32 90 00 - PLANTING

PART 1 - GENERAL

1.1 SUMMARY

The extent of planting work is shown on the Drawings and includes trees, shrubs, ground cover and ornamental grasses, perennials; and mulching.

1.2 RELATED WORK

A. Related Documents: Construction Documents, General and Special Conditions of the Contract apply to work of this section.

1.3 QUALITY ASSURANCE

A. Contractor Qualifications: Install work using skilled persons, proficient in the trades required, in a neat, orderly and responsible manner with recognized standards of workmanship. All landscape crews shall be supervised by an on-site superintendent or foreman holding a Certified Landscape Technician (CLT) certificate as provided by the Associated Landscape Contractors of Colorado (ALCC)

B. Observation: The Owner shall observe plant materials at place of growth or at site before planting, for compliance with requirements for name, variety, size, and form. Contractor shall give 48 hours notice of observation. Do not install plants, which have not been observed. Plant materials planted prior to inspection are subject to rejection. This observation does not relieve the Contractor of responsibility for providing healthy, disease free plants meeting all the requirements of the Contract.

C. Reference Standards:
   1. AAN-ASNS: American Association of Nurserymen, Inc., "American Standard for Nursery Stock" = 2004 Edition.
   2. CNA: Colorado Nursery Act of 1988.

1.4 SUBMITTALS

A. Materials List: The Contractor shall work in collaboration with the Owner in identifying sources and purchasing of plants at wholesale cost. The Owner may purchase or propagate specialty plantings and the Contractor shall coordinate this with the Owner. Submit a list of all plants to be installed, including names and addresses of sources, to Owner within 21 calendar days after receipt of Notice to Proceed.

B. Samples and Product Certification: Submit to Owner not less than 21 calendar days prior to scheduled delivery of these materials.
   1. Samples:
      a. Mulch: 0.5 cubic foot for each specified mulch type.

b. Staking and guying material: 1 complete assembly or 8-1/2" x 11" detailed drawing.
c. Soil amendment: .5 cubic foot sample; product certification; delivery tickets for all amendment on site

C. Sedum Trays: submit product certification; licensed grower information and plant list to Owner within 30 calendar days after receipt of Notice to Proceed.

D. LEED Submittals:

1. Submit product data or other published information verifying the location of manufacturing facility including name, address, and distance between manufacturing facility and the project site. Provide manufacturer's documentation indicating location where the base materials were extracted, mined, quarried, harvested, etc. and the distance between this location and the project site. Also include material costs (excluding costs of installation).

b. Include information on Material Tracking Worksheets.

1.5 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Delivery: Do not prune prior to delivery. Provide adequate protection to root systems and balls from drying winds and sun. Do not bind or tie trees or shrubs in such a manner as to injure plants or destroy natural shape. Provide protection covering during delivery. Deliver plants after planting preparation has been completed and plant immediately.

B. Handling: Handle plants by ball or container only. Do not drop plants. Do not lift plants by the trunk, stems or foliage. All balled plants with balls broken or trunks loose in ball will be rejected.

C. Storage: If planting is delayed more than 4 hours after delivery, set plants in shade, protect from weather and mechanical damage, and keep roots moist by setting balled stock on ground and covering ball with soil, saw dust or other acceptable materials. Do not remove container-grown stock from containers before time of planting. Periodically water root systems of all plants stored on site using a fine mist spray. Water as often as necessary to maintain root system in a moist condition.

1.6 SITE CONDITIONS

A. Environmental Requirements: Install frost-tender plants only after danger of frost is past or sufficiently before frost season to allow for establishment before first frost. Do not install plants in frozen soil. Do not plant after October 15 or before March 15 unless prior written approval from the Owner has been obtained.

B. Protection: Determine location of all underground utilities prior to installation of plants. Avoid damage to utility lines by hand excavating in close proximity to lines.

C. Sequencing: Coordinate installation of plants with irrigation and seeding work to ensure that damage will not occur. Install plants after final grades are established and prior to seeding or sodding.

D. Environmental Conditions: Contractor shall inspect planting areas to verify soils, drainage, and compaction. Start of planting work constitutes acceptance of these conditions.

1.6 LEED REQUIREMENTS:

1. Local/Regional Materials: Preference shall be given to products and materials which have been manufactured, harvested, extracted mined quarried, etc. within a 500 mile radius of the project site.

1.7 GUARANTEE

A. Guarantee all plantings as indicated in the General Contract Conditions against defects including death and unsatisfactory growth, except for defects resulting from neglect by Owner, abuse or damage by others, or unusual phenomena or incidents which are beyond the Contractor's control.

B. Guarantee all plantings to be true to name and to meet all conditions of these specifications. Any plant, which is not true to name as indicated by leaf, flower form or fruiting characteristics revealed within guarantee period, shall be replaced by Contractor at Contractor's expense.

C. Remove and replace plants found to be dead or in an unhealthy condition within one month of notice to replace such plants. Upon Owner's written approval, the Contractor may replace rejected plants at a later date, mutually agreed upon, provided that the Contractor removes all rejected plants within seven (7) calendar days of the notice to replace such plants. If the rejected plants are not removed in seven (7) calendar days, the Owner may remove and replace these plants and the cost of such removal and replanting shall be charged to the Contractor. All areas damaged by replacement operations are to be fully restored to their original condition as specified.

PART 2 - PRODUCTS

2.1 PLANTS

A. Plant Quality: Provide plants grown in a recognized nursery, except as otherwise indicated, in accordance with proper horticultural practice. Provide healthy, well-branched vigorous stock with a growth habit normal to the species and variety and free of diseases, insects and injuries. All plants shall conform to standards for measurements, grading, branching, quality, ball and burlapping as stated in the AAN-ASNS and CNA. All trees shall have been grown in areas of zone 4 hardiness or colder.

B. Identification: Label each plant with securely attached waterproof tag bearing legible designation of botanical and common name in accordance with AJCHN-SPN.

C. Plant Size: Sizes specified in plant list on the plans are minimums and all plants shall equal or exceed measurements.

D. Root Ball Size: Balled and burlapped trees shall meet the following minimum root ball sizes:

TREE SIZE	MIN. DEPTH	MIN. DIAMETER
2" caliper	18"	22"
2-1/2" caliper	20"	24"
3" caliper	22"	28"

E. Measurements: Measure plants before pruning and with branches, trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6" above ground for trees up to 4" caliper size, and 12" above ground for larger sizes. Measure main body of plant for height and spread dimensions, do not measure from branch or root tip-to-tip.

F. Substitutions: Provide plants as specified on plans. No substitutions will be permitted without approval of Owner.

G. Balled and Burlapped Plants: Where indicated to be balled and burlapped (B&B), provide plant dug with firm, natural ball of soil in which plant was grown.

H. Container Grown Plants: Where indicated to be container plant, provide established container stock that has been transplanted and grown in container for a length of time sufficient to develop new fibrous roots, so that the root-mass will retain its shape and hold together when removed from container. Use rigid containers, which will hold ball shape and protect root-mass during shipping.

I. Deciduous Plants:
Deciduous Tree: Where shown as "clump," provide tree with 3 or more main stems starting from the ground. Where indicated as "specimen" provide exceptionally heavy branched, well-shaped plant material. "Specimen" plant material shall be hand selected by Owner at Contractor's place of growth or storage. Submit product data or other published information verifying the location of source, growing or manufacturing facility (see Submittals).

2.2 FERTILIZER

Trees, Shrubs and Ground Covers: None required.

2.3 BACKFILL

Backfill material for all plantings shall be excavated material from planting pit. Backfill shall be free of all stones, sticks, roots and debris greater than 1" size. Backfill soil shall be amended as specified in Section 329113 Soil Preparation.

2.4 WATER

Supplied and distributed from irrigation system. Owner shall pay for cost of water.

2.5 GUYS, STAKES AND WRAPPING

A. Guys: Provide 12 gauge wire.

B. Stakes: Provide 6'-6" long metal t-bar posts, with bottom anchor plate intact.

C. Straps: Provide 12" long, 1-3/4" wide nylon straps with metal grommets at each end.

D. Wrapping: Provide tree wrap material, 4" wide, corrugated or crepe paper, brown in color, specifically manufactured for tree wrapping.

2.6 MULCH

A. Wood Mulch: Clean pine or spruce "pole peelings" with an approximate width of 1-2" and 3-4" length, fibrous and capable of matting together and interlocking when moistened and settled. Submit product data or other published information verifying the location of source, growing or manufacturing facility (see Submittals).

2.7 LANDSCAPE FABRIC

A. Non-woven geotextile fabric, Typar Premium Landscape Fabric or approved equivalent. Submit product data or other published information verifying the location of source, growing or manufacturing facility (see Submittals).

2.8 SEDUM TRAYS

A. Trays shall be LiveRoof Standard of the numbers and sizes indicated on the Drawings as manufactured by Live Roof, LLC; PO Box 533; Spring Lake, MI 49456, liveroof.com. System shall include tray/module; engineered soil; underlayment and recommended plant material. Plant material shall be grown/produced and trays assembled by a licensed LiveRoof grower.

PART 3 - EXECUTION

3.1 PREPARATION

A. Soil Preparation: Prepare soils as specified prior to planting.

B. Layout and Staking: Owner will approve layout and staked locations for all plantings and shrub beds.

3.2 PLANTING

A. Excavating: Excavate plant pits shown on Drawings. Loosen hard subsoil in bottom and sides of plant pit.

B. Setting: Set plant plumb, in center of pit and positioned to offer best appearance or relationship to adjacent area. Set at depth shown on Drawings. Prune all broken and damaged roots.

C. Backfilling: Backfill after plant is properly set. During backfilling, as plant becomes secured, remove all wire baskets, rope and wire binding from top and sides of all. Peel back burlap from top of ball. Do not remove materials from under ball. Settle backfill and eliminate air pockets.

D. Mechanical Spade Planting: Do not plant by mechanical spade unless approved by Owner.

E. Pruning: Prune, thin and shape plants in accordance with standard horticultural practice and to retain natural character. Remove all dead or injured branches. Avoid damage to leaders.

F. Guying, Staking and Wrapping: Guy, stake and wrap plants immediately after backfilling as shown on Drawings. Set stakes vertically and avoid penetrating root ball. Guys to tree trunk shall be connected to straps to prevent injury to tree trunks. Wrap deciduous trees by starting at ground and covering trunk to height of first branches. Secure end of wrap with tape. Before wrapping inspect tree trunks for injury, improper pruning and insect infestation and take corrective measures in accordance with standard horticultural practice. All deciduous trees shall be wrapped November 15 through April 15. Tree wrapping shall be removed by the Contractor between April 1 and April 15 of the guarantee period. Trees shall not have wrapping in place between April 15 and November 15. Cottonwoods shall not be wrapped.

3.3 MULCHING

Mulch: Place evenly over all planted areas, 4” layer minimum. Place wood mulch in all tree saucers in turf at the depth indicated on the Drawings.

3.4 CLEANUP AND PROTECTION

During planting work, store materials and equipment in area approved by the Owner. Keep pavements clean and work areas in an orderly condition. Protect planting work and materials from damage due to landscape and other Contractor operations or trespassers. Maintain protection until completion of work.

3.5 CONSTRUCTION WASTE MANAGEMENT AND RECYCLING

All project construction waste and recycled materials shall be managed in accordance with Division 1 Section 01690 – “Construction Waste Management and Recycling.” The Contractor shall submit documentation satisfying the requirements of that section.

END OF SECTION 32 90 00

SECTION 32 91 13 - SOIL PREPARATION

PART 1: GENERAL

1.1 RELATED DOCUMENTS: The General Contract Conditions, Drawings and Division - 1 Specification sections apply to Work of this section.

1.2 SUMMARY:

A. Work Included: Preparation of soil for the purpose of sodding or planting operations. Soil preparation consists of ripping, fertilizing, soil conditioning and fine grading the topsoil. Soil preparation as specified herein MUST precede all landscape work.

1.3 SUBMITTALS:

A. Quality Control Submittals:

1. Certificates: State, federal and other inspection certificates shall accompany invoice for materials showing source or origin. Submit to Project Manager prior to acceptance of material.
2. Material Analysis: Provide soil conditioner analysis performed no more than 3 months prior to delivery to site.
3. Soil Amendment: .5 cubic foot sample; product certification; delivery tickets for all amendment on site
4. Soils Analysis: provide agricultural soil test from accredited soils laboratory for existing site soils 4 weeks prior to landscape work start up. Soil test shall include soil texture and type, pH balance, free lime, salinity, organic matter content and available nutrients.
5. Soils Bulk Density Test: provide bulk density test from accredited soils laboratory.

B. LEED Submittals:

1. Submit product data or other published information verifying the location of manufacturing facility including name, address, and distance between manufacturing facility and the project site. Provide manufacturer's documentation indicating location where the base materials were extracted, mined, quarried, harvested, etc. and the distance between this location and the project site. Also include material costs (excluding costs of installation).

   b. Include information on Material Tracking Worksheets.

1.4 DELIVERY, STORAGE AND HANDLING:

A. Fertilizer: Deliver inorganic or chemical fertilizer to site in original unopened containers bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark and conformance to state law, bearing name and warranty or producer.

B. Notify Project Manager of delivery schedule in advance so material can be inspected upon arrival at project site. Immediately remove unacceptable material from project site.

1.5 PROJECT/SITE CONDITIONS:

A. General: Do not perform work when climate and existing site conditions will not provide satisfactory results.

B. Vehicular accessibility on site shall be as directed by the Project Manager. Repair damage to prepared ground and surface caused by vehicular movement during work under this section to original condition at no additional cost to the City.

PART 2: PRODUCTS

2.1 SOIL MATERIALS:

A. Topsoil: Shall be as specified under Section 312343 - Topsoil.

B. Soil Conditioner:

1. Composted material shall consist of aged organic matter, free of weed or other noxious plant seeds, lumps, stones, or other foreign contaminants harmful to plant life, and having the following characteristics based on a nutrient test performed no longer than 3 months prior to its incorporation into the project:
   a. Organic matter: 25% minimum.
   b. Salt content: 5.0 mmhos/cm maximum
   c. pH: 8.5 maximum.
   d. Carbon to nitrogen ratio of 10:1 to 20:1.
2. Mountain peat, aspen humus, gypsum and sand will not be accepted.
3. Acceptable product: Class I compost, such as Ecogro or Bio-comp, as produced by A1 Organics, Eaton, CO, or approved equal.

C. PLANTER SOIL (all areas of raised planters)
See Section 31 23 43 Topsoil

D. LEED Requirements:

1. Local/Regional Materials: Preference shall be given to products and materials which have been manufactured, harvested, extracted mined quarried, etc. within a 500 mile radius of the project site.

2.2 FERTILIZER:

A. General:

1. Fertilizer shall conform to applicable State fertilizer laws. It shall be uniform in composition, dry, and free flowing, and shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis. Fertilizer that has become caked or damaged will

not be accepted.

B. Turf Grass Lawns:

1. Diamonium phosphate (18-46-0). Nitrogen shall be composed of sulphur-coated Urea only. Provide in sufficient quantity to apply at the rate of 100 lbs. nitrogen per acre, unless otherwise indicated by the soils tests.

2.3 HERBICIDE:

A. Post Emergent Herbicide: Roundup (Glyphosate) as manufactured by Monsanto Company or approved equal.

PART 3: EXECUTION

3.1 EXAMINATION:

A. General: Verify that existing site conditions are as specified and indicated before beginning work under this Section.

1. Grades: Inspect to verify rough grading is within +/- 0.1 foot of grades indicated and specified.
2. Damaged Earth: Inspect to verify that earth rendered unfit to receive planting due to concrete, water, mortar, limewater or any other contaminant dumped on it has been removed and replaced with clean earth from a source approved by the Project Manager.

B. Unsatisfactory Conditions: Report in writing to General Contractor with copy to Project Manager.

C. Acceptance: Beginning of installation means acceptance of existing conditions by installer.

3.2 PREPARATION

A. Areas of Previous Hardscape:

1. Add topsoil and soil amendments as specified. TILL TO 18” DEPTH.

B. Areas of Newly Placed Topsoil:

1. Protection:
   a. Locate sewer, water, irrigation, gas, electric, phone and other pipelines or conduits and equipment prior to commencing work.
   b. Be responsible for proper repair to landscape, utilities, walls, pavements and other site improvements damaged by operations under this section.
2. Weed Control: Remove annual weeds by tilling. Remove perennial weeds by applying herbicide 1 week before soil preparation and as needed, but no sooner than 3 months before beginning work. Water prepared soil to encourage weed germination two weeks prior to applying

herbicide.

3. Surface Grade: Remove weeds, debris, clods and rocks larger than 1". Dispose of accumulated debris at direction of Project Manager.
4. Runoff: Take measures and furnish equipment and labor necessary to control the flow, drainage, and accumulation of water. Insure that all excess water will run off the grades or will percolate within 12 hours.
5. Erosion Control: Take measures and furnish equipment and labor necessary to control and prevent soil erosion, blowing soil and accumulation of wind-deposited material on the site throughout duration of work.
6. Soil Testing: Unless otherwise specified in the Contract, the Contractor shall be responsible for performing horticultural soil tests on a minimum of 4 current soil samples for each source of topsoil to be used in the project. Reference Section 02925 – Topsoil, Paragraph 1.3, for soil analysis report information. Soil test will be used to determine the type and amount of soil organic amendment and fertilizer to be applied prior to seeding and sodding. Locations for testing shall be approved by the Project Manager.
7. Timing: Perform soil preparation just prior to planting operations and in accordance with final planting schedule. Coordinate with irrigation system installation to avoid damage to work of one by the other.

C. Areas of Existing Compacted Topsoil:

1. If the existing area has turf that is sparse, stunted, anemic, weedy or was used as a construction staging and/or parking area and/or subjected to heavy visitor use, it is likely that the soils are compacted and will require ripping and/or shatter aeration to prepare the soil for revegetation. Scarify compacted soil to a 6-inch depth to loosen and bond topsoil to subsoil.

D. Areas of Existing Disturbed Topsoil:

1. If the areas are disturbed but not severely compacted, shattering for aerification alone should be sufficient to prepare the soil for revegetation.

3.3 INSTALLATION

A. Soil Preparation in Landscape Areas:

1. Apply amendments at the following rates:
   a. Soil conditioner: 4 cubic yards per 1000 square feet
   b. Diamonium phosphate: 2 lbs. of nitrogen per 1000 square feet
2. After applying soil conditioner and fertilizer, thoroughly till area to depth of 6" minimum by plowing, harrowing, or disking until soil is well pulverized and thoroughly mixed.

B. Fine Grading in all Landscape Areas:

1. Do fine grading for all areas prior to seeding or planting. Allow for natural settlement.
2. For ground surface areas surrounding buildings to be landscaped, maintain required positive drainage away from buildings.

3. Establish finish grades to within 0.05 foot of grades indicated, in order to prevent “bird-baths” or ponding.
4. Finish grade to be below edge of pavement prior to sodding, seeding or planting.
   a. Sodded Areas: Allow 1-½ ” for sod.
   b. Shrub Beds: Allow 4” for mulch.
5. Noxious weeds or parts thereof shall not be present in the surface grade prior to seeding.
6. Compaction of Surface Grade Prior to Landscape Installation: Firm, but not hard (85% standard Proctor density within 2% optimum moisture).
7. Hand Raking:
   a. Turfgrass Lawn Areas: Prior to acceptance of grades, hand rake to smooth, even surface, free of debris, clods, rocks and vegetable matter greater than ½ inch.
8. Restore planting areas to specified condition if eroded or otherwise disturbed after fine grading and prior to planting.

3.4 NOTIFICATION AND INSPECTION

A. Inspection: Provide notice to Project Manager requesting inspection at least seven (7) days prior to anticipated date of completion.

B. Deficiencies: Project Manager will specify deficiencies to Contractor who shall make satisfactory adjustments and shall again notify Project Manager for final inspection.

3.5 CLEANING

A. General: Remove debris and excess materials from site. Clean out drainage inlet structures. Clean paved and finished surfaces soiled as a result of work under this Section, in accordance with direction given by Project Manager.

3.6 PROTECTION

A. General: Provide and install barriers as required and as directed by Project Manager to protect completed areas against damage from pedestrian and vehicular traffic until acceptance by City.

3.7 CONSTRUCTION WASTE MANAGEMENT AND RECYCLING

A. All project construction waste and recycled materials shall be managed in accordance with Division 1. The Contractor shall submit documentation satisfying the requirements of that section.

END OF SECTION 32 91 13

SECTION 329200 – SODDING / SEEDING

PART ONE - GENERAL

1.1 RELATED WORK

A. Related Documents: Drawings and general provisions of the Contract, including General and Special Conditions apply to work of this section.

1.2 SUMMARY

The extent of sodding and seeding work is shown on the Drawings.

1.3 QUALITY ASSURANCE

A. Contractor Qualifications: Install work using skilled persons, proficient in the trades required, in a neat orderly and responsible manner with recognized standards of workmanship. Contractor shall have not less than 5 years successful experience with installation of similar work. All landscape crews shall be supervised by an on-site superintendent or foreman holding a Certified Landscape Technician (CLT) certificate as provided by the Associated Landscape Contractors of Colorado (ALCC)

B. Reference Standards:
1. ASPA: American Sod Producers Association

1.4 SUBMITTALS

A. Product Certification: Submit to Owner not less than 14 days prior to scheduled delivery of these materials:
1. Product Certification:
    a. Sod: Name, address and telephone number of supplier and statement of proposed sod blend.
    b. Seed: Dealer's statement of analysis stating for each seed type -- name and address of seller, lot number, test date, seed type and variety, purity and germination percentage, crop seed percentage, inert matter percentage, weed seed percentage, noxious weeds by name and number per pound.
    b. Straw Mulch: Colorado Department of Agriculture Weed Free Certification Transit Certificate
2. Delivery Tickets:
    a. Seed: seed tags from seed bags and order ticket

B. LEED Submittals:
1. Submit product data or other published information verifying the location of manufacturing facility including name, address, and distance between manufacturing facility and the project site. Provide manufacturer’s documentation indicating location where the base materials were extracted, mined, quarried, harvested, etc. and the distance between this location and the project site. Also include material costs (excluding costs of installation).

b. Include information on Material Tracking Worksheets.

1.5 PRODUCT DELIVERY, HANDLING AND STORAGE

A. General: Delivery in original, unopened containers. Protect materials from animals and moisture. Wet, moldy, open or broken packages will not be accepted. Non-flowing materials will be rejected.

1.6 SITE CONDITIONS

A. Environmental Conditions: No work shall occur when soil is in a frozen or wet condition causing it to clump and become nonfriable. Seeding operations shall not proceed when conditions cause seed drill depth bands to accumulate mud.

B. Sequencing: Sodding work shall occur after installation of irrigation system soil preparation and plantings.

1.7 GUARANTEE

Guarantee all sodding as indicated in the General Contract Conditions against defects including death and unsatisfactory growth, except for defects resulting from neglect by Owner, abuse, or damage by others, or unusual phenomena or incidents which are beyond the Contractor's control.

A. Irrigated Sod Areas:
   1. Resod all areas bare or with dead grass greater than 4" square. Resodding shall occur within 14 calendar days of notice to resod. Upon Owner's written approval, the Contractor may resod at a later date mutually agreed upon. Replacement sodding and installation shall comply with specifications for original sodding.

B. Dryland Seed Areas
   1. Reseed all areas bare or with dead grass greater than 36" square. Reseeding shall occur within 14 calendar days of notice to reseed. Upon Owner's written approval, the Contractor may reseed at a later date mutually agreed upon. Replacement seeding and installation shall comply with specifications for original seeding.

PART 2 - PRODUCTS

2.1 SOD

A. Provide sod composed of 3 -4 Kentucky bluegrass cultivars (100%). Acceptable cultivars are: Merion, SR2000, Livingston, Gnome, Suffolk, Liberty and Monopoly. Sod shall be strongly rooted and free of diseases, insects, stones and other plants. Sod shall be capable or growth and development when planted and shall not be dormant. All yellow areas without normal green color will be rejected. Cut sod in strips not more than 18" wide by 3' long with a thickness of 3/4 to 1-¼". Height of grass blades to be 1-½ - 2".

B. LEED Requirements:

1. Local/Regional Materials: Preference shall be given to products and materials which have been manufactured, harvested, extracted mined quarried, etc. within a 500 mile radius of the project site.

2.2 SEED MIXES

A. General: delivered in original containers, unopened, bearing dealer's warranty analysis. Maximum crop and weed content shall be 0.10% each. Noxious weeds (Colorado lists A, B and C) are not permitted. Seed mix shall be supplied on basis of pure live seed (P.L.S.) in pounds. Formula for determining quantity of P.L.S. shall be:

Bulk Pounds of Seed Required =
PLS pounds specified / (% Purity* x % Germination*)

* Percents expressed as decimal, eg. 10%=.10

B. Dryland Seed Mix:

Common Name and Variety	**Scientific Name**	**% PLS/acre**	**Pounds PLS/acre**†
Grasses			
Western wheatgrass, Arriba	*Pascopyrum smithii*	33.3	7.0
Blue grama, Pastura	*Bouteloua gracilis*	9.5	2.0
Sideoats grama, Vaughn	*Bouteloua curti-pendula*	19	4.0
Buffalograss	*Buchloe dacty-loides*	38.2	8.0
Total		**100**	**21**

2.3 SEED MULCH (straw)

A. Straw Mulch: mulch shall consist of clean, certified weed free straw certified under the Colorado Department of Agriculture Weed Free Forage Certificate Program and inspected as regulated by the Weed Free Forage Act, Title 35, Article 27.5, CRS. Each certified weed free mulch bale shall be identified by one of the following:

1. One of the ties binding the bale shall consist of blue and orange twine, or
2. One of the ties binding the bale shall consist of specially produced galvanized shiny wire, or
3. The bale shall have a regional Forage Certification Program tag indicating the Regional Forage Certification Program Number.

At least 50% (by weight) of straw shall be 10” or longer. No noxious weeds or seed heads are permitted. Mulch in an advanced state of decomposition will not be accepted.

B. Tackifier: tackifier shall be guara-based, free flowing, non-corrosive powder. The material shall not contain any mineral filler, recycled cellulose fiber, clays or other substances which may inhibit germination or plant growth.

PART 3 - EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT AND RECYCLING

A. All project construction waste and recycled materials shall be managed in accordance with Division 1 Section 01690 – "Construction Waste Management and Recycling." The Contractor shall submit documentation satisfying the requirements of that section.

3.2 INSPECTION

Examine site to verify conditions are acceptable for proper installation of sod.

3.3 PREPARATION

A. Soil Preparation: Complete work specified prior to sodding. See Section 329119 – Soil Preparation.

B. Observation: Notify Owner 48 hours in advance and request observation of sodding areas prior to installation.

3.4 SODDING

A. Lay sod within 24 hours from time of cutting. Do not plant if sod is dormant or ground is frozen.

B. Lay sod on a firm, moist subgrade.

C. Lay sod parallel to contours to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips. Do not overlap. Stagger strips to offset joints in adjacent courses. Allow for sod thickness in areas adjacent to walks so that finish sod grade will be flush with adjacent pavement.

D. On slopes greater than 25% (4:1) secure strips to subgrade with wood pins 1" diameter be 6" long. Place a minimum of 4 pins along each side of strip.

E. Roll or tamp thoroughly to bond sod to subgrade. Place sifted soil into minor cracks between sod strips. Remove excess to avoid smothering of adjacent grass.

F. Water thoroughly until moisture permeates to 4-6" depth. Water lightly to avoid erosion.

3.5 SEEDING

A. Seeding or hydromulching shall not occur during windy weather or when ground is frozen or otherwise untillable.

B. Broadcast Seeding: some small portions of the site may be seeded by broadcast seeding. Any areas to be broadcast seeded must be approved by Owner prior to seeding. Broadcast seeding maybe be used for areas that were not covered

sufficiently by drill seeding and the reseeding of small areas after initial seeding operations. Area to be broadcast shall be roughened by raking with metal-tined rakes or harrowed immediately prior to seeding. Seed shall be evenly spread by hand or mechanical broadcaster at twice the rate shown in the seed mix table. Immediately following broadcast the seeded surface will be deeply raked or harrowed to provide cover for seed.

3.6 MULCHING (Straw Mulch)

A. Timing: after seeding, mulch shall be applied and tackified.

B. Mulching: apply hay mulch at a rate of 3000 lbs./acre. Hay mulch shall be spread using a spreader built to maintain long strand length. Chopping type spreaders such as straw blowers will not be accepted. Mulch shall not be crimped.

C. Tackifier: apply tackifier for mulch tacking at a rate of 250 lbs. per acre. Apply as per manufacturer's recommendations.

3.7 PROTECTION PROCEDURES

Keep equipment, vehicles and foot traffic off all landscaped areas. All damaged materials shall be replaced and all damaged areas restored to original condition.

3.8 CLEAN UP

Contractor shall make a reasonable effort to clean up project on a daily basis to maintain a neat and orderly site as directed by the Owner. The Contractor shall leave the site in an orderly condition free of all debris so that other construction operations may proceed immediately. All areas outside the Contract limits, which have been disturbed, shall be restored to their original condition in accordance with procedures as described herein. Cleanup shall also include the washing of all walks and streets adjacent to site. The Owner reserves the right to withhold any payments for services until final cleanup has been completed.

END OF SECTION 329200

SECTION 331000 - WATER SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Denver Water Rules Regulations shall be the standards in and above all water line specifications.

1.02 SUMMARY

A. This Section includes water systems piping for potable water service and fire protection service outside the building.

B. This Section does not include tapping of utility company water main by utility company and charged directly to Owner.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 15 Sections for fire protection systems inside building.

2. Division 15 Sections for water distribution systems inside building.

D. Utility-furnished products include water meters and vaults that will be furnished to the site and ready for installation.

1.03 SYSTEM PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure Ratings: Except where otherwise indicated, the following are minimum pressure requirements for water system piping.

1. Underground Piping: 150 psig (1035 kPa).

2. Underground Piping, Downstream of Fire Department Connections: 200 psig (1380 kPa).

1.04 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Product data, including pressure rating, rated capacity, and settings of selected models for the following:

1. Water meters - with pulse readout.

2. Backflow preventers.

3. Valves.

4. Fire department connections.

5. Identification materials and devices.

C. Shop drawings for precast concrete pits. Include frames and covers. Include drains when indicated.

D. Shop drawings for cast-in-place concrete valve and meter pits. Include frames and covers. Include drains when indicated.

E. Wiring diagrams for alarm devices.

F. Coordination drawings showing pipe sizes and valves, meter and specialty locations and elevations. Include details of underground structures, connections, anchors, and reaction backing. Show other piping in same trench and clearances from water system piping. Indicate interface and spatial relationship between piping and proximate structures.

G. Record drawings at Project closeout of installed water system piping and products according to Division 1 Section "Project Closeout."

H. Test reports specified in "Field Quality Control" Article in Part 3.

I. Maintenance data for inclusion in "Operating and Maintenance Manual" specified in Division 1 Section "Project Closeout." Include data for the following:

1. Water meters.

2. Backflow preventers.

3. Valves.

1.05 QUALITY ASSURANCE

A. Comply with requirements of utility supplying water. Include tapping of water mains and backflow prevention.

B. Comply with standards of authorities having jurisdiction for fire protection systems. Include materials, hose threads, installation, and testing.

C. Comply with standards of authorities having jurisdiction for potable water piping and plumbing systems. Include materials, installation, testing, and disinfection.

D. Comply with NFPA 24 "Standard for the Installation of Private Fire Service Mains and Their Appurtenances" for materials, installations, tests, and flushing.

E. Comply with NFPA 70 "National Electrical Code" for electrical connections between wiring and

electrically operated devices.

F. Provide listing/approval stamp, label, or other marking on equipment made to specified standards.

G. Listing and Labeling: Provide equipment and accessories that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in "National Electrical Code," Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

H. Product Options: Water systems specialties and accessories are based on specific types, manufacturers, and models indicated. Components by other manufacturers but having equal performance characteristics may be considered, provided deviations in dimensions, operation, and other characteristics do not change design concept or intended performance as judged by Engineer. The burden of proof of equality of products is on Contractor. Refer to Division 1 Section "Product Substitutions."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, for shipping as follows:

1. Ensure that valves are dry and internally protected against rust and corrosion.

2. Protect valves against damage to threaded ends, flange faces, and weld ends.

3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. Storage: Use the following precautions for valves, including fire hydrants, during storage:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.

2. Protect valves from weather. Store valves indoors and maintain temperature higher than ambient dew point temperature. Support valves off ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and piping specialties from moisture and dirt.

G. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.07 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Verify that water system piping may be installed in compliance with original design and referenced standards.

C. Site Information: Reports on subsurface condition investigations made during the design of the Project are available for informational purposes only; data in reports are not intended as representations or warranties of accuracy or continuity of conditions (between soil borings). Owner assumes no responsibility for interpretations or conclusions drawn from this information.

1.08 SEQUENCING AND SCHEDULING

A. Coordinate connection to water main with utility company.

B. Coordinate with pipe materials, sizes, entry locations, and pressure requirements of building fire protection systems piping.

C. Coordinate with pipe materials, sizes, entry locations, and pressure requirements of building water distribution systems piping.

D. Coordinate with other utility work.

E. Coordinate electrical requirements of actual equipment furnished with requirements specified in Division 16.

PART 2 PRODUCTS

2.01 PIPE

A. Polyvinyl Chloride (PVC) Pipe: AWWA C900; Classes 150 and 200; with bell end and elastomeric gasket, with plain end for cast-iron or ductile-iron fittings, or with plain end for PVC elastomeric gasket fittings.

1. Pipe Marking: NSF 14, "NSF-pvc cto only." Gaskets: ASTM F 477, elastomeric seal.

B. Ductile Iron (DI) Pipe: ANSI/AWWA C151/A21.51; Class 50 with plain end for cast-iron or ductile-iron fittings, or with plain end for PVC elastomeric gasket fittings.

2.02 FITTINGS

A. Ductile-Iron and Cast-Iron Pipe Fittings: ANSI/AWWA C110/A21.10, ductile-iron or cast-iron, 250-psig (1725 kPa) minimum pressure rating; or AWWA C153, ductile-iron compact fittings, 350-psig (2400 kPa) pressure rating.

1. Lining: ANSI/AWWA C104/A21.4, cement mortar.

2. Gaskets: AWWA C111, rubber

2.03 JOINING MATERIALS

A. Ductile-Iron Pipe and Ductile-Iron or Cast-Iron Fittings: The following materials apply:

1. Push-On Joints: AWWA C111 rubber gaskets and lubricant.

2. Mechanical Joints: AWWA C111 ductile-iron or gray-iron glands, high-strength steel bolts and nuts, and rubber gaskets.

3. Flanged Joints: AWWA C115 ductile-iron or gray-iron pipe flanges, rubber gaskets, and high-strength steel bolts and nuts.

a) Gaskets: Rubber, flat face, 1/8 inch (3 mm) thick except where other thickness is indicated; and full-face or ring type except where other type is indicated.

b) Flange Bolts and Nuts: ASME B18.2.1, carbon steel, except where other material is indicated.

2.04 VALVES

A. Gate Valves 3 Inches and Larger

1. AWWA C-509, 250 psi max working pressure for twelve inch size and larger and 200 psi for ten inches size and smaller. Federal Spec WW-V-58 for cast iron valves and Federal Spec WW-V-54 for bronze valves. Valves shall be M & H or Watrous.

2. The modified wedge disk shall have solid guide lugs and resilient rubber seat ring.

3. The valve shall be designed to allow for flow in either direction, have no resistance to flow when fully opened and provide bubble tight shutoff.

B. Rising Stem Gate Valves, 2 Inches (50 mm) and Smaller: UL 262, FM-approved, bronze body and bonnet, OS&Y, bronze stem, 175-psig (1200 kPa) working pressure, with threaded ends.

C. Valve Boxes: Cast-iron box having top section and cover with lettering "WATER," bottom section with base of size to fit over valve and barrel approximately 5 inches (124 mm) in diameter, and adjustable cast-iron extension of length required for depth of bury of valve.

1. Provide a steel tee-handle operating wrench with each valve box. Wrench shall have tee handle with one pointed end, stem of length to operate valve, and socket-fitting valve-operating nut.

D. Indicator Posts: UL 789, FM-approved, vertical type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of bury of valve.

E. Curb Stops: Bronze body, ground key plug or ball, and wide tee head, with inlet and outlet to match service piping material.

F. Service Boxes for Curb Stops: Cast-iron box with telescoping top section of length required for depth of bury of valve. Include cover having lettering "WATER," and bottom section with base of size to fit over curb stop and barrel approximately 3 inches (75 mm) in diameter.

1. Provide steel tee-handle shutoff rod with each service box. Shutoff rod shall have tee handle with 1 pointed end, stem of length to operate curb stop, and slotted end fitting curb stop head.

G. Tapping Sleeve and Tapping Valve: Complete assembly, including tapping sleeve, tapping valve, and bolts and nuts. Use sleeve and valve compatible with tapping machine.

1. Tapping Sleeve: Cast-iron or ductile-iron 2-piece bolted sleeve with flanged outlet for new branch connection. Sleeve may have mechanical joint ends with rubber gaskets or sealing rings in sleeve body. Use sleeve that mates with size and type pipe material being tapped. Outlet flange shall be size required for branch connection.

H. Service Clamps and Corporation Stops: Complete assembly, including service clamp, corporation stop, and bolts and nuts. Use service clamp and stop compatible with drilling machine.

1. Service Clamp: Cast iron or ductile iron with gasket and AWWA C800 threaded outlet for corporation stop, and threaded end straps.

2. Corporation Stops: Bronze body and ground key plug, with AWWA C800 threaded inlet and outlet matching service piping material.

3. Manifold: Copper with 2 to 4 inlets as required, with ends matching corporation stops and outlet matching service piping.

2.05 WATER METERS

A. Water meters will meet AWWA C700-90 Standards.

B. All meters must include a pulse output.

2.06 IDENTIFICATION

A. Plastic Underground Warning Tapes: Polyethylene plastic tape, 6 inches (150 mm) wide by 4 mils (1 mm) thick, solid blue in color with continuously printed caption in black letters "CAUTION - WATER LINE BURIED BELOW."

PART 3 EXECUTION

3.01 SERVICE ENTRANCE PIPING

A. Extend water system piping and connect to water supply source and building water distribution and fire protection systems at outside face of the building wall in locations and pipe sizes

indicated.

1. Terminate water system piping at building wall until building water systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building water systems when those systems are installed.

B. Water distribution systems and fire protection systems are specified in Division 15 Sections. Sleeves and mechanical sleeve seals are specified in Division 15 Section "Basic Mechanical Materials and Methods."

C. Install restrained joints for buried piping within 5 feet of building. Use restrained-joint pipe and fittings, thrust blocks, anchors, tie-rods and clamps, and other supports at vertical and horizontal offsets.

3.02 JOINT CONSTRUCTION

A. Ductile-Iron Piping Gasketed Joints: Construct joints according to AWWA C600.

3.03 PIPING INSTALLATION

A. Water Main Connection: Arrange for tap in water main, of size and in location indicated, from water utility.

3.04 ANCHORAGE INSTALLATION

A. Anchorages: Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron Piping: According to AWWA C600.

2. Gasketed-Joint, Polyvinyl Chloride (PVC) Piping: According to AWWA M23.

3. Fire Service Piping: According to NFPA 24.

B. Apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of installed ferrous anchorage devices.

3.05 VALVE INSTALLATION

A. General Application: Use mechanical-joint-end valves for 3-inch and larger buried installation. Use threaded- and flanged-end valves for installation in pits and inside building. Use nonrising stem UL/FM gate valves for installation with indicator posts. Use bronze corporation stops and valves, with ends compatible with piping, for 2-inch and smaller installation.

B. AWWA-Type Gate Valves: Comply with AWWA C600. Install buried valves with stem pointing up and with cast-iron valve box.

C. UL/FM-Type Gate Valves: Comply with NFPA 24.

1. Install buried valves and valves in pits with stem pointing up and with vertical cast-iron indicator post.

D. Bronze Corporation Stops and Curb Stops: Comply with manufacturer's installation instructions. Install buried curb stops with head pointed up and with cast-iron curb box.

3.06 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to Denver Water requirements.

B. Water Meter: Install displacement (disc)-type water meters 2-inch (50 mm) size and smaller in meter boxes with shutoff valve on meter inlet. Include valve on meter outlet and valved bypass around meter when indicated.

C. Water meter to be installed per manufacturers instructions and recommendations.

3.07 IDENTIFICATION INSTALLATION

A. Install continuous plastic underground warning tape during back-filling of trench for underground water service piping. Locate 6 inches (150 mm) to 8 inches (200 mm) below finished grade, directly over piping.

B. Attach nonmetallic piping label permanently to main electrical meter panel.

3.08 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours prior to testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than 1-1/2 times working pressure for 2 hours.

1. Increase pressure in 50-psig (350 kPa) increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig (0 kPa). Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within above limits.

3.09 CLEANING

A. Clean and disinfect water distribution piping as follows:

1. Purge new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired prior to use.

2. Use purging and disinfecting procedure prescribed by authority

having jurisdiction or, if method is not prescribed by that authority, use procedure described in AWWA C651 or as described below:

a) Comply with NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.

b) Fill system or part of system with water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) system or part thereof and allow to stand for 24 hours.

c) Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 parts per million of chlorine; isolate and allow to stand for 3 hours.

d) Following allowed standing time, flush system with clean, potable water until chlorine does not remain in water coming from system.

e) Submit water samples in sterile bottles to authority having jurisdiction. Repeat procedure if biological examination made by authority shows evidence of contamination.

B. Prepare reports for purging and disinfecting activities.

END OF SECTION 331000

SECTION 333000 –SANITARY

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes sewerage and drainage systems outside the building. Systems include the following:

1. Sanitary sewerage.

B. Related Sections:

1. Division 2 Section - “Excavation, Trenching and Backfill” for bedding requirements.

2. Division 15 Section - “Plumbing” for sanitary and storm drain systems inside building.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. City and County of Denver Wastewater Management Division Standards for Sanitary Sewer and Storm Drainage Construction. The Contractor shall obtain and maintain on site copies of both the following documents, as they provide details for materials and construction to be used on this project. The documents can be obtained from the City and County of Denver, Wastewater Management Division, 2300 West Third Avenue, Denver, Colorado 80223, or the City and County of Denver web site. If there are any conflicts between these specifications and the following documents, the documents shall govern.

1. Storm Drainage and Sanitary Sewer Construction Detail and Specifications, latest edition.

2. Standard Details, 1995.

C. Colorado Department of Transportation (CDOT) Standard Specifications for road and Bridge Construction. The Contractor shall obtain and maintain on site a copy of this document, as it provides details for materials and construction to be used on this project. The document can be obtained from the Colorado Department of Transportation, Office of Bid Plans, 4201 East Arkansas Avenue, Denver, Colorado 80222. If there are any conflicts between these specifications and referenced portions of the CDOT Specifications, the referenced CDOT specifications shall govern.

1.03 DEFINITIONS

A. Sewerage Piping: System of sewer pipe, fittings, and appurtenances for gravity flow of sanitary sewage.

1.04 SUBMITTALS

A. General. Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections. Submittals shall be provided in a timely manner to allow a minimum of one week for review, and so the review shall not affect the timely advance of the project.

B. Details of all fittings and specials shall be submitted for approval to the Project Manager prior to construction. Fittings and specials shall be made up materials having he same structural qualities as the adjoining pipe, and shall have the interior treated the same as the pipe.

C. The Contractor shall submit Shop Drawings showing the exact dimensions of the joints, including permissible tolerances, for each size of concrete pipe being furnished and the size, type and locations of gasket materials.

D. Inspection and test reports specified in the "Quality Control" Section.

E. At project Closeout, the Contractor shall submit as-built drawings prepared in accordance with City and County of Denver requirements. The Contractor shall include an as-built survey, prepared and certified by a registered Professional Land Surveyor, of all detention and water quality ponds so that the design volumes can be certified by the Engineer.

F. Recycled Content (MRc4):

a) Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).

b) Include information on Material Tracking Worksheets.

1.05 QUALITY ASSURANCE

A. Environmental Agency Compliance: Comply with regulations pertaining to construction of sanitary sewerage and storm drainage systems. This includes, erosion and storm water control, management of concrete and other waste materials, spill management, etc.

B. Utility Compliance: Comply with City and County of Denver Wastewater Management Division regulations pertaining to the construction of sanitary sewerage and storm drainage systems.

1.06 DELIVERY, STORAGE, AND HANDLING

A. General. Sections 10.1.8 and 10.1.9 of the City and County of Denver Wastewater Management Division Standards for Sanitary Sewer and Storm Drainage Construction.

1. Protect pipe, pipe fittings, and seals from dirt and damage.

2. Handle precast concrete pipe, manholes and other structures according to manufacturer's rigging instructions.

B. Poly Vinyl chloride Pipe. Sections 10.6.5, and subsections, of the City and County of Denver Wastewater Management Division Standards for Sanitary Sewer and Storm Drainage Construction.

1.07 PROJECT CONDITIONS

A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.

B. At all locations where the new Sewerage and Drainage Facilities connect to existing features, the Subcontractor shall pothole and expose piping to verify alignment and grades of the existing facilities. Prior to proceeding with installation of new work, the subcontractor shall report any problems to the Engineer in the event grades and alignment deviate from that shown on the drawings.

C. Existing Utilities. Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.

1. Notify Project Designer not less than 48 hours in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without receiving Project Designer's written permission.

1.08 SEQUENCING AND SCHEDULING

A. Coordinate sanitary sewerage system connection with the City and County of Denver Wastewater Management Division.

PART 2 PRODUCTS

2.01 GENERAL

A. All materials provided as part of this specification or as shown on the Drawings shall be as specified in the in the City and County of Denver Wastewater Management Division Standards for Sanitary Sewer and Storm Drainage Construction. If any discrepancies exist between what is specified herein or on the Drawings and what is specified in the City and County of Denver Wastewater Management Division Standards for Sanitary Sewer and Storm Drainage Construction, the Contractor shall immediately notify the Engineer. The materials specified in the City and County of Denver Wastewater Management Division Standards for Sanitary Sewer and Storm Drainage Construction have precedence over materials specified herein.

2.02 PIPES AND FITTINGS

A. Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.

1. All materials, manufacturing, operations, testing and production shall comply with the requirements of Section 10.6.2 of the *Storm Drainage and Sanitary Sewer Construction Detail and Specifications, latest edition.*

2. All PVC sewer materials shall comply with the requirements of Section 10.6.3 of the *Storm Drainage and Sanitary Sewer Construction Detail and Specifications, latest edition.*

    a) Pipe and Fittings – Section 10.6.3.1

    b) Gaskets – Section 10.6.3.2

    c) Lubricant – Section 10.6.3.3

B. Reinforced-Concrete Sewer Pipe and Fittings:

1. All materials, manufacturing, operations, testing and production shall comply with the requirements of Sections 10.1.2, 10.1.7 and 10.1.9 of the *Storm Drainage and Sanitary Sewer Construction Detail and Specifications, latest edition.*

2. Diameter of the Pipe – the diameter indicated on the Contract Documents shall mean the inside diameter of the pipe.

3. Wall Thickness and Class of Pipe – Section 10.1.4

4. Lifting Holes – Section 10.1.6

5. Joints – Section 10.1.10, including subsections, and Standard Drawings S-401 through S-450.

6. Protective Coatings – Section 10.1.11

2.03 CLEANOUTS

A. Description: ASME A112.36.2M, round, cast-iron housing with clamping device and round, secured, scoriated, cast-iron cover. Include cast-iron ferrule with inside caulk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:

1. Light Duty: In earth or grass, foot-traffic areas.

2. Medium Duty: In paved, foot-traffic areas.

3. Heavy Duty: In vehicle-traffic service areas.

4. Extra Heavy Duty: In roads.

B. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, service class, cast-iron soil pipe and fittings or same material as sewer main.

PART 3 EXECUTION

3.01 GENERAL

A. Contractor shall notify the City of Denver Inspector at least 24 hours prior to covering any work. Work shall not be covered without allowing at least 24 hours for an inspection.

B. All work installed as part of this specification shall be completed in accordance with the requirements specified in the City and County of Denver Wastewater Management Division Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications and Standard Details (dated 1995), and documents referenced therein. If any discrepancies exist between what is specified herein and what is specified in the City and County of Denver Specifications and Standard Details, the Contractor shall immediately notify the Engineer. The requirements specified in the City and County of Denver Wastewater Management Division Specifications and Standard Details have precedence over requirements specified herein.

3.02 EARTHWORK

A. For Piping

1. The requirements for excavating, trenching, and backfilling pipe are specified in Division 2 Section 02221 - Excavation, Trenching and Backfilling.

2. The requirements for pipe bedding, and the geofabric to be placed between the bedding and backfill materials, are specified in Division 2 Section 02221 – Excavation Trenching and Backfilling.

3. The requirements for final grading and landscaping are specified in Division 2 Section.

B. For Structures

1. General. All excavation for the construction of structures shall be in conformance with the applicable provisions of the CDOT Specifications, Section 206, except as modified herein.

2. Unless otherwise stipulated in the Proposal or in the Measurement and Payment portions of these specifications, no separate payment will me made for structural excavation, except for overexcavation as directed by the Engineer, and all costs incurred will be considered to be included in the unit price bid for the associated structure.

3. Overexcavation.

a) In locations where soil with unsuitable bearing characteristics are encountered, the Engineer may order that the unsuitable material be removed and be replaced with granular and/or rock backfill material to provide suitable bearing for the structure.

b) The overexcavation will paid for in accordance with the unit price set forth in the proposal for excavation and replacement with granular material; provided, however, no measurement for payment will be made of any material required to fill over excavated areas outside of the pay limits specified in the CDOT Specifications Section 206.3, if the Contractor for his own convenience, excavates beyond the limits required for structural excavation, the excavation and backfill thereof shall be at the Contractor’s expense; or where excavations for footings, slabs, etc., are made below the required elevations

without specific authorization from the Engineer, the over excavated area shall be filled in a manner satisfactory to the Engineer by the Contractor at his expense.

4. Removal of Water. All water encountered in structural excavations shall be removed as required in Section 02221 of these Specifications.

5. Backfill.

   a) General.

      i) Backfill around structures shall be as per requirements of CDOT Section 206.3, and backfill shall be placed only after walls or other constructed items have been inspected and the approval of the Engineer to commence backfilling has been obtained.

      ii) Backfilling against structures is allowed only after the concrete has properly cured for not less than seven days, or until other testing procedures (i.e., concrete test cylinders) indicate the concrete has attained sufficient strength so as not to be damaged by the backfilling operation.

   b) Section 11.04, and subsections, of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications includes information specific to the backfill requirements around manholes structures, inlets, utilities and appurtenances.

3.03 EXISTING FACILITIES

A. General.

1. The Contractor shall at all times take extreme and proper precautions for the protection of utility lines, the presence of which are known or can be determined by the examination of appropriate utility maps, exploratory excavations, etc. The Contractor shall be responsible for the repair of any damaged service or utility lines, and any utility line damaged by construction operations shall be repaired at the Contractor's expense.

2. The Contractor shall notify the Denver Water Board, Xcel Energy, telephone, cable and fiber optic companies, as well as all other interested parties, prior to commencement of work in order to ensure there will not be interruptions of these services during construction. Existing utility lines and utility poles, trees, shrubbery, fences, water mains, gas mains, sewers, cables, conduits, curb, gutter, walks, and other structures in the vicinity of the work not authorized to be removed, shall be supported and protected from damage by the Contractor until all construction and related work is complete. The Contractor shall be liable for all damage done to existing facilities, structures, and property.

3. Section 3 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications, including subsections, describe procedures to be used for managing existing facilities.

B. Utilities. Utilities, underground and above-ground, shall include but not be limited to: fiber optics (including empty ducts), gas, telephone, electric, steam, water, sanitary and storm sewers, telegraph lines, conduits, all abandoned utilities, etc., and their accessories, appurtenances and service connection. The type, size, location and number of all known above-ground and underground utilities have been shown on the drawings, however, no guarantee is made as to the true size, location or number of such utilities. It shall be the responsibility of the Contractor to

verify the existence and location (vertically and horizontally) of all underground utilities along the route of the work, to ensure construction as shown in the Contract Documents. The omission from of the inclusion of existing or abandoned utility locations on the drawings is not to be considered as the nonexistence of, or a definite location of, said utilities.

C. Exploratory Excavations. See Section 3.0.3 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

D. Relocation and Adjustment of Utilities. See Section 3.0.4 and subsections of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

E. Abandonment of Existing Sewer Facilities. See Section 3.0.5 and subsections of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

F. Crossing of Existing Utilities. See Section 3.0.6 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

3.04 INSTALLATION/CONSTRUCTION OF SEWER PIPING

A. General. General requirements for the installation of sewer piping can be found on Standard Detail Drawings S-301.1 through S-350, and S-401 through S-450, and in Section 4 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

1. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of underground sewerage and drainage systems piping. Location and arrangement of piping layout take into account many design considerations. Install piping as indicated.

2. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's recommendations for use of lubricants, cements, and other installation requirements.

3. Use manholes for changes in direction, except where fittings are indicated. Use fittings for branch connections, except where direct tap into existing sewer is indicated.

4. Use proper size increasers, reducers, and couplings, where different sizes or materials of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.

5. Install gravity-flow-systems piping at constant slope between points and elevations indicated. Install straight piping runs at constant slope, not less than that specified, where slope is not indicated.

6. Extend sewerage piping and connect to building's sanitary drains, of sizes and in locations indicated. Terminate piping as indicated.

7. Install sewerage piping pitched down in direction of flow, at minimum slope of 2% except where otherwise indicated.

8. Extend drainage piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.

B. Poly Vinyl chloride Pipe (PVC).

1. General. Requirements specific to the installation of RCP are provided in Section 10.6, especially 10.6.6 and subsections, of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

2. Joints. See Section 10.6.6.3 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

3. Cutting and Beveling Pipe. See Section 10.6.6.4 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

4. Sanitary Sewer Connections. See Section 10.6.6.5 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

5. Water Stops. See Section 10.6.6.6 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

6. Field Performance and Acceptance Tests. See Section 10.6.7, and subsections, of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

3.05 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

B. Set cleanout frames and covers in concrete paving with tops flush with surface of paving.

3.06 FIELD QUALITY CONTROL

A. In accordance with the requirements of Section 01400. If a discrepancy exists between this section and 01400, section 01400 will supercede.

B. Clear interior of piping and structures of dirt and superfluous material as the work progresses.

   1. Place plug in end of incomplete piping at end of day and whenever work stops.

   2. Flush piping between manholes and other structures, if required by authorities having jurisdiction, to remove collected debris.

C. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 in. of backfill is in place, and again at completion of the Project.

   1. Submit separate reports for each system inspection.

   2. Defects requiring correction include the following:

a) Alignment: Less than full diameter of inside of pipe is visual between structures.

b) Deflection: Flexible piping with deflection that prevents passage of a ball or cylinder of a size not less than 92.5% of piping diameter.

c) Crushed, broken, cracked, or otherwise damaged piping.

d) Infiltration: Water leakage into piping.

e) Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.

4. Re-inspect and repeat procedure until results are satisfactory.

D. Test new piping systems and parts of existing systems that have been altered, extended, or repaired for leaks and defects as required by Section 9 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

1. Schedule tests, and their inspections by authorities having jurisdiction, with at least 24 hours; advance notice.

2. Submit separate reports for each test.

END OF SECTION 333000

SECTION 334000 – STORM

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes sewerage and drainage systems outside the building. Systems include the following:

1. Storm drainage.

B. Related Sections:

1. Division 2 Section - “Excavation, Trenching and Backfill” for bedding requirements.

2. Division 15 Section - “Plumbing” for sanitary and storm drain systems inside building.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. City and County of Denver Wastewater Management Division Standards for Sanitary Sewer and Storm Drainage Construction. The Contractor shall obtain and maintain on site copies of both the following documents, as they provide details for materials and construction to be used on this project. The documents can be obtained from the City and County of Denver, Wastewater Management Division, 2300 West Third Avenue, Denver, Colorado 80223, or the City and County of Denver web site. If there are any conflicts between these specifications and the following documents, the documents shall govern.

1. Storm Drainage and Sanitary Sewer Construction Detail and Specifications, latest edition.

2. Standard Details, 1995.

C. Colorado Department of Transportation (CDOT) Standard Specifications for road and Bridge Construction. The Contractor shall obtain and maintain on site a copy of this document, as it provides details for materials and construction to be used on this project. The document can be obtained from the Colorado Department of Transportation, Office of Bid Plans, 4201 East Arkansas Avenue, Denver, Colorado 80222. If there are any conflicts between these specifications and referenced portions of the CDOT Specifications, the referenced CDOT specifications shall govern.

1.03 DEFINITIONS

A. Drainage Piping: System of sewer pipe, fittings, and appurtenances for gravity flow of storm drainage.

1.04 SUBMITTALS

A. General. Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections. Submittals shall be provided in a timely manner to allow a minimum of one week for review, and so the review shall not affect the timely advance of the project.

B. Details of all fittings and specials shall be submitted for approval to the Project Manager prior to construction. Fittings and specials shall be made up materials having he same structural qualities as the adjoining pipe, and shall have the interior treated the same as the pipe.

C. The Contractor shall submit Shop Drawings showing the exact dimensions of the joints, including permissible tolerances, for each size of concrete pipe being furnished and the size, type and locations of gasket materials.

D. Inspection and test reports specified in the "Quality Control" Section.

E. At project Closeout, the Contractor shall submit as-built drawings prepared in accordance with City and County of Denver requirements. The Contractor shall include an as-built survey, prepared and certified by a registered Professional Land Surveyor, of all detention and water quality ponds so that the design volumes can be certified by the Engineer.

F. Recycled Content (MRc4):

a) Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).

b) Include information on Material Tracking Worksheets.

1.05 QUALITY ASSURANCE

A. Environmental Agency Compliance: Comply with regulations pertaining to construction of sanitary sewerage and storm drainage systems. This includes, erosion and storm water control, management of concrete and other waste materials, spill management, etc.

B. Utility Compliance: Comply with City and County of Denver Wastewater Management Division regulations pertaining to the construction of sanitary sewerage and storm drainage systems.

1.06 DELIVERY, STORAGE, AND HANDLING

A. General. Sections 10.1.8 and 10.1.9 of the City and County of Denver Wastewater Management Division Standards for Sanitary Sewer and Storm Drainage Construction.

1. Protect pipe, pipe fittings, and seals from dirt and damage.

B. Poly Vinyl chloride Pipe. Sections 10.6.5, and subsections, of the City and County of Denver Wastewater Management Division Standards for Sanitary Sewer and Storm Drainage Construction.

1.07 PROJECT CONDITIONS

A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.

B. At all locations where the new Sewerage and Drainage Facilities connect to existing features, the Subcontractor shall pothole and expose piping to verify alignment and grades of the existing facilities. Prior to proceeding with installation of new work, the subcontractor shall report any problems to the Engineer in the event grades and alignment deviate from that shown on the drawings.

C. Existing Utilities. Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.

1. Notify Project Designer not less than 48 hours in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without receiving Project Designer's written permission.

1.08 SEQUENCING AND SCHEDULING

A. Coordinate storm drainage system connections with the City and County of Denver Wastewater Management Division.

PART 2 PRODUCTS

2.01 GENERAL

A. All materials provided as part of this specification or as shown on the Drawings shall be as specified in the in the City and County of Denver Wastewater Management Division Standards for Sanitary Sewer and Storm Drainage Construction. If any discrepancies exist between what is specified herein or on the Drawings and what is specified in the City and County of Denver Wastewater Management Division Standards for Sanitary Sewer and Storm Drainage Construction, the Contractor shall immediately notify the Engineer. The materials specified in the City and County of Denver Wastewater Management Division Standards for Sanitary Sewer and Storm Drainage Construction have precedence over materials specified herein.

2.02 PIPES AND FITTINGS

A. Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.

1. All materials, manufacturing, operations, testing and production shall comply with the requirements of Section 10.6.2 of the *Storm Drainage and Sanitary Sewer Construction Detail and Specifications, latest edition.*

2. All PVC sewer materials shall comply with the requirements of Section 10.6.3 of the *Storm Drainage and Sanitary Sewer Construction Detail and Specifications, latest edition.*

    a) Pipe and Fittings – Section 10.6.3.1

    b) Gaskets – Section 10.6.3.2

    c) Lubricant – Section 10.6.3.3

B. Reinforced-Concrete Sewer Pipe and Fittings:

1. All materials, manufacturing, operations, testing and production shall comply with the requirements of Sections 10.1.2, 10.1.7 and 10.1.9 of the *Storm Drainage and Sanitary Sewer Construction Detail and Specifications, latest edition.*

2. Diameter of the Pipe – the diameter indicated on the Contract Documents shall mean the inside diameter of the pipe.

3. Wall Thickness and Class of Pipe – Section 10.1.4

4. Lifting Holes – Section 10.1.6

5. Joints – Section 10.1.10, including subsections, and Standard Drawings S-401 through S-450.

6. Protective Coatings – Section 10.1.11

2.03 CLEANOUTS

A. Description: ASME A112.36.2M, round, cast-iron housing with clamping device and round, secured, scoriated, cast-iron cover. Include cast-iron ferrule with inside caulk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:

1. Light Duty: In earth or grass, foot-traffic areas.

2. Medium Duty: In paved, foot-traffic areas.

3. Heavy Duty: In vehicle-traffic service areas.

4. Extra Heavy Duty: In roads.

B. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, service class, cast-iron soil pipe and fittings or same material as sewer main.

2.04 RECYCLED CONTENT (MRc4)

A. Building materials in this section must have post- and/or pre-consumer recycled content by weight of total product.

PART 3 EXECUTION

3.01 GENERAL

A. Contractor shall notify the City of Denver Inspector at least 24 hours prior to covering any work. Work shall not be covered without allowing at least 24 hours for an inspection.

B. All work installed as part of this specification shall be completed in accordance with the requirements specified in the City and County of Denver Wastewater Management Division Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications and Standard Details (dated 1995), and documents referenced therein. If any discrepancies exist between what is specified herein and what is specified in the City and County of Denver Specifications and Standard Details, the Contractor shall immediately notify the Engineer. The requirements specified in the City and County of Denver Wastewater Management Division Specifications and Standard Details have precedence over requirements specified herein.

3.02 EARTHWORK

A. For Piping

1. The requirements for excavating, trenching, and backfilling pipe are specified in Division 2 Section 02221 - Excavation, Trenching and Backfilling.

2. The requirements for pipe bedding, and the geofabric to be placed between the bedding and backfill materials, are specified in Division 2 Section 02221 – Excavation Trenching and Backfilling.

3. The requirements for final grading and landscaping are specified in Division 2 Section.

4. Removal of Water. All water encountered in structural excavations shall be removed as required in Section 02221 of these Specifications.

5. Backfill.

a) General.

i) Backfill around structures shall be as per requirements of CDOT Section 206.3, and backfill shall be placed only after walls or other constructed items have been inspected and the approval of the Engineer to commence backfilling has been obtained.

ii) Backfilling against structures is allowed only after the concrete has properly cured for not less than seven days, or until other testing procedures (i.e., concrete test cylinders) indicate the concrete has attained sufficient strength so as not to be damaged by the backfilling operation.

b) Section 11.04, and subsections, of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications includes information specific to the backfill requirements around manholes structures, inlets, utilities and appurtenances.

3.03 EXISTING FACILITIES

A. General.

1. The Contractor shall at all times take extreme and proper precautions for the protection of utility lines, the presence of which are known or can be determined by the examination of appropriate utility maps, exploratory excavations, etc. The Contractor shall be responsible for the repair of any damaged service or utility lines, and any utility line damaged by construction operations shall be repaired at the Contractor's expense.

2. The Contractor shall notify the Denver Water Board, Xcel Energy, telephone, cable and fiber optic companies, as well as all other interested parties, prior to commencement of work in order to ensure there will not be interruptions of these services during construction. Existing utility lines and utility poles, trees, shrubbery, fences, water mains, gas mains, sewers, cables, conduits, curb, gutter, walks, and other structures in the vicinity of the work not authorized to be removed, shall be supported and protected from damage by the Contractor until all construction and related work is complete. The Contractor shall be liable for all damage done to existing facilities, structures, and property.

3. Section 3 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications, including subsections, describe procedures to be used for managing existing facilities.

B. Utilities. Utilities, underground and above-ground, shall include but not be limited to: fiber optics (including empty ducts), gas, telephone, electric, steam, water, sanitary and storm sewers, telegraph lines, conduits, all abandoned utilities, etc., and their accessories, appurtenances and service connection. The type, size, location and number of all known above-ground and underground utilities have been shown on the drawings, however, no guarantee is made as to the true size, location or number of such utilities. It shall be the responsibility of the Contractor to verify the existence and location (vertically and horizontally) of all underground utilities along the route of the work, to ensure construction as shown in the Contract Documents. The omission from of the inclusion of existing or abandoned utility locations on the drawings is not to be considered as the nonexistence of, or a definite location of, said utilities.

C. Exploratory Excavations. See Section 3.0.3 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

D. Relocation and Adjustment of Utilities. See Section 3.0.4 and subsections of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

E. Abandonment of Existing Sewer Facilities. See Section 3.0.5 and subsections of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

F. Crossing of Existing Utilities. See Section 3.0.6 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

3.04 INSTALLATION/CONSTRUCTION OF SEWER PIPING

A. General. General requirements for the installation of sewer piping can be found in Section 4 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

1. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of underground sewerage and drainage systems piping. Location and arrangement of piping layout take into account many design considerations. Install piping as indicated.

2. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's recommendations for use of lubricants, cements, and other installation requirements.

3. Use proper size increasers, reducers, and couplings, where different sizes or materials of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.

4. Install gravity-flow-systems piping at constant slope between points and elevations indicated. Install straight piping runs at constant slope, not less than that specified, where slope is not indicated.

5. Extend drainage piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.

B. Poly Vinyl chloride Pipe (PVC).

1. General. Requirements specific to the installation of RCP are provided in Section 10.6, especially 10.6.6 and subsections, of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

2. Joints. See Section 10.6.6.3 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

3. Cutting and Beveling Pipe. See Section 10.6.6.4 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

4. Sanitary Sewer Connections. See Section 10.6.6.5 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

5. Water Stops. See Section 10.6.6.6 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

6. Field Performance and Acceptance Tests. See Section 10.6.7, and subsections, of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

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3.05 FIELD QUALITY CONTROL

A. In accordance with the requirements of Section 01400. If a discrepancy exists between this section and 01400, section 01400 will supercede.

B. Clear interior of piping and structures of dirt and superfluous material as the work progresses.

1. Place plug in end of incomplete piping at end of day and whenever work stops.

2. Flush piping between manholes and other structures, if required by authorities having jurisdiction, to remove collected debris.

C. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 in. of backfill is in place, and again at completion of the Project.

1. Submit separate reports for each system inspection.

2. Defects requiring correction include the following:

a) Alignment: Less than full diameter of inside of pipe is visual between structures.

b) Deflection: Flexible piping with deflection that prevents passage of a ball or cylinder of a size not less than 92.5% of piping diameter.

c) Crushed, broken, cracked, or otherwise damaged piping.

d) Infiltration: Water leakage into piping.

e) Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.

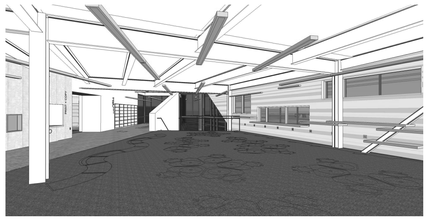
4. Re-inspect and repeat procedure until results are satisfactory.

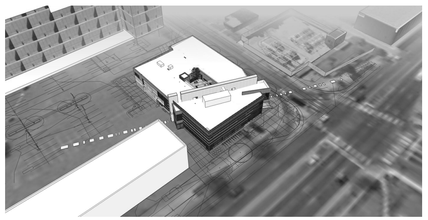
D. Test new piping systems and parts of existing systems that have been altered, extended, or repaired for leaks and defects as required by Section 9 of the Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications.

1. Schedule tests, and their inspections by authorities having jurisdiction, with at least 24 hours; advance notice.

2. Submit separate reports for each test.

END OF SECTION 334000





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ABBREVIATIONS

@ = AT, THEREFORE
A.B. = ANCHOR BOLT
ADJ. = ADJACENT
A.F.F. = ABOVE FINISH FLOOR
AP = ACOUTICAL PANELS
ARCH. = ARCHITECT
BLDG. = BUILDING
BLKG. = BLOCKING
BM. = BEAM
B.O. = BOTTOM OF
B.O.D. = BASIS OF DESIGN
BRG. = BEARING
B.S. = BOTH SIDES
BSMT. = BASEMENT
BYND = BEYOND
CCD = CITY AND COUNTY OF DENVER
CL = CENTERLINE
CLG. = CEILING
C.I.P. = CAST IN PLACE
COL. = COLUMN
CONC. = CONCRETE
CONN. = CONNECTI(ON)
CONT. = CONTINUOUS
COORD. = COORDINATE
CRPT. = CARPET
DBL = DOUBLE
DET. = DETAIL
DIA. = DIAMETER
DIM. = DIMENSION
DR. = DOOR
DS = DOWNSPOUT
DW = DISHWASHER
EA. = EACH
ELEC. = ELECTRICAL
ELEV. = ELEVATION
EQ. = EQUAL
EN = ENVIROMENTAL
ESMT. = EASEMENT
E.W. = EACH WAY
(E) or EXST. = EXISTING
EXT. = EXTERIOR
FC = FACE
FD = FLOOR DRAIN
FEC = FIRE EXTINGUISHER CABINET
FF = FLUSH FACE
FND = FOUNDATION
FIN. = FINISH
FLR. = FLOOR
FOC = FACE OF CONCRETE
FOF = FACE OF FRAMING
FOM = FACE OF MASONRY
FOS = FACE OF STRUCTURE
FOST = FACE OF STONE
FP = FIREPLACE
FTG = FOOTING
GFI = GROUND FAULT INTERRUPTER
GL. = GLASS
GLB = GLU-LAM BEAM
GWB = GYPSUM WALL BOARD
HB = HOSE BIB
HC = HOLLOW CORE
HDR = HEADER
HT = HEIGHT
IBC = INTERNATIONAL BUILDING CODE
IRC = INTERNATIONAL RESIDENTIAL CODE
I.B.C. = INSTALLED BY CONTRACTOR
I.B.O. = INSTALLED BY OWNER
INSUL. = INSULATION
INT. = INTERIOR
JST = JOIST
LAV = LAVATORY
MAX. = MAXIMUM
MECH. = MECHANICAL
MFR. = MANUFACTURER
MIN. = MINIMUM
MIR = MIRROR
MLB = MICRO-LAM BEAM
MTL = METAL
N.I.C. = NOT IN CONTRACT
NTS = NOT TO SCALE
O.C. = ON CENTER
O.D. = OVERFLOW DRAIN
O.H. = OVERHANG
O.L.F. = OCUPANT LOAD FACTOR
PBO = PROVIDED BY OWNER
PT = PAINT
PL = PLATE
PLAM = PLASTIC LAMINATE
PLY = PLYWOOD
P.I.P = POURED IN PLACE
P.T. = PRESSURE TREATED
R = RADIUS
RD = ROOF DRAIN
RE: = REFER TO OR REFERENCE
REINF. = REINFORCING
REQ'D. = REQUIRED
RM = ROOM
RO = ROUGH OPENING
S.B.O. = SUPPLIED BY OWNER
SC = SOLID CORE
SF = SQUARE FEET
SHT = SHEET
SHTG = SHEATHING
SIM = SIMILAR
SPECS. = SPECIFICATIONS
S.O.G. = SLAB ON GRADE
SS = STAINLESS STEEL
ST = STAIN
STL = STEEL
STRL. = STRUCTURAL
SUBFLOOR = SUBFLOOR
SW = SHEAR WALL
T = TREAD
TB = THROUGH BOLT
TBD = TO BE DETERMINED
T.G. = TEMPERED GLASS
T.O. = TOP OF
T.O.C. = TOP OF CONCRETE
T.O.W. = TOP OF WALL
T.P.O. = THERMOPLASTIC POLYOLEFIN
TYP. = TYPICAL
U.O.N. = UNLESS OTHERWISE NOTED
VB = VAPOR BARRIER
VERT. = VERTICAL
V.I.F. = VERIFY IN FIELD
W/ = WITH
WD = WOOD
W/D = WASHER AND DRYER
WC = WATER CLOSET
WD. = WOOD
WIN. = WINDOW

1 / A101 SIM — BUILDING SECTION DESIGNATION

1 / A101 SIM — WALL SECTION DESIGNATION

1 / A101 SIM — SECTION DETAIL REFERENCE

1 / A101 SIM — ENLARGED DETAIL REFERENCE

A# — WALL TYPE IDENTIFICATION WITH VARIABLE SUBSCRIPT

Room name 101 — ROOM IDENTIFICATION

101 — DOOR IDENTIFICATION

— GLAZING TYPE IDENTIFICATION

SPOT ELEVATION

A## — WINDOW FRAME TYPE IDENTIFICATION

BUILDING MATCH LINE

EXTERIOR ELEVATION REFERENCE

INTERIOR ELEVATION REFERENCE

MATERIAL LEGEND

EARTH - UNDISTURBED OR COMPACTED

EARTH - DISTURBED

STRUCTURAL FILL

FREE DRAINING GRANULAR FILL

CONCRETE

MASONRY - BRICK

WOOD

STEEL

ALUMINUM

GYPSUM PRODUCTS (GWB)

ROUGH WOOD

CELLULOSE INSULATION

RIGID INSULATION

BATT INSULATION

GENERAL NOTES

1. DO NOT SCALE DRAWINGS. SCALES ON DRAWINGS ARE FOR FULL SIZE DRAWINGS, PRINTED ON 24X36 SIZE SHEETS. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE. IF ADDITIONAL DIMENSIONS ARE REQUIRED, CONTACT ARCHITECT.

2. CONTRACTOR TO VERIFY ALL FIELD CONDITIONS AND DIMENSIONS AND LAY OUT PROPOSED WORK PRIOR TO COMMENCEMENT WITH CONSTRUCTION. REPORT DISCREPANCIES TO ARCHITECT FOR RESOLUTION.

3. IN THE EVENT OF CONFLICTING OR UNCLEAR INFORMATION, CONTRACTOR SHALL CONTACT ARCHITECT FOR CLARIFICATION BEFORE COMMENCING WITH THE WORK AFFECTED.

4. CONTRACTOR SHALL VERIFY ALL SITE CONDITIONS, LOCATION, AND DISPOSITION OF EXISTING UTILITIES AND EASEMENTS.

5. ALL WORK SHALL CONFORM TO APPLICABLE CODES. NOTIFY ARCHITECT OF ANY CONDITIONS OR DETAILS WHICH ARE DEEMED TO BE NONCONFORMING.

6. CONTRACTOR SHALL SET DOORS TO MEET ADA REQUIRED CLEARANCES WITH THE LATCH SIDE OF DOOR TO HAVE 12" ON PUSH SIDE AND 18" ON PULL SIDE U.O.N. ON DRAWINGS.

7. DIMENSIONS TO FACE/STUDS IN SHELVING ALCOVE LOCATIONS SHALL BE COORDINATED WITH SHELVING MANUFACTURER/SUPPLIER.

LOCATION MAP

PROJECT INFO

1. PROJECT DESCRIPTION : THIS PROJECT IS PART OF THE "BUILDING A BETTER DENVER" BOND PROGRAM APPROVED BY VOTERS IN NOVEMBER 2007. THE WEST DENVER BRANCH LIBRARY IS A NEW TWO STORY BUILDING

2. PROJECT ADDRESS : 1498 NORTH IRVING ST, DENVER CO 80204

3. LEGAL DESCRIPTION : NORTHWEST 1/4 OF SECTION 5, TOWNSHIP 4 SOUTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN,

CITY AND COUNTY OF DENVER LEGAL DESCRIPTION:

COMMENCING AT THE MOST WEST, NORTH CORNER OF SAID BLOCK "A",

THENCE SOUTH 89°42'03" EAST ALONG THE NORTH LINE OF SAID BLOCK "A", A DISTANCE OF 288.56 FEET TO **THE POINT OF BEGINNING;**

THENCE SOUTH 89°42'03" EAST, A DISTANCE OF 46.28 FEET;

THENCE SOUTH 00°00'50" WEST, A DISTANCE OF 317.64 FEET TO A POINT ON THE SOUTH LINE OF SAID BLOCK "A";

THENCE ALONG SAID SOUTH LINE BEING THE ARC OF A NON-TANGENT CURVE TO THE LEFT HAVING A RADIUS OF 359.00 FEET, A CENTRAL ANGLE OF 07°29'00", A CHORD THAT BEARS NORTH 80°59'47" WEST A DISTANCE OF 46.86 FEET, AND AN ARC LENGTH OF 46.89 FEET;

THENCE NORTH 00°00'50" EAST, A DISTANCE OF 310.55 FEET TO **THE POINT OF BEGINNING.**

CONTAINING 14,512 SQUARE FEET (0.333 ACRES) MORE OR LESS.

4. SEE G-001, G-002 FOR CODE ANALYSIS.

5. 100'-0" EQUALS 5301.00' PER SURVEY

CITY AND COUNTY OF DENVER
DEPARTMENT OF PUBLIC WORKS

APPROVED BY:		
MANAGER OF PUBLIC WORKS	DATE	1.9.12
CITY ENGINEER	DATE	1.9.12
DIRECTOR OF ENGINEERING CAPITAL PROJECTS	DATE	1/9/12
CITY TRAFFIC ENGINEER	DATE	1-9-12
DIRECTOR OF SMALL BUSINESS OPPORTUNITY	DATE	1-9-12

DRAWING LIST

G-001	CODE STUDY
G-002	CODE STUDY
G-003	WALL ASSEMBLIES
C-101	GRADING PLAN
C-102	OVERALL UTILITY PLAN
C-103	SUB-DRAIN SYSTEM
C-104	CASMP SITE IMPROVEMENT PLAN
C-105	GEOMETRIC CONTROL LAYOUT
C-106	FINISHED FLOOR ELEVATION EXHIBIT
C-107	DEMOLITION PLAN
C-501	CASMP DETAILS
C-502	CASMP DETAILS
C-503	SITE DETAILS
EV-101	SUB-SLAB VAPOR VENTILATION DESIGN
EV-102	SUB-SLAB VAPOR VENTILATION DESIGN
EV-103	SUB-SLAB VAPOR VENTILATION DESIGN
L-101	PLANTING PLAN
L-401	SITE FURNISHINGS PLAN
L-402	SITE FURNISHINGS DETAILS
L-501	LANDSCAPE DETAILS
I-101	IRRIGATION PLAN
I-102	IRRIGATION DETAILS
I-103	IRRIGATION DETAILS
AS001	ARCHITECTURAL SITE PLAN
AS002	ENLARGED SITE PLANS
AS003	ENLARGED SITE PLANS AND ELEVATIONS
AS004	ARCHITECTURAL SITE DETAILS
A-100	FOUNDATION PLAN
A-101	LEVEL ONE FLOOR PLAN
A-102	LEVEL TWO FLOOR PLAN
A-110	LEVEL 1 FF&E PLAN
A-111	LEVEL 2 FF&E PLAN
A-112	LEVEL 1 FINISH PLAN
A-113	LEVEL 2 FINISH PLAN
A-114	LEVEL 1 RAISED FLOOR PLAN
A-115	LEVEL 2 RAISED FLOOR PLAN
A-120	ROOF PLAN
A-130	LEVEL 1 RCP
A-131	LEVEL 2 RCP
A-200	BUILDING ELEVATIONS
A-201	BUILDING ELEVATIONS
A-202	BUILDING ELEVATIONS
A-300	BUILDING SECTIONS
A-301	BUILDING SECTIONS
A-302	BUILDING SECTIONS
A-320	WALL SECTIONS
A-321	WALL SECTIONS
A-323	WALL SECTIONS
A-324	WALL SECTIONS
A-325	WALL SECTIONS
A-326	WALL SECTIONS
A-327	WALL SECTIONS
A-400	INTERIOR ELEVATIONS
A-401	INTERIOR ELEVATIONS
A-402	INTERIOR ELEVATIONS
A-403	INTERIOR ELEVATIONS
A-404	INTERIOR ELEVATIONS WONDER WALL
A-405	INTERIOR ELEVATIONS
A-410	ENLARGED FINISH PLANS
A-440	VERTICAL CIRCULATION
A-441	VERTICAL CIRCULATION
A-442	VERTICAL CIRCULATION
A-450	RESTROOMS
A-451	RESTROOMS
A-500	SCREEN ELEVATIONS
A-501	SCREEN DETAILS
A-502	EXTERIOR DETAILS
A-503	EXTERIOR DETAILS
A-504	EXTERIOR DETAILS
A-505	EXTERIOR DETAILS
A-510	WINDOW DETAILS
A-511	WINDOW DETAILS
A-520	INTERIOR DETAILS
A-521	INTERIOR DETAILS (FORTHCOMING)
A-522	INTERIOR DETAILS
A-530	CASEWORK DETAILS
A-531	CASEWORK DETAILS
A-532	CASEWORK DETAILS
A-600	WINDOW SCHEDULE
A-601	WINDOW SCHEDULE
A-602	DOOR SCHEDULE
A-603	FINISH SCHEDULE
A-610	GRAPHICS
A-611	GRAPHICS - DETAILS
A-612	GRAPHICS - DETAILS
A-614	GRAPHICS - ELEVATIONS
A-615	GRAPHICS - ELEVATIONS
A-901	EXPLODED AXON
S-100	GENERAL NOTES SHEET 1
S-101	GENERAL NOTES SHEET 2
S-102	COLUMN SCHEDULE
S-200	FIRST FLOOR PLAN
S-201	SECOND FLOOR PLAN
S-202	ROOF PLAN
S-203	UPPER ROOF PLAN AND WONDER WALL DETAILS
S-204	ENLARGED PLANS
S-205	ISO VIEWS
S-206	ISO VIEWS
S-300	FOUNDATION DETAILS
S-301	GRADE BEAM ELEVATIONS AND SECTIONS
S-302	FOUNDATION DETAILS
S-400	FRAMING DETAILS
S-401	DECK DETAILS
S-402	FRAMING DETAILS
S-403	FRAMING DETAILS
S-500	BRACED FRAME ELEVATION
S-501	WONDER WALL ELEVATIONS AND DETAILS
S-600	LT GAGE DETAILS
M-000	MECHANICAL LEGEND AND GENERAL INFORMATION
M-001	MECHANICAL SCHEDULES
M-002	MECHANICAL SCHEDULES
M-100	MECHANICAL SITE PLAN
M-101	LEVEL 1 UNDER FLOOR MECHANICAL PLAN
M-102	LEVEL 1 MECHANICAL PLAN
M-103	LEVEL 2 UNDER FLOOR MECHANICAL PLAN
M-104	LEVEL 2 MECHANICAL PLAN
M-105	ROOF LEVEL MECHANICAL PLAN
M-201	ENLARGED MECHANICAL PLAN AND ELEVATIONS
M-301	MECHANICAL CONTROL DIAGRAMS
M-302	MECHANICAL CONTROL DIAGRAMS
M-303	MECHANICAL CONTROL DIAGRAMS
M-304	MECHANICAL CONTROL DIAGRAMS
M-401	MECHANICAL DETAILS
M-402	MECHANICAL DETAILS
M-403	MECHANICAL DETAILS
P-000	PLUMBING LEGEND AND GENERAL INFORMATION
P-001	PLUMBING SCHEDULES
P-100	UNDERGROUND PLUMBING PLAN
P-101	LEVEL 1 UNDER FLOOR PLUMBING PLAN
P-102	LEVEL 1 PLUMBING PLAN
P-103	LEVEL 2 PLUMBING PLAN
P-104	LEVEL 2 PLUMBING PLAN
P-105	ROOF LEVEL PLUMBING PLANS
P-201	ENLARGED MECHANICAL ROOM PLUMBING PLAN
P-202	ENLARGED PLUMBING PLANS
P-301	PLUMBING DETAILS
P-302	PLUMBING DETAILS
P-303	PLUMBING DETAILS
FP-000	FIRE PROTECTION LEGEND AND GENERAL INFORMATION
FP-001	FIRE PROTECTION SCHEDULES AND DETAILS
FP-101	LEVEL 1 FIRE PROTECTION PLAN
FP-102	LEVEL 2 FIRE PROTECTION PLAN
E-000	ELECTRICAL LEGEND AND GENERAL INFORMATION
E-001	ELECTRICAL COMCHECK & LUMINAIRE SCHEDULE
E-002	COMCHECK (FORTHCOMING)
E-101	LEVEL 1 LIGHTING PLAN
E-102	LEVEL 2 LIGHTING PLAN
E-103	LEVEL 1 POWER PLAN
E-104	LEVEL 2 POWER PLAN
E-105	ROOF LEVEL ELECTRICAL PLAN
E-201	ELECTRICAL ONE-LINE DIAGRAM
E-301	ELECTRICAL PANEL SCHEDULES
E-302	ELECTRICAL PANEL SCHEDULES
ES001	ELECTRICAL SITE PLAN
T-000	TECHNOLOGY SHEET INDEX AND LEGEND
TA-101	AUDIOVISUAL - FIRST FLOOR PLAN
TA-102	AUDIOVISUAL - SECOND FLOOR PLAN
TA-121	AUDIOVISUAL - FIRST FLOOR RCP
TA-401	AUDIOVISUAL ONE-LINES
TC-101	TELECOM - FIRST FLOOR PLAN
TC-102	TELECOM - SECOND FLOOR PLAN
TC-121	TELECOM - FIRST FLOOR RCP
TC-122	TELECOM - SECOND FLOOR RCP
TC-400	TELECOM - ENLARGED ROOMS
TS-101	SECURITY - FIRST FLOOR PLAN
TS-102	SECURITY-SECOND FLOOR PLAN
TS-121	SECURITY - FIRST FLOOR RCP
TS-122	SECURITY - SECOND FLOOR RCP

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F. 303.953.9016
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PINYON ENVIROMENTAL
14925 Camp Robber Ct.
Black Forest, CO 80908
P. 303.980.5200
F. 303.980.0089
www.pinyon-env.com

PROJECT: WEST DENVER BRANCH LIBRARY
1498 NORTH IRVING STREET
DENVER, COLORADO 80204

sDC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02089

ISSUE DATE 01-12-2012
PHASE 100% CD

TITLE SHEET / GENERAL INFORMATION

T-100

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OCCUPANCY LOAD CALCULATIONS FOR **EXIT REQUIREMENTS**

FUNCTION OF SPACE	PER : IBC 2006 TABLE 1004.1.1FLOOR AREA IN SQ. FT. PER OCCUPANT	AREA SQ. FT.	OCC. LOAD
LIBRARY: READING ROOM	50 NET	8,865	178
LIBRARY: STACK AREA	100 GROSS	6,906	70
BUSINESS AREAS	100 GROSS	2,456	25
ACCESSORY STORAGE AREAS, MECHANICAL EQUIPMENT ROOM	300 GROSS	1,322	5
COURTYARD	50 NET	824	17
RESTROOMS ASSUMED FULLY OCCUPIED			9
TOTAL OCC. LOAD FOR BUILDING			**304**

REFER TO FLOOR PLANS FOR OCC. LOADS PER ROOM

PLUMBING FIXTURE COUNTS: PER CHAPTER 29. 2006 IBC	304 OCC LOAD, **159 PER GENDER**	PROVIDED	NOTE
MENS WATER CLOSETS:			
REQUIRED FOR A-3 (1 PER 125):	2	2	1 WATER CLOSET + 1 URINAL
WOMENS WATER CLOSETS:			
REQUIRED FOR A-3 (1 PER 65):	3	3	INCLUDES UNISEX BATHROOM
MENS LAVATORIES:			
REQUIRED FOR A-3 (1 PER 200):	1	1	
WOMENS LAVATORIES:			
REQUIRED FOR A-3. (1 PER 200):	1	1	
DRINKING FOUNTAINS:			
REQUIRED IF A-3 (1 PER 500):	1	2	
SERVICE SINK:			
REQUIRED FOR A-3:	0	1	
FAMILY WATER CLOSETS:			
REQUIRED FOR A-3:	0	1	
FAMILY LAVATORIES:			
REQUIRED FOR A-3:	0	1	
UNISEX WATER CLOSETS:			
REQUIRED FOR A-3:	0	2	
UNISEX LAVATORIES:			
REQUIRED FOR A-3:	0	2	

EXITS FOR SITE + BUILDING:

REFER TO OCCUPANCY LOAD CHART AND DIAGRAMS

PER TABLE 1015.1 AND 1019.1, THREE (3) EXITS ARE REQUIRED

EXIT REQUIREMENTS:

MAX TRAVEL DISTANCE
FULLY SPRINKLED = 250'
NON-SPRINKLED = 200'

MAX DEAD END CORRIDOR = 20'
WITH EXCEPTION 2(B) = 50'

COMMON PATH OF TRAVEL
75' MAX PER IBC 1014.3

HAZARDOUS MATERIAL LIST AS PROVIDED BY OWNER IN LANDSCAPE STORAGE RM 152:

Gasoline (5 gallon minimum)
2-cycle engine oil
Round Up
Machines that contain gasoline and/or 2-cycle engine oil
Paint
Spray paint
Lawn fertilizer
Herbicide
Ice Melt
Anti-freeze
Insecticide

	MAX AREA PER FLOOR	MAX STORIES	FRONTAGE INCREASE PER IBC 506.2	AUTOMATIC SPRINKLER AREA INCREASE PER IBC 506.3	AUTOMATIC SPRINKLER MAX HEIGHT INCREASE PER IBC 504.2
TYPE II-B	9,500 SF	2		x 200%	+ 20'

NOTE: FRONTAGE INCREASE NOT NEEDED & THEREFORE NOT CALCULATED

1. PROJECT DESCRIPTION : THIS PROJECT IS PART OF THE "BUILDING A BETTER DENVER" BOND PROGRAM APPROVED BY VOTERS IN NOVEMBER 2007. THE WEST DENVER BRANCH LIBRARY IS TO BE A NEW BUILDING

2. PROJECT LOCATION : SOUTH EAST CORNER OF W. COLFAX AVE. & IRVING STREET
1498 NORTH IRVING STREET, DENVER, COLORADO 80204

3. APPLICABLE CODES:
The Building Code for the City and County of Denver is based on the 2008 National Electrical Code, NFPA 72 and the 2009 Series of I - Codes. They are:

- 2009 International Building Code
- 2009 International Energy Conservation Code
- 2009 International Fire Code
- 2009 International Fuel Gas Code
- 2009 International Mechanical Code
- 2009 International Plumbing Code
- Including the 2011 Denver Building Code Amendments
- 2011 National Electric Code

4. BUILDING INFORMATION:

PROPOSED CONSTRUCTION PER IBC 2009 - CHAPTER 6

ROOF:	ACOUSTICAL DECK ON STEEL ROOF BEAMS
COLUMNS/BEAMS:	STEEL COLUMNS AND COMPOSITE STEEL BEAMS & GIRDERS
INTERIOR LOAD BEARING WALLS:	N/A
EXTERIOR LOAD BEARING WALLS:	VARIES, RE: ARCH ELEVATIONS & SECTIONS
EXTERIOR NON-LOAD BEARING WALLS:	VARIES, RE: ARCH ELEVATIONS & SECTIONS
PARTITIONS:	VARIES, PRIMARILY METAL STUD W/ GWB
PARTY WALLS:	NONE, NOT REQUIRED PER TABLE 602

BUILDING DATA:	MAX	PROVIDED
NO. OF STORIES:	12	2
BUILDING HEIGHT:	150'	42'-0" +/-

OCCUPANCY CLASSIFICATION: A-3

CONSTRUCTION TYPE: II-B
2006 IBC:
TABLE 601 = 0 HOUR FIRE RESISTIVE RATING FOR ALL BUILDING ELEMENTS

BUILDING AREA WITHOUT COURTYARD: 26,073 SF = TOTAL
13,398 SF = LEVEL 1
12,675 SF = LEVEL 2

BUILDING AREA WITH COURTYARD: 26,973 SF = TOTAL
13,398 SF = LEVEL 1
13,575 SF = LEVEL 2

ALLOWABLE FLOOR AREA 19,000 SF

ADJACENT BUILDINGS AND GENERAL BUILDING HEIGHTS AND AREAS:
NO RATING REQUIRED IF II-B, PER IBC 503.1.2, TABLE 503 AND TABLE 602:

OCCUPANCY SEPARATIONS:
OCCUPANCY SEPARATION IN BUILDING:
NOT REQUIRED

FIRE SPRINKLER SYSTEM:
REQUIRED: YES
PROVIDED: YES

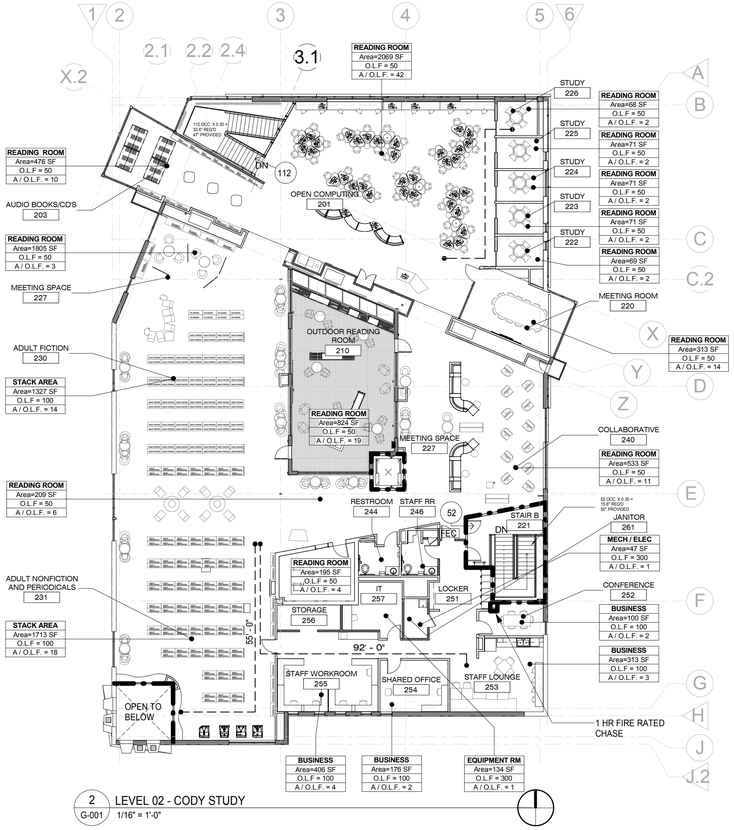
FIRE PROTECTION SYSTEM: CLASS 2-A, ORDINARY HAZARD OCCUPANCY
PER TABLE 906.3(1) MAX FLOOR AREA PER UNIT: 1,500 SQ FT
MAX FLOOR AREA FOR EXTINGUISHER: 11,250 SQ FT
MAX TRAVEL DISTANCE TO EXTINGUISHER: 75 FEET

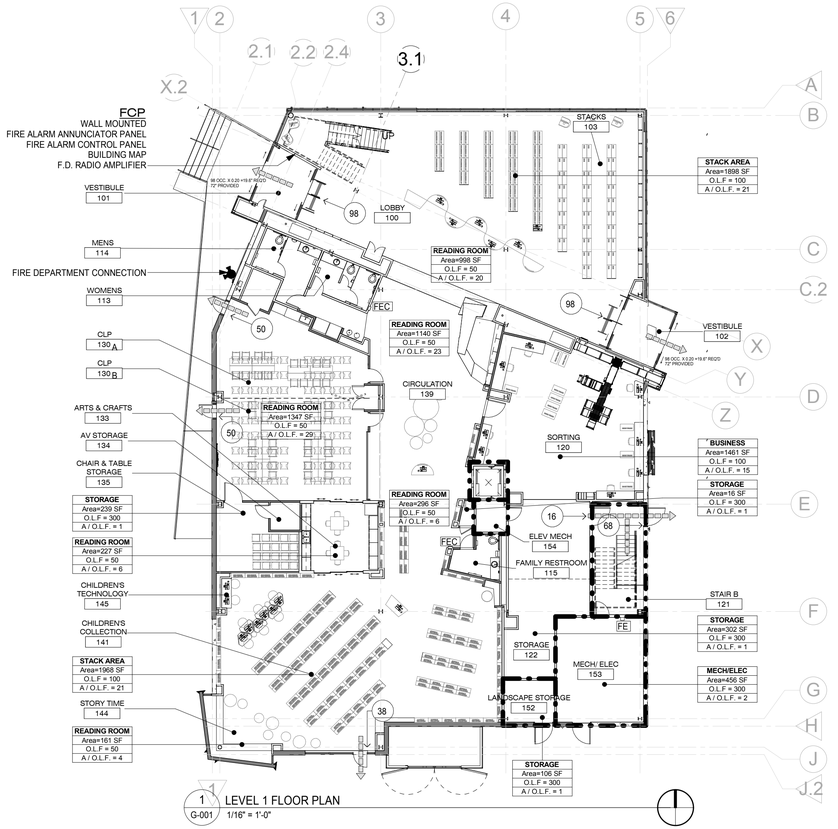
USE OF PLASTIC IN LOBBY 100, PER 2606.74
SPRINKLERS SHALL BE INSTALLED ABOVE & BELOW SUSPENDED PLASTIC PANELS
USE OF PLASTIC FOR INTERIOR & EXTERIOR WALL PANELS, PER SECTION 2607
SINGLE AREA OF WALL PANELS LOCATED <30' FROM E. PROPERTY LINE SHALL NOT EXCEED 180 SF.

POSTING OF OCCUPANCY LOAD REQUIRED: YES

MAXIMUM ALLOWABLE FLOOR AREA (IBC-2006, TABLE 503):

OCCUPANCY A-3: TYPE II-B 9,500 S.F. / 2 STORIES





CODE LEGEND

- 1 HR RATED
- 2 HR RATED
- 0'-0" COMMON PATH OF TRAVEL
- CODE REQUIRED SIGNAGE (FORTHCOMING)
- BUILDING EXIT
- 39 DIRECTION OF EGRESS W/ NUMBER OF OCCUPANTS INDICATED
- FCP FIRE CONTROL PANEL
- FE FIRE EXTINGUISHER/ BRACKET
- FEC FIRE EXTINGUISHER CABINET
- FIRE DEPT. CONNECTION

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sDC PROJECT NO: 1020.00
COOD PROJECT NO: CE 02089

ISSUE DATE 01-12-2012
PHASE 100% CD

CODE STUDY

G-001

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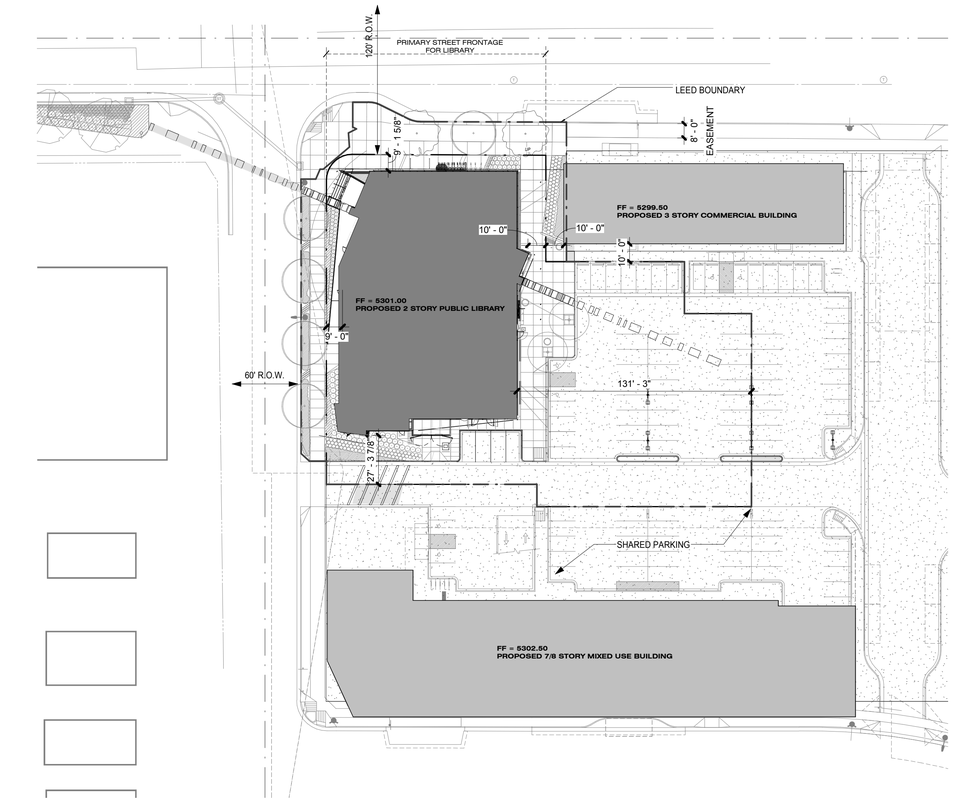
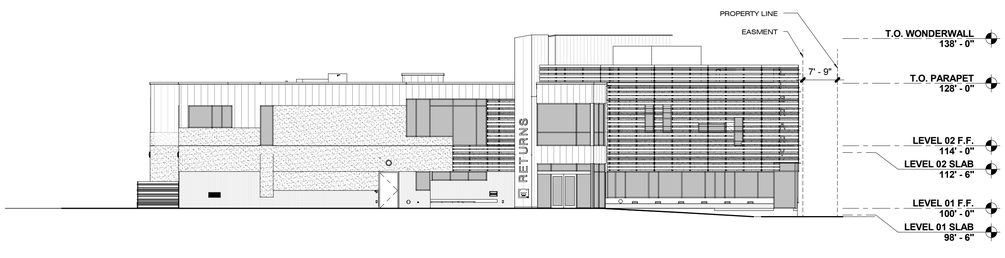
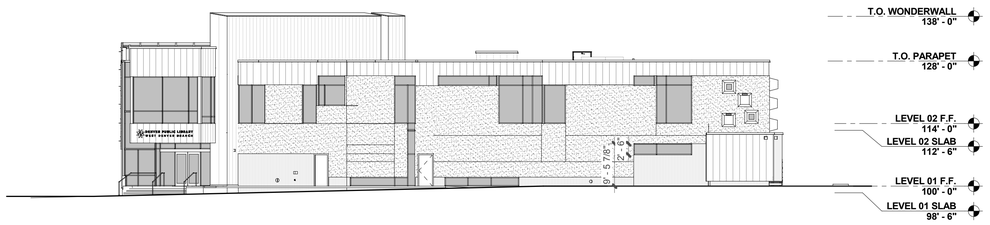


NOTE: DEVELOPMENT PLAN REVIEW DOCUMENTS APPROVED BY CCOD SHOW A 10' MIN DISTANCE FROM FUTURE PROPOSED COMMERCIAL BUILDING TO ENSURE A 20' MIN. DISTANCE BETWEEN BUILDINGS.

5 G-002 SITE PLAN - ZONING
1" = 40'-0"

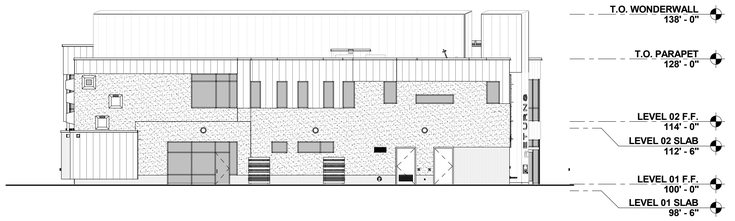


4 G-002 EAST ELEVATION - ZONING STUDY
1/16" = 1'-0"

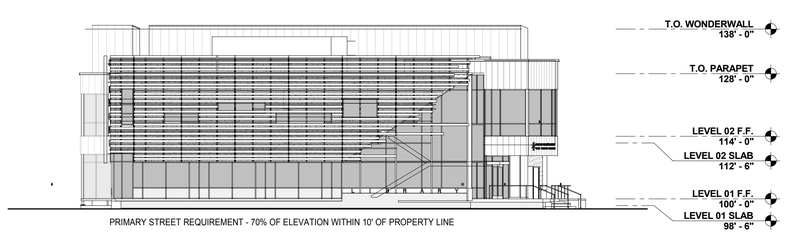


2 G-002 WEST ELEVATION, SIDE STREET (IRVING)
1/16" = 1'-0"

22% TRANSPARENCY PROVIDED AT GROUND STORY + 3% ARCHITECTURAL EXPRESSION WALL PLANE
(25% MIN REQUIRED GROUND STORY ACTIVATION FOR C-MX-12)



3 G-002 SOUTH ELEVATION - ZONING STUDY
1/16" = 1'-0"



PRIMARY STREET REQUIREMENT - 70% OF ELEVATION WITHIN 10' OF PROPERTY LINE

1 G-002 NORTH ELEVATION, PRIMARY STREET (COLFAX)
1/16" = 1'-0"

55% TRANSPARENCY PROVIDED AT GROUND STORY
(40% MIN REQUIRED GROUND STORY ACTIVATION FOR C-MX-12)

ZONING CODE STUDY

ZONE = CMx-12

ZONE LOT
- CCOD is recognizing the ULC development as one zone lot, with multiple property lines
- The zone lot has three fronts and one rear
- Fronts = Colfax, Irving, 14th
- Rear = shared driveway

EASEMENT
- The 8' easement could potentially be vacated, but this is unlikely and entirely at the discretion of the owner of the easement, Xcel Energy
- sDC will seek clarification of 13.2.2.2(c)(2), with respect to distance from easement.

PRIMARY ENTRY
- Section 13.1.2.4 and Figure 13, along with Section 7.3.6.2.B-1 + 2 indicate the Zoning Administrator shall determine location of primary street

- sDC met with Ken Brewer of CCOD to explain reasons for an entry location off Colfax
  - The Colfax side is north facing and will be unpleasant due to lack of solar access
  - The public library shall establish a welcoming face towards the west and south
  - The entry shall be convenient and accessible from the parking lot to the SE
  - Mr. Brewer accepted the proposal to locate the primary entry on Irving
  - entry shall be visible from Colfax Avenue
  - building face along Colfax Avenue shall NOT appear as a side lot
  - 40% Minimum transparency

PARKING
- Public Library = 1 stall per 1,000 sf, or roughly 28 stalls
- 39 stalls + 2 ADA accessible dedicated for library use
- 20 additional shared stalls

SETBACKS
- 70% of building must be 10' maximum from property line along Primary Street = Req.
  100% = Provided

HEIGHT
- 150' Max height
- 12 Stories max
- 38' Actual height
- 2 Stories

CENTERLINE OF STREET

8' EASEMENT

PROPERTY LINE

LEED BOUNDARY

ELEVATION LEGEND

GLAZING

STUCCO

METAL PANEL

TRANSLUCENT PANEL

CONCRETE

CONCRETE w/ FORMLINER

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PROJECT:
WEST DENVER BRANCH LIBRARY
1498 NORTH IRVING STREET
DENVER, COLORADO 80204

sDC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02089

ISSUE DATE
01-12-2012

PHASE
100% CD

CODE STUDY

G-002

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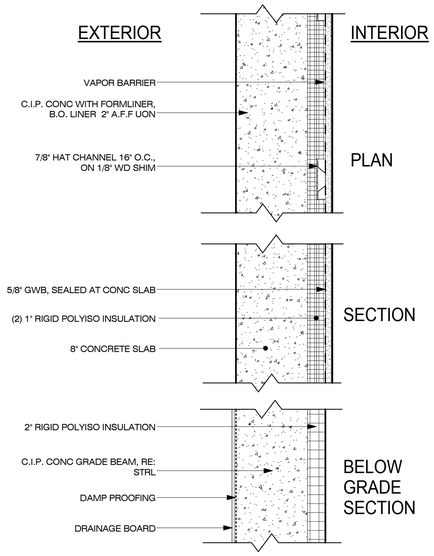
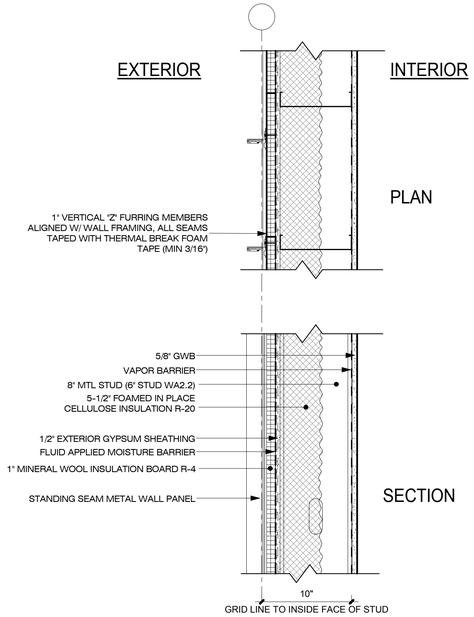
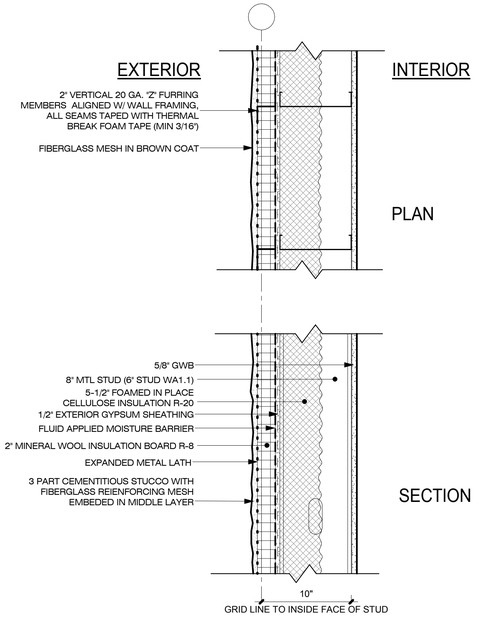


WALL TYPE - WA-3



WALL TYPE - WA-2
WA-2.2



WALL TYPE - WA-1
WA-1.1

GENERAL PARTITION NOTES

1. WRITTEN DIMENSIONS SHALL ESTABLISH LOCATIONS OF ALL PARTITIONS. WHERE DISCREPANCIES EXIST BETWEEN LARGER AND SMALLER SCALED DRAWINGS CONTRACTOR SHALL NOTIFY ARCHITECT IN WRITING PRIOR TO PROCEEDING WITH CONSTRUCTION.

2. **PLAN DIMENSIONS** SHOWN ARE TO THE FACE OF STUDS U.O.N. THESE MAY BE CRITICAL FOR ADA CLEARANCES OR MILLWORK TOLERANCES AND SHOULD NOT BE ALTERED. IF DISCREPANCIES ARE FOUND, NOTIFY ARCHITECT IN WRITING.

3. NOTES TO 'ALIGN' SHALL MEAN TO ALIGN FINISHES U.O.N.

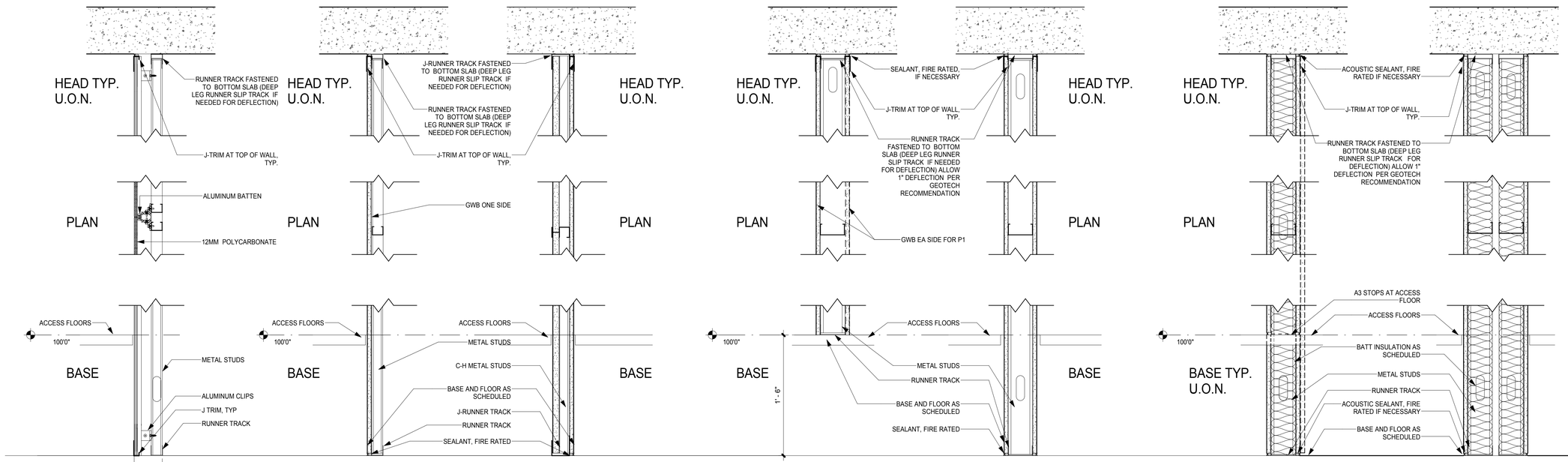
4. ALL INTERIOR PARTITIONS SHALL BE TYPE "P1" U.O.N.

5. MAINTAIN ANY REQUIRED FIRE RATING AT RECESSED COMPONENTS AND CABINETS PER CODE.

6. PROVIDE WOOD BLOCKING OR METAL BLOCKING AS REQUIRED FOR ATTACHMENT OF WALL MOUNTED HARDWARE, TOILET ACCESSORIES, CASEWORK, MILLWORK, FINISH CARPENTRY AND WHERE REQUIRED FOR THE SECURE ATTACHMENT OF ADJOINING WORK.

7. U.O.N., THE HINGE SIDE OF ALL DOOR JAMBS SHALL BE LOCATED 4" FROM ANY ADJACENT PERPENDICULAR SURFACE.

8. FOR ALL PARTITION TYPES THAT HAVE A GA-FILE NUMBER REFER TO GYPSUM ASSOCIATION DESIGN MANUAL FOR CONSTRUTION DETAILS.



WALL TYPE - SHAFT

TYPE	WIDTH	GA-FILE	FIRE RATING	DESCRIPTION
S1	3-1/8"	WP 7008	1 HR	(1) LAYER OF 1"X24" TYPE "X" GYP PANELS BETWEEN 2-1/2" FLOOR AND CLNG J-RUNNER WITH "H" SECTIONOF 2-1/2" C-H STUD BETWEEN PANELS
CW1f	2-1/8"	CM 1001	1 HR	(1) 1/2" LAYER TYPE "X" GWB ON (1) SIDE OF1-5/8" STUDS, METAL CORNER BEADS
CW1	2-1/4"		1 HR	(1) 5/8" LAYER GWB ON (1) SIDE OF1-5/8" STUDS

REFER TO ACCESS FLOOR DETAILS ON A-522

WALL TYPE - PARTITION

TYPE	WIDTH	GA-FILE	FIRE RATING	DESCRIPTION
P1	4-7/8"	N/A	N/A	(1) LAYER 5/8" GWB EA SIDE OF 3-5/8" MTL STUD
P1f	4-7/8"	WP 1049	1 HR	(1) LAYER TYPE X 5/8" GWB EA SIDE OF 3-5/8" MTL STUD
P2	4-1/4"	N/A	N/A	(1) LAYER TYPE 5/8" GWB (1) SIDE OF 3-5/8" MTL STUD

REFER TO ACCESS FLOOR DETAILS ON A-522

WALL TYPE - ACCOUSTIC

TYPE	GA-FILE	WIDTH	STC RATING	FIRE RATING	DESCRIPTION
A1	WP 1078	4-7/8"	45-49	N/A	(1) LAYER 5/8" GWB EA SIDE OF 3-5/8" MTL STUD 3 1/2" SOUND ATTENUATION BLANKET
A1f	WP 1078	4-7/8"	45-49	1HR	(1) LAYER 5/8" GWB EA SIDE OF 3-5/8" MTL STUD 3 1/2" SOUND ATTENUATION BLANKET
A2 (A3)	WP 1052	5-1/2"	50-54	N/A	(1) LAYER 5/8" GWB EA SIDE OF 3-5/8" MTL STUD WITH (1) ADDITIONAL FACE LAYER 5/8" GWB WITH 3 1/2" SOUND ATTENUATION BLANKET
A4	WP 5060	10-3/4"	65-69	N/A	(2) LAYERS 5/8" GWB EA SIDE OF DOUBLE ROW OF 3-5/8" MTL STUD, 1" SPACE BETWEEN STUD ROWS, 3 1/2" SOUND ATTENUATION BLANKET EA SIDE

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sDC PROJECT NO: 1020.00
COOD PROJECT NO: CE 02069

ISSUE DATE: 01-12-2012
PHASE: 100% CD

WALL ASSEMBLIES

G-003

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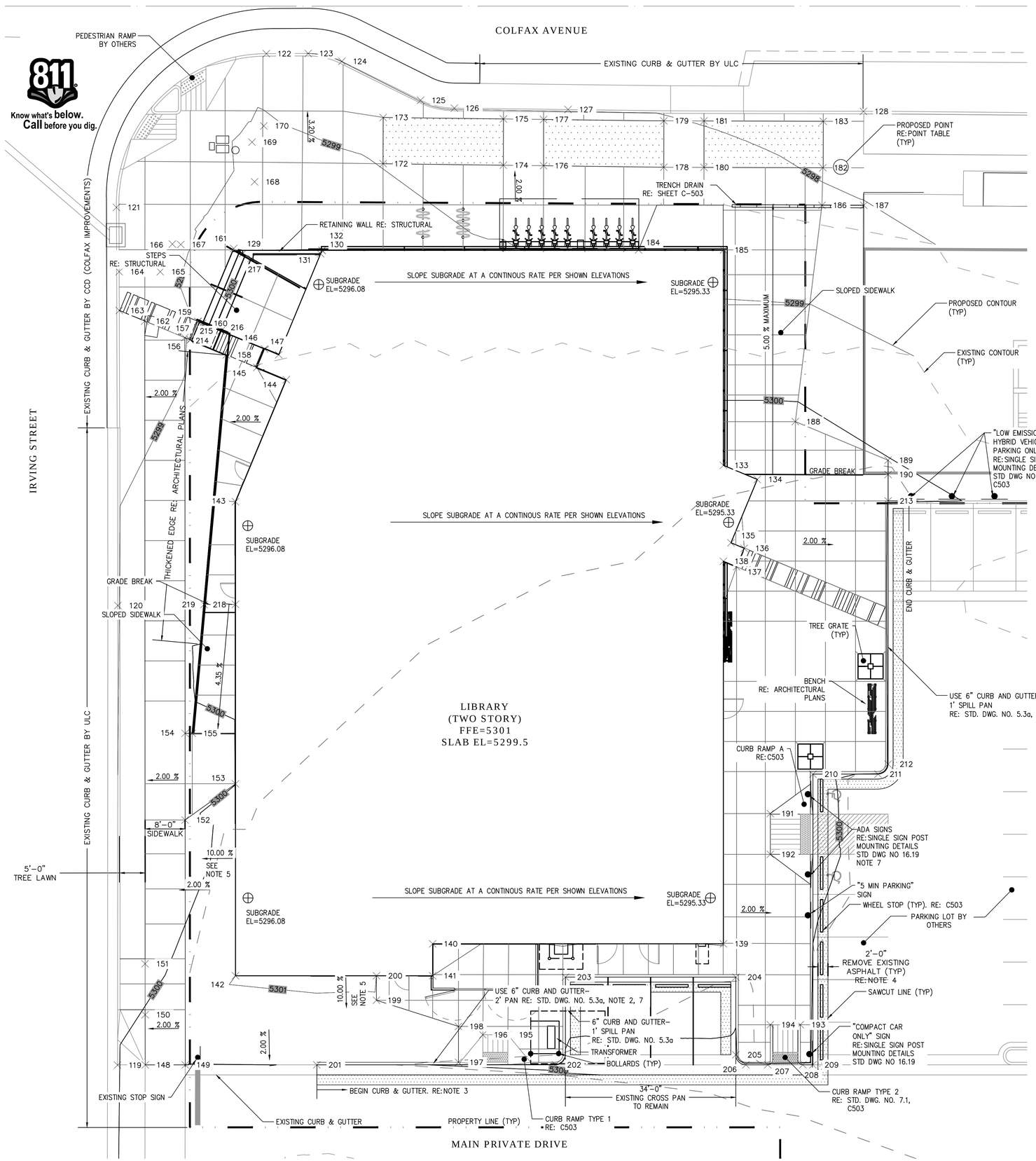

LEGEND

- SIDEWALKS
- SAWCUT/ASPHALT REMOVAL
- PAVING REMOVAL
- PROPERTY LINE
- TREE GRATE

NOTES

1. USE 6" CURB AND GUTTER-1' SPILL PAN AT LOCATIONS ADJACENT TO PARKING AREAS
2. USE 6" CURB AND GUTTER-2' CATCH PAN AT LOCATIONS ADJACENT TO MAIN PRIVATE DRIVE
3. REMOVE EXISTING TEMPORARY CROSS PAN IN AREAS IN CONFLICT WITH THE PROPOSED 6" CURB AND GUTTER BY SAW CUTTING TRANSITION EDGES. REFER TO SHEET C-106 FOR GEOMETRIC CONTROL LAYOUT.
4. CONTRACTOR TO RE-STRIPE DISTURBED AREAS
5. SLOPES AT LANDSCAPED AREAS TO BE 10% FOR THE FIVE FEET ADJACENT TO THE BUILDING THEN TRANSITION TO 2% SLOPE AS RECOMMENDED BY THE GEOTECHNICAL REPORT. REFER TO LANDSCAPE PLANS FOR AFFECTED AREAS.
6. SEE SITE FURNISHINGS PLAN FOR PAVEMENT FINISHING AND SCORING.
7. PLEASE REFER TO THE MOST CURRENT VERSION OF THE "TRANSPORTATION STANDARDS AND DETAILS FOR THE ENGINEERING DIVISION" FOR ANY REFERENCES TO STANDARD DETAILS.

BENCHMARK

DENVER BENCHMARK 77A, CITY AND COUNTY OF DENVER
BRASS CAP AT THE SOUTHEAST CORNER OF COLFAX AVENUE AND IRVING STREET, LOCATED ON THE TOP OF THE CURB INLET.
NAVD 1988 DATUM, ELEV=5298.48

0 10 20
SCALE: 1"=10'-0"

Point Table				
Point #	Elevation	Northing	Easting	Description
219	5300.87	2230.28	2003.71	LANDING
218	5301.00	2230.29	2009.97	LANDING
217	5300.76	2299.30	2013.12	TOP STEP
216	5300.81	2284.83	2007.10	TOP STEP
215	RE:STRUCTURAL	2286.72	2002.49	WALL TOP
214	RE:STRUCTURAL	2283.07	2000.96	WALL TOP
213	5300.29	2250.93	2140.17	FL
212	5299.87	2198.43	2140.17	FL
211	5299.91	2196.43	2138.17	FL
210	5300.17	2196.43	2125.17	FL
209	5299.58	2138.43	2125.17	FL
208	5299.62	2138.43	2123.17	FL
207	5299.74	2138.43	2116.17	FL
206	5299.61	2138.43	2111.80	FL
205	5299.80	2140.43	2109.80	FL
204	5300.37	2155.93	2109.80	FL
203	5300.37	2155.93	2075.80	FL
202	5299.92	2138.43	2073.80	FL
201	5300.09	2138.43	2026.21	FL
200	5301.00	2156.20	2038.10	SDWLK
199	5300.91	2151.32	2038.10	SDWLK
198	5300.61	2146.10	2054.46	SDWLK
197	5300.48	2138.93	2054.46	SDWLK
196	5300.57	2144.43	2059.33	SDWLK
195	5300.58	2144.43	2064.32	SDWLK
194	5300.38	2146.43	2116.67	SDWLK
193	5300.25	2146.43	2122.67	SDWLK
192	5300.82	2180.42	2116.67	SDWLK
191	5300.82	2188.57	2116.67	SDWLK
190	5300.39	2256.20	2140.17	SDWLK
189	5300.35	2259.06	2140.17	SDWLK
188	5300.21	2266.75	2121.67	SDWLK
187	5297.95	2309.90	2135.33	SDWLK
186	5298.09	2309.91	2126.98	SDWLK
185	5298.78	2301.00	2107.34	SDWLK
184	5298.72	2301.01	2090.38	SDWLK
183	5297.74	2326.67	2127.24	SDWLK
182	5297.94	2317.40	2127.16	SDWLK
181	5297.97	2326.74	2103.44	SDWLK
180	5298.23	2317.47	2103.44	SDWLK
179	5298.04	2326.76	2095.44	SDWLK
178	5298.32	2317.49	2095.42	SDWLK
177	5298.24	2327.03	2071.44	SDWLK
176	5298.61	2317.80	2071.44	SDWLK
175	5298.28	2327.13	2063.45	SDWLK
174	5298.70	2317.90	2063.42	SDWLK
173	5298.61	2327.43	2039.45	SDWLK
172	5298.70	2318.20	2039.42	SDWLK
170	5299.10	2325.74	2015.63	MATCH EX
169	5299.26	2322.51	2013.27	MATCH EX

Point Table				
Point #	Elevation	Northing	Easting	Description
168	5299.26	2314.59	2013.79	MATCH EX
167	5298.93	2302.09	1999.06	MATCH EX
166	5298.91	2302.18	1997.40	MATCH EX
165	5298.84	2296.65	1994.97	MATCH EX
164	5298.62	2296.65	1986.78	MATCH EX
163	5298.66	2288.92	1986.80	SDWLK
162	5298.77	2286.81	1991.88	SDWLK
161	5299.28	2301.30	2009.62	SDWLK
160	5299.07	2286.35	2003.41	SDWLK
159	5299.05	2286.74	2002.48	SDWLK
158	5300.85	2280.07	2008.15	RAMP
157	5298.98	2283.07	2000.95	SDWLK
156	5298.95	2283.51	1999.88	SDWLK
155	5299.71	2204.57	2001.36	SDWLK
154	5299.68	2204.57	1999.92	SDWLK
153	5299.97	2194.48	2009.98	SDWLK
152	5299.83	2187.28	1999.93	SDWLK
151	5299.90	2158.59	1991.95	SDWLK
150	5300.02	2148.43	1991.96	SDWLK
149	5300.31	2138.43	1999.96	SDWLK
148	5300.21	2138.42	1991.98	SDWLK
147	5301.00	2280.09	2018.60	BUILDING
146	5301.00	2281.26	2015.77	BUILDING
145	5301.00	2277.55	2014.23	BUILDING
144	5301.00	2275.10	2020.11	BUILDING
143	5301.00	2250.77	2009.98	BUILDING
142	5301.00	2156.20	2009.98	BUILDING
141	5301.00	2156.20	2049.31	BUILDING
140	5301.00	2162.58	2049.31	BUILDING
139	5301.00	2162.58	2107.31	BUILDING
138	5301.00	2238.90	2107.31	BUILDING
137	5301.00	2237.80	2109.94	BUILDING
136	5301.00	2241.48	2111.47	BUILDING
135	5301.00	2242.58	2108.83	BUILDING
134	5301.00	2255.23	2114.08	BUILDING
133	5300.93	2258.03	2107.31	SDWLK
132	5299.47	2300.91	2027.25	SDWLK
131	RE:STRUCTURAL	2300.25	2026.97	WALL TOP
130	RE:STRUCTURAL	2300.91	2027.25	WALL TOP
129	RE:STRUCTURAL	2300.28	2011.42	WALL TOP
128	5297.13	2328.64	2135.25	EX. FL
127	5297.64	2329.01	2076.33	EX. FL
126	5297.74	2329.29	2053.64	EX. FL
125	5297.77	2330.85	2046.91	EX. FL
124	5297.91	2338.63	2031.21	EX. FL
123	5298.00	2340.20	2024.49	EX. FL
122	5298.12	2340.16	2016.14	EX. FL
121	5298.10	2309.50	1986.23	EX. FL
120	5298.70	2230.07	1986.51	EX. FL
119	5299.55	2138.37	1986.45	EX. FL

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COLORADO LICENSED EDWARD H. SAWYER 38527 REGISTERED PROFESSIONAL ENGINEER

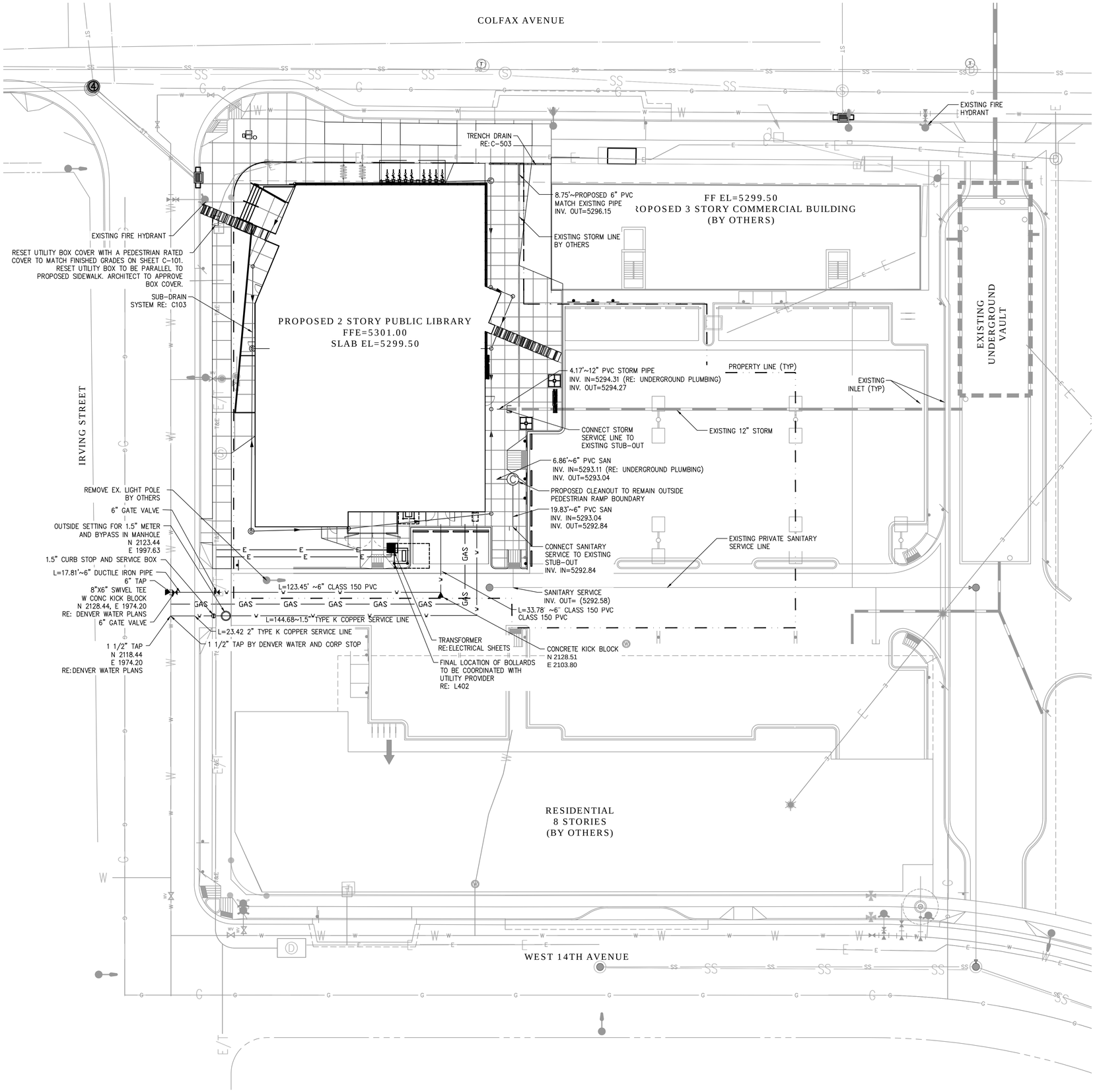
eDC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02089

ISSUE DATE 1/12/2012
PHASE 100% CD

San Engineering LLC
Civil and Structural Engineering

GRADING PLAN

C-101



LEGEND

- SIDEWALKS
- PROPOSED SANITARY
- E — PROPOSED ELECTRIC
- GAS — PROPOSED GAS
- W — PROPOSED WATER
- EXISTING STORM
- SS — EXISTING SANITARY
- PROPERTY LINE
- EXISTING INLET
- Ⓒ CLEANOUT

NOTES

1. REFER TO SHEET AS001 FOR SCOPE OF WORK.
2. CONTRACTOR TO VERIFY LOCATION OF UTILITIES PRIOR TO CONSTRUCTION.
3. REFER TO DENVER WATER PLANS FOR WATER INFORMATION.
4. REPAIR STREET AS REQUIRED AS PART OF THE INSTALLATION OF WATER IMPROVEMENTS.

DENVER WATER STANDARD DETAILS REFERENCE

TRENCH DETAIL	SHEET 11
CONCRETE KICKBLOCKS BEARING SURFACES & INSTALLATION	SHEET 26
CONCRETE KICKBLOCKS	SHEET 27
LENGTH OF RESTRAINED PIPE DETAIL	SHEET 28
MECHANICAL JOINT RESTRAINED DETAILS	SHEET 34
3" AND LARGER DOMESTIC AND FIRELINE CONNECTIONS	SHEET 51
GENERAL METER NOTES	SHEET 53
SERVICE LINE, STOP BOX AND OUTSIDE METER INSTALLATION	SHEET 54
O. S. FOR 2" METER WITH CHECK VALVE AND BYPASS IN MANHOLE	SHEET 60

FIRE FLOW DATA

TOTAL FIRE FLOW REQUIRED FOR THIS SITE IS 1750 GPM MINIMUM @ 20 PSI RESIDUAL PRESSURE
THIS FLOW MUST BE PROVIDED FROM A MINIMUM OF 1 FIRE HYDRANTS. INDIVIDUALLY, EACH FIRE HYDRANT MUST SUPPLY 1500 GPM MINIMUM @ 20 PSI RESIDUAL PRESSURE.

CODE USED FOR ANALYSIS: 2006 IFC WITH 2008 AMENDMENTS
OCCUPANCY GROUP: A3
CONSTRUCTION TYPE: 2B
FIRE FLOW CALCULATION AREA: 28,000 SF
THIS BUILDING IS FULLY SPRINKLERED

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ISSUE DATE 01/12/2012
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0 20 40
SCALE: 1"=20'-0"

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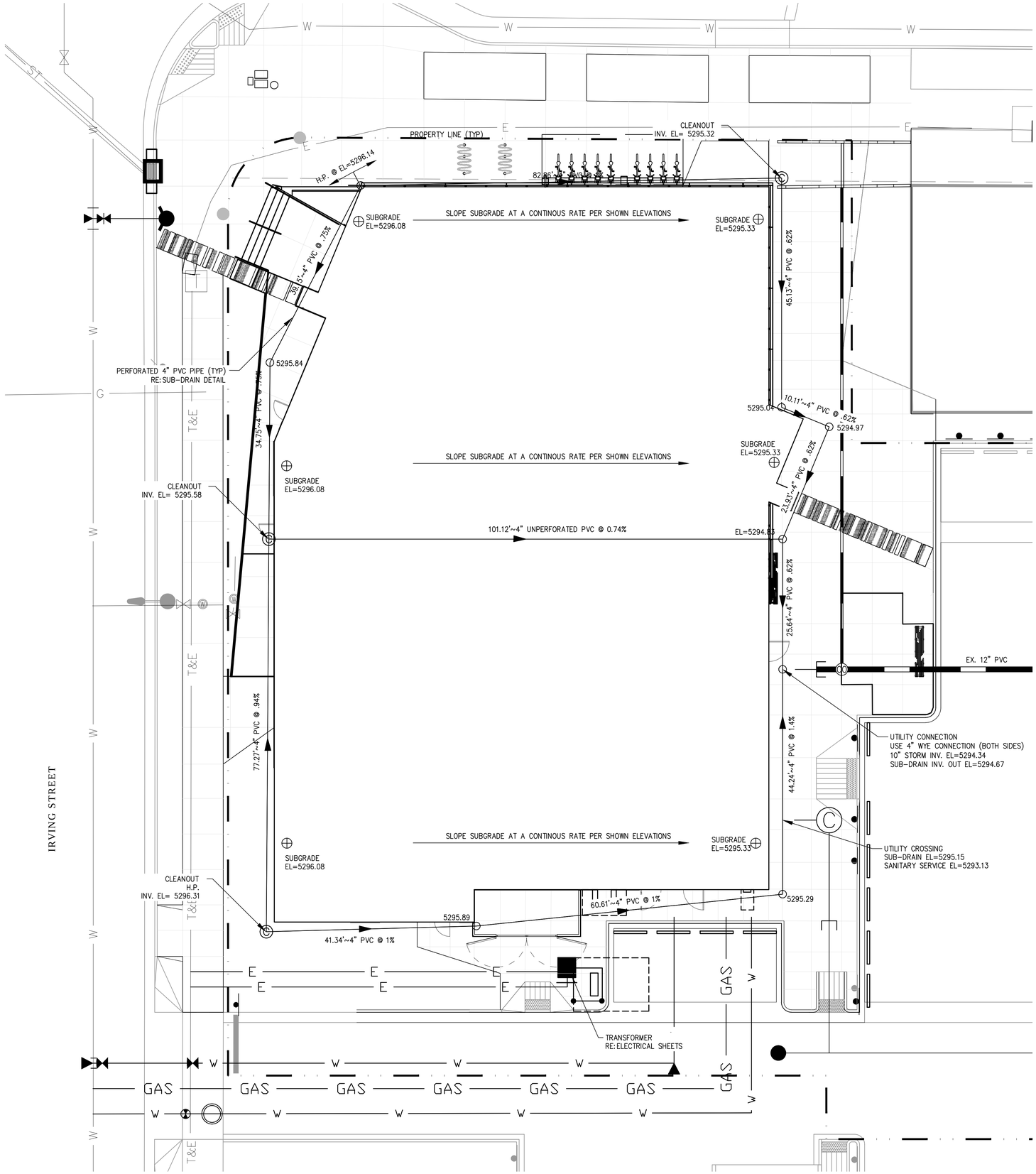
OVERALL
UTILITY PLAN

C-102



LEGEND

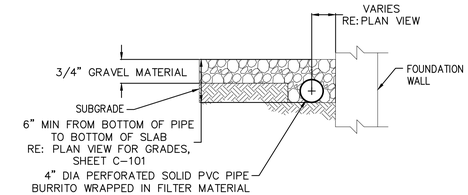
SIDEWALKS

4" PVC PERFORATED PIPE WITH DIRECTION OF FLOW ARROW.

H.P. HIGH POINT

NOTES

1. ALL ELEVATIONS SHOWN INDICATE BOTTOM OF PIPE UNLESS OTHERWISE SPECIFIED.
2. IF UTILITY CONFLICTS ARISE, CONTRACTOR IS TO COORDINATE AND RESOLVE THEM WITH THE OWNER'S REPRESENTATIVE.
3. FREE-DRAINING 3/4" GRAVEL TO BE USED AS BEDDING MATERIAL.
4. TRENCHES SHALL BE CUT INTO THE SUBGRADE IN THE GENERAL ALIGNMENT AS SHOWN ON THE PLAN VIEW.



NOTES:
1. PERFORATION SPECIFICATIONS:
   1. 2 ROWS OF PERFORATION
   2. 5/8" HOLE SIZE
   3. 5" HOLE SPACING PER ROW
2. REFER TO PLAN VIEW FOR HORIZONTAL AND VERTICAL ALIGNMENT

SUB-DRAIN DETAIL

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SUB-DRAIN SYSTEM

C-103

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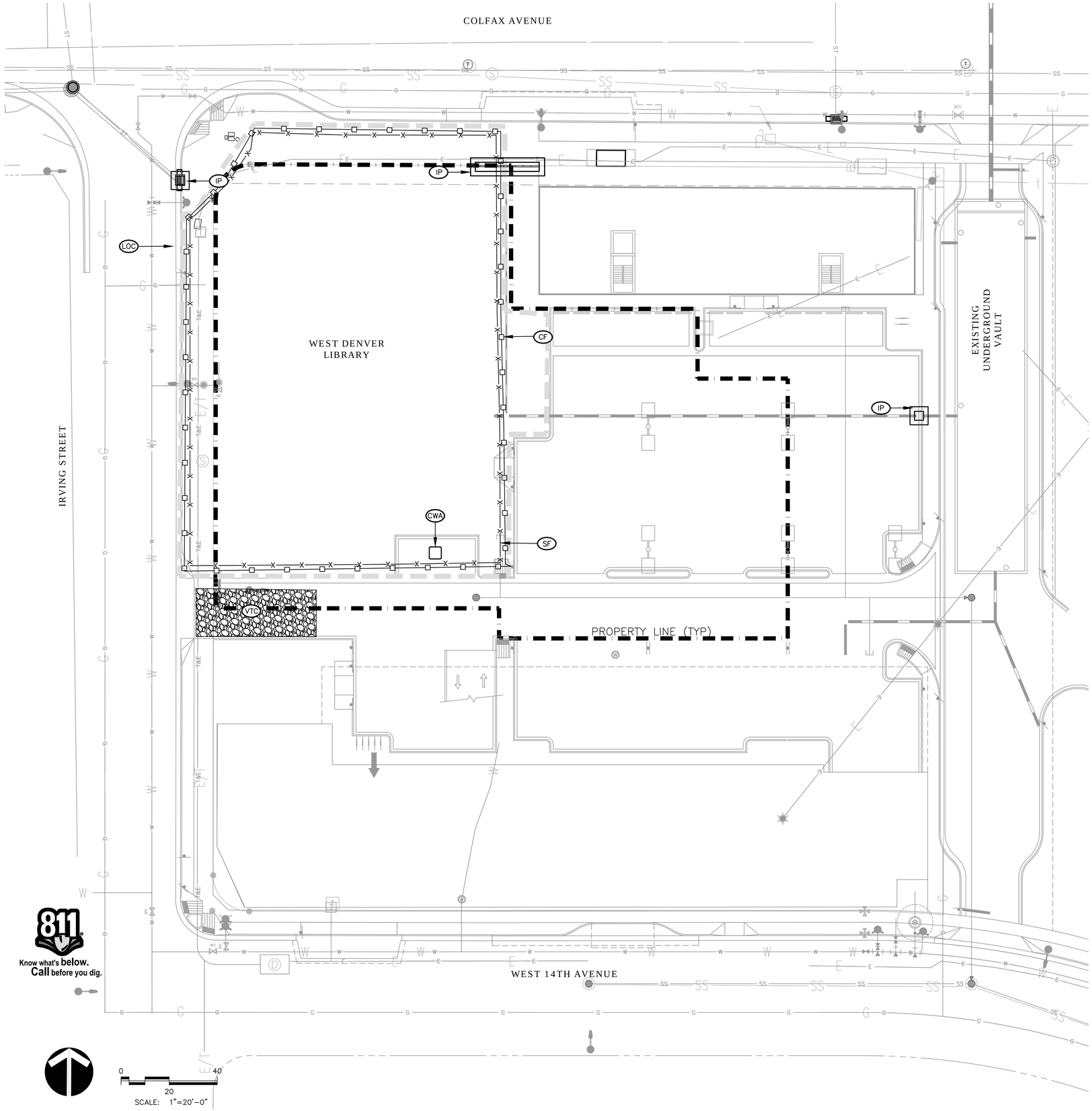

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LEGEND

- CWA — CONCRETE WASHOUT AREA
- CF — CHAIN LINK FENCE
- IP — INLET PROTECTION
- SF — SILT FENCE
- VTC — VEHICLE TRACKING CONTROL
- LOC — LIMITS OF CONSTRUCTION

NOTES

1. THE EROSION CONTROL PLANS HAVE BEEN DESIGNED BASED ON THE CITY AND COUNTY OF DENVER CONSTRUCTION ACTIVITIES STORMWATER MANUAL (WASTEWATER MANAGEMENT DIVISION, DEPARTMENT OF PUBLIC WORKS, REVISED JUNE 2010)

2. GENERAL CONTRACTOR TO LOCATE STAGING WITHIN PROPERTY LINE

STANDARD NOTES

STANDARD NOTE # 1
The Permittee and/or Contractor shall remove all sediment, mud, construction debris, or other potential pollutants that may have been discharged to or, accumulate in, the flowlines, storm drainage appurtenances, and public rights of ways of the City and County of Denver as a result of construction activities associated with this site development or construction project. Said removal shall be conducted in a timely manner."

STANDARD NOTE #2
"The Contractor shall prevent sediment, debris and all other pollutants from entering the storm sewer system during all demolition, excavation, trenching, boring, grading, or other construction operations that are part of this project. The Contractor shall be held responsible for remediation of any adverse impacts to the Municipal Separate Storm Sewer System, receiving waters, waterways, wetlands, and or other public or private properties, resulting from work done as part of this project."

STANDARD NOTE # 3
"Soil stabilization measures shall be implemented within fourteen (14) days following completion of grading activities. Stabilization of disturbed areas adjacent to receiving waters or with slopes 3 to 1 or greater shall be completed within seven (7) days following completion of grading activities. Note: Federal and State regulations may soon require stabilization within seven (7) days of completion of grading activities. In such cases, the shorter timeframe shall apply to projects within Denver as well."

STANDARD NOTE #4
"The Developer, General Contractor, Grading Contractor and/or their authorized agents shall insure that all loads of cut and fill material imported to or exported from this site shall be properly covered to prevent loss of the material during transport on public rights of way."
(Sec.49-552; Revised Municipal Code)

STANDARD NOTE #5
"The use of rebar to anchor best management practices is prohibited." Steel fence posts may be used on a case by case basis and requires approval from the City and County of Denver SWMP reviewer or the stormwater enforcement investigator prior to installation."

STANDARD NOTE #6
"Soils that will be stockpiled for more than thirty (30) days shall be protected from wind and water erosion within fourteen (14) days of stockpile construction. Stabilization of stockpiles located within 100 feet of receiving waters, or with slopes 3 to 1 or greater shall be completed within seven (7) days following stockpile construction. Stabilization and protection of the stockpile may be accomplished by any of the following: Mulching, Temporary/Permanent Revegetation Operations, Chemical Soil Stabilizer Application (requires Denver Public Works approval), or erosion control matting/Geotextiles. If stockpiles are located within 100 feet of receiving waters, a drainageway or the site perimeter, additional sediment controls such shall be required."

STANDARD NOTE # 7
"Approved erosion and sediment control 'Best Management Practices' shall be maintained and kept in good repair for the duration of this project. At a minimum, the Permittee or contractor shall produce and retain weekly written inspection records for all BMPs and after significant precipitation events. All necessary maintenance and repair shall be completed immediately. Additionally, street sweeping is to be completed by the close of the business day or (and) on an as needed basis throughout the day.

STANDARD NOTE # 8
"Water used in the cleaning of cement truck delivery chutes shall be discharged into a predefined, concrete washout area on the job site. Bermed containment or commercially available concrete washout devices that fully contain all wash water are acceptable. Wash water discharged into the containment area or device shall be allowed to infiltrate, evaporate, and or be disposed of in accordance with all applicable regulations. Dried cement waste is to be removed from the containment area and properly disposed.
Should the use of a predefined bermed containment area or approved washout device be technically infeasible due to the project size, or lack of an area with a suitable ground surface for establishing containment, proper disposal of concrete washout and wash water at the job site shall conform to the approved techniques and practices identified in the Colorado Department of Public Health & Environment's training video entitled 'Building For a Cleaner Environment, Ready Mix Washout Training' and its accompanying manual entitled, 'Ready Mix Washout Guidebook, Vehicle and Equipment Washout at Construction Sites.'
The direct or indirect discharge of water containing waste cement to the storm sewer system is prohibited." (Sec.56- 102a, c; Revised Municipal Code, City and County of Denver)

STANDARD NOTE #9
"The Contractor shall protect all storm sewer facilities adjacent to any location where pavement cutting operations involving wheel cutting, saw cutting, or abrasive water jet cutting are to take place.
The Contractor shall remove and properly dispose of all waste products generated by said cutting operations on a daily basis or as needed throughout the work day."
The discharge of any water contaminated by waste products from cutting operations to the storm sewer system is prohibited." (Sec.56-102a, c; Revised Municipal Code, City and County of Denver)

STANDARD NOTE #10
"Paved and impervious surfaces which are adjacent to construction sites must be swept on a daily basis and as needed during the day when sediment and other materials are tracked or discharged onto them. Either sweeping by hand or use of Street Sweepers is acceptable. Street sweepers using water while sweeping is preferred in order to minimize dust. Flushing off paved surfaces with water is prohibited." (Sec.56-102a, c; Revised Municipal Code, City and County of Denver)

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CASMP SITE IMPROVEMENT PLAN

C-104

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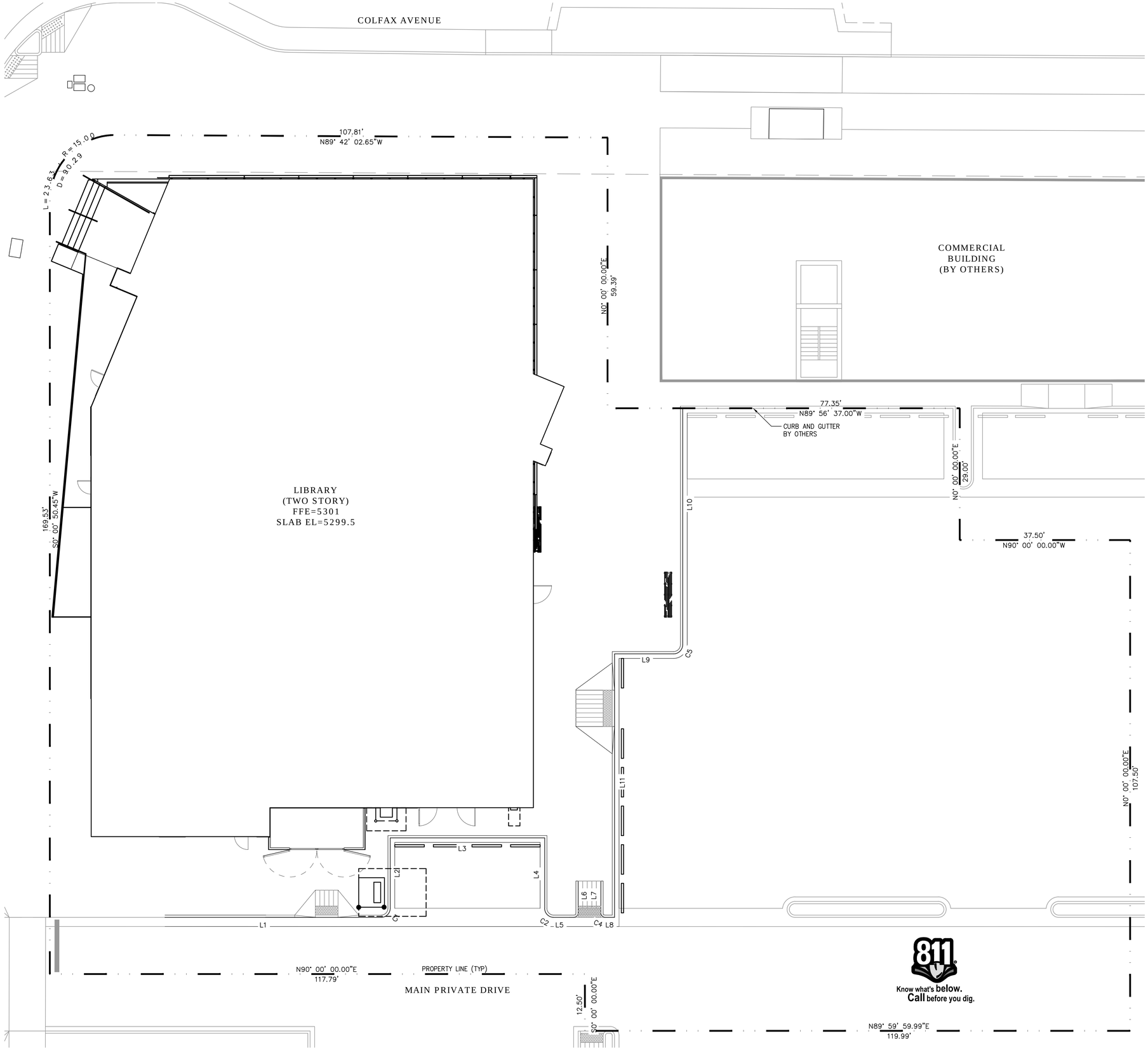

LEGEND

PROPERTY LINE

NOTES

1. REFER TO SHEET C101 FOR BUILDING FOOTPRINT DIMENSIONS.

BENCHMARK

DENVER BENCHMARK 77A, CITY AND COUNTY OF DENVER BRASS CAP AT THE SOUTHEAST CORNER OF COLFAX AVENUE AND IRVING STREET, LOCATED ON THE TOP OF THE CURB INLET.
NAVD 1988 DATUM, ELEV=5298.48

BASIS OF BEARING

BEARINGS ARE BASED ON THE SOUTH LINE OF BLOCK 'A', NEW AVONDALE, MONUMENTED AT THE WEST END BY A NUMBER 4 REBAR WITH NO CAP AND AT THE EAST END BY A CHISELED "X" IN THE SIDEWALK, AND BEARING SOUTH 90°00'00" WEST AND MEASURING 255.62 FEET.

FLOWLINE

PARCEL LINE DATA

SEGMENT	LENGTH	DIRECTION
L1	47.59	N90° 00' 00"W
L2	15.50	S0° 00' 00"E
L3	34.00	N90° 00' 00"E
L4	15.50	S0° 00' 00"E
L5	4.37	N90° 00' 00"W
L6	7.00	N0° 00' 00"E
L7	7.00	S0° 00' 00"E
L8	2.00	N90° 00' 00"W
L9	13.00	N90° 00' 00"E
L10	52.00	N0° 00' 00"E
L11	57.99	N0° 00' 01"W

FLOWLINE

PARCEL CURVE DATA

SEGMENT	LENGTH	RADIUS	DELTA
C1	3.14	2.00	90.00
C2	3.14	2.00	90.00
C3	1.57	1.00	90.00
C4	1.57	1.00	90.00
C5	3.14	2.00	90.00

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SCALE: 1"=10'-0"

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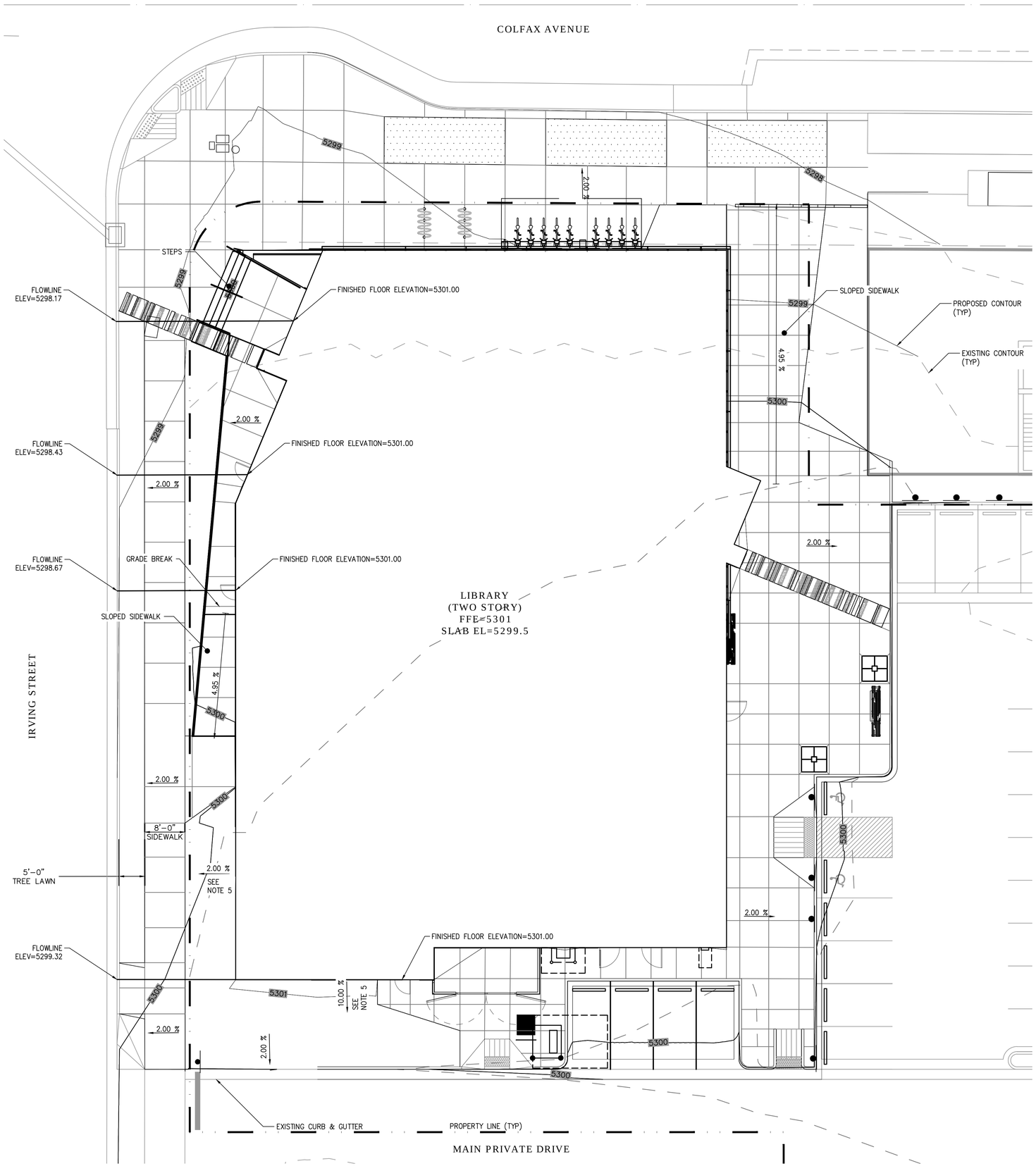
GEOMETRIC CONTROL LAYOUT

C-105



LEGEND

SIDEWALKS

PROPERTY LINE

BENCHMARK

DENVER BENCHMARK 77A, CITY AND COUNTY OF DENVER BRASS CAP AT THE SOUTHEAST CORNER OF COLFAX AVENUE AND IRVING STREET, LOCATED ON THE TOP OF THE CURB INLET.
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COLFAX AVENUE

EXISTING CURB AND GUTTER TO REMAIN

COLFAX IMPROVEMENTS TO REMAIN

EXISTING PLANTING TO REMAIN AMENDED PER LANDSCAPE DRAWINGS

EXISTING PLANTING TO REMAIN AMENDED PER LANDSCAPE DRAWINGS

TRAFFIC STRUCTURES TO REMAIN

REMOVE EXISTING SIDEWALK RE:NOTE 2

REMOVE EXISTING ASPHALT

UTILITY BOX TO REMAIN RE:C102

IRVING STREET

CURB AND GUTTER TO REMAIN

EXISTING WATER METER AND MANHOLE(S) TO BE REMOVED AS PART OF MILE HIGH VISTA SITE DEVELOPMENT. NOT IN WEST DENVER BRANCH LIBRARY CONTRACT.

GRAVEL FOUND THROUGHOUT ENTIRE SITE RE: NOTE 4

PROPERTY LINE (TYP)

EXISTING LIGHT POLE TO BE REMOVED AS PART AS PART OF MILE HIGH VISTA SITE DEVELOPMENT. NOT IN WEST DENVER BRANCH LIBRARY CONTRACT.

REMOVE EXISTING ASPHALT

PROPERTY LINE (TYP)

FUTURE MAIN PRIVATE DRIVE

LEGEND

- CONCRETE REMOVALS
- ASPHALT REMOVAL
- PROPERTY LINE

NOTES

1. CONTRACTOR TO OBTAIN ALL REQUIRED PERMITS PRIOR TO DEMOLITION.
2. REMOVE SIDEWALK PORTIONS BY SAW CUTTING IN A STRAIGHT LINE. SET SAW CUT LINES AT CONCRETE JOINTS ONLY.
3. ALL CURB AND GUTTERS AND PEDESTRIAN RAMPS ARE TO REMAIN AND BE PROTECTED.
4. ON-SITE GRAVEL IS TO BE REMOVED IN AREAS WHERE THE PROPOSED CONCRETE FLAT WORK AND LANDSCAPING IS TO BE LOCATED.
5. REMOVE FUTURE CONCRETE PAN SHOWN ON SHEET C-101 AS NECESSARY TO POUR NEW CURB AND GUTTER.

0 10 20

SCALE: 1"=10'-0"

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ISSUE DATE
01/12/2012

PHASE
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DEMOLITION PLAN

C-107

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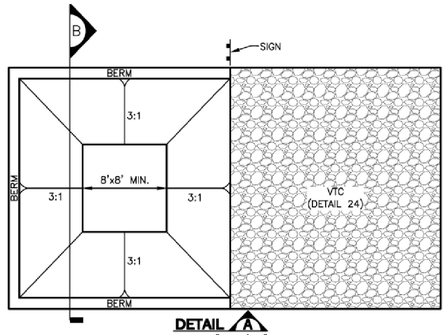
BMP LEGEND

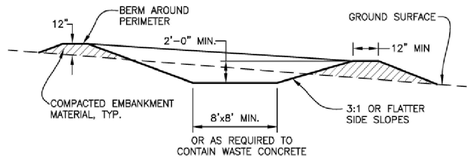
CD	CHECK DAM
CB	COMPOST BLANKET
CFB	COMPOST FILTER BERM
CWA	CONCRETE WASHOUT AREA
CF	CONSTRUCTION FENCE
CM	CONSTRUCTION MARKERS
DW	DEWATERING
DD	DIVERSION DITCH
ECB	EROSION CONTROL BLANKET
IP	INLET PROTECTION
RCD	REINFORCED CHECK DAM
RRB	REINFORCED ROCK BERM
RRC	RRB FOR CULVERT PROTECTION
SB	SEDIMENT BASIN
SCL	SEDIMENT CONTROL LOG
ST	SEDIMENT TRAP
SM	SEEDING AND MULCHING
SF	SILT FENCE
SSA	STABILIZED STAGING AREA
SR	SURFACE ROUGHENING
TSD	TEMPORARY SLOPE DRAIN
TSC	TEMPORARY STREAM CROSSING
TER	TERRACING
VTC	VEHICLE TRACKING CONTROL
WW	VTC WITH WHEEL WASH

ROCK AND RIPRAP GRADATIONS

LOC	LIMITS OF CONSTRUCTION



DETAIL A
SCALE: 1" = 5'-0"



SECTION B
SCALE: 1" = 5'-0"

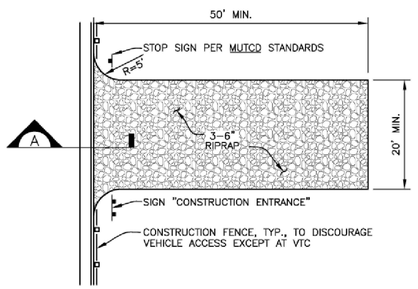
CONCRETE WASHOUT AREA INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   – LOCATIONS OF CONCRETE WASHOUT AREA.
2. THE CONCRETE WASHOUT AREA SHALL BE INSTALLED PRIOR TO ANY CONCRETE PLACEMENT ON SITE.
3. VEHICLE TRACKING CONTROL (DETAIL 24) IS REQUIRED AT THE ACCESS POINT.
4. SIGNS SHALL BE PLACED AT THE CONSTRUCTION ENTRANCE, AT THE WASHOUT AREA, AND ELSEWHERE AS NECESSARY TO CLEARLY INDICATE THE LOCATION OF THE CONCRETE WASHOUT AREA TO OPERATORS OF CONCRETE TRUCKS AND PUMP RIGS.
5. EXCAVATED MATERIAL SHALL BE UTILIZED IN PERIMETER BERM CONSTRUCTION.

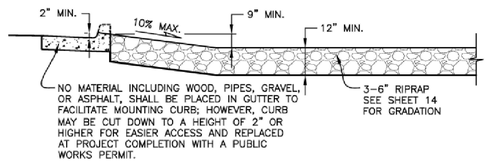
CONCRETE WASHOUT AREA MAINTENANCE NOTES

1. THE CONCRETE WASHOUT AREA SHALL BE REPAIRED AND ENLARGED OR CLEANED OUT AS NECESSARY TO MAINTAIN CAPACITY FOR WASTED CONCRETE.
2. AT THE END OF CONSTRUCTION, ALL CONCRETE SHALL BE REMOVED FROM THE SITE AND DISPOSED OF AT AN APPROVED WASTE SITE.
3. WHEN THE CONCRETE WASHOUT AREA IS REMOVED, THE DISTURBED AREA SHALL BE DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE TOWN.
4. INSPECT WEEKLY, DURING AND AFTER ANY STORM EVENT.

CWA CONCRETE WASHOUT AREA



PLAN
SCALE: 1" = 10'-0"



SECTION A
SCALE: 1/2" = 1'-0"

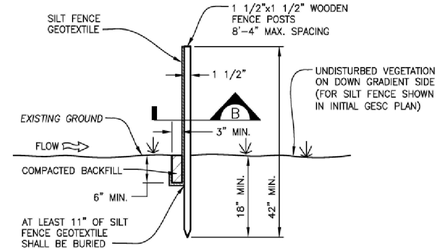
VEHICLE TRACKING CONTROL INSTALLATION NOTES

1. VEHICLE TRACKING CONTROL PADS SHALL BE INSTALLED AT EVERY ACCESS POINT TO SITE.
2. VEHICLE TRACKING CONTROL PADS SHALL CONSIST OF HARD, DENSE, DURABLE STONE, ANGULAR IN SHAPE AND RESISTANT TO WEATHERING. ROUNDED STONE OR BOULDERS WILL NOT BE ACCEPTABLE. THE STONES SHALL BE 3" WITH A MAXIMUM SIZE OF 6". THE STONE SHALL HAVE A SPECIFIC GRAVITY OF AT LEAST 2.6. CONTROL OF GRADATION WILL BE BY VISUAL INSPECTIONS.
3. ANY CRACKED OR DAMAGED CURB AND GUTTER AND SIDEWALK SHALL BE REPLACED BY PERMITTEE.
4. ALL ACCESS POINTS TO THE SITE SHALL BE APPROVED AS PART OF THE GESC PERMIT AND BE SHOWN ON THE GESC PLANS.
5. A STOP SIGN INSTALLED IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD), AS AMENDED, SHALL BE INSTALLED FOR EXITING TRAFFIC AT THE VTC.

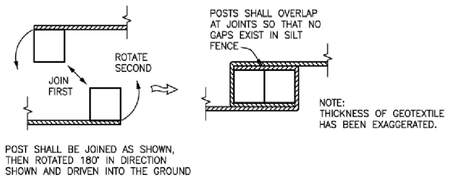
VEHICLE TRACKING CONTROL MAINTENANCE NOTES

1. GESC MANAGER SHALL INSPECT VEHICLE TRACKING CONTROL DAILY. GRAVEL SURFACE SHALL BE CLEAN AND LOOSE ENOUGH TO RUT SLIGHTLY UNDER WHEEL LOADS AND CAUSE LOOSE GRAVEL TO DISLODGE MUD FROM TIRES. WHEN GRAVEL BECOMES COMPACTED OR FILLED WITH SEDIMENT SO THAT THE EFFECTIVENESS OF THE PAD IS DIMINISHED, CONTRACTOR SHALL RIP, TURN OVER, OR OTHERWISE LOOSEN GRAVEL, PLACE ADDITIONAL NEW GRAVEL, OR REPLACE WITH NEW GRAVEL AS NECESSARY TO RESTORE EFFECTIVENESS.
2. VEHICLE TRACKING CONTROL SHALL BE REMOVED AT THE END OF CONSTRUCTION, THE GRAVEL MATERIAL REMOVED OR, IF APPROVED BY THE TOWN, USED ON SITE, AND THE AREA TOPSOILED, DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED.

VTC VEHICLE TRACKING CONTROL



DETAIL A
SCALE: 1" = 1'-0"



JOINTS - SECTION B
SCALE: N.T.S.

SILT FENCE INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   – LOCATION AND LENGTH OF FENCE.
2. ANCHOR TRENCH SHALL BE EXCAVATED WITH TRENCHER, OR WITH SILT FENCE INSTALLATION MACHINE; NO ROAD GRADERS, BACKHOES, ETC. SHALL BE USED. TRENCH SHALL BE COMPACTED BY HAND, WITH "JUMPING JACK", OR BY WHEEL ROLLING. COMPACTION SHALL BE SUCH THAT SILT FENCE RESISTS BEING PULLED OUT OF ANCHOR TRENCH BY HAND.
3. SILT FENCE GEOTEXTILE SHALL MEET THE FOLLOWING REQUIREMENTS:
   – 6–TO 12–GALLONS PER MINUTE PER SQUARE FOOT FLOW CAPACITY.
   – 90 LB. TENSILE STRENGTH PER ASTM D4622.
   – UV DESIGN AT 500 HRS MIN. 70% STRENGTH RETAINED PER ASTM D 4355.
4. SILT FENCE INDICATED ON INITIAL GESC PLAN SHALL BE INSTALLED PRIOR TO ANY LAND–DISTURBING ACTIVITIES.

SILT FENCE MAINTENANCE NOTES

1. THE GESC MANAGER SHALL INSPECT SILT FENCE DAILY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF SILT FENCE SHALL BE REMOVED WHEN THE UPSTREAM SEDIMENT REACHES A DEPTH OF 6–INCHES.
3. SILT FENCE SHALL BE REMOVED WHEN THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER IS APPROVED BY THE TOWN. IF ANY DISTURBED AREA EXISTS AFTER REMOVAL, IT SHALL BE SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE TOWN.

SF SILT FENCE

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CASMP DETAILS

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BMP LEGEND

CD	CHECK DAM
CB	COMPOST BLANKET
CFB	COMPOST FILTER BERM
CWA	CONCRETE WASHOUT AREA
CF	CONSTRUCTION FENCE
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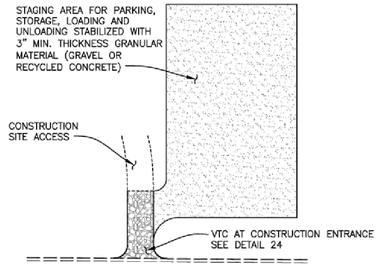
	ROCK AND RIPRAP GRADATIONS
LOC	LIMITS OF CONSTRUCTION



PLAN
SCALE: 1" = 40'-0"

STABILIZED STAGING AREA INSTALLATION NOTES

1. SEE PLAN VIEW FOR GENERAL LOCATION OF STAGING AREA. CONTRACTOR MAY MODIFY LOCATION AND SIZE OF STABILIZED STAGING AREA WITH TOWN APPROVAL.
2. STABILIZED STAGING AREA SHALL BE LARGE ENOUGH TO FULLY CONTAIN PARKING, STORAGE, AND UNLOADING AND LOADING OPERATIONS.
3. IF REQUIRED BY THE TOWN, SITE ACCESS ROADS SHALL BE STABILIZED IN THE SAME MANNER AS THE STAGING AREA.
4. STAGING AREA SHALL BE STABILIZED PRIOR TO ANY OTHER OPERATIONS ON THE SITE.
5. THE STABILIZED STAGING AREA SHALL CONSIST OF A MINIMUM OF 3" OF GRANULAR MATERIAL (GRAVEL OR RECYCLED CONCRETE).

STABILIZED STAGING AREA MAINTENANCE NOTES

1. THE GESC MANAGER SHALL INSPECT THE STABILIZED STAGING AREA WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. GESC MANAGER SHALL PROVIDE ADDITIONAL THICKNESS OF GRANULAR MATERIAL IF ANY RUTTING OCCURS OR UNDERLYING SUBGRADE BECOMES EXPOSED.
3. STABILIZED STAGING AREA SHALL BE ENLARGED IF NECESSARY TO CONTAIN PARKING, STORAGE, AND UNLOADING AND LOADING OPERATIONS.
4. ANY ACCUMULATED DIRT OR MUD SHALL BE REMOVED FROM THE SURFACE OF THE STABILIZED STAGING AREA.
5. THE STABILIZED STAGING AREA SHALL BE REMOVED AT THE END OF CONSTRUCTION. THE GRANULAR MATERIAL SHALL BE REMOVED OR, IF APPROVED BY THE TOWN, USED ON SITE, AND THE AREA TOPSOILED, DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED.

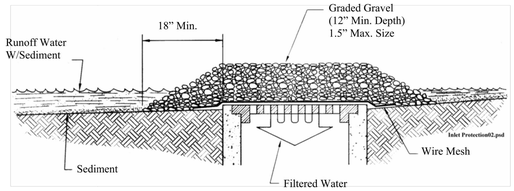
SSA **STABILIZED STAGING AREA**

IP

3. Valley Inlet Protection

Definition: A sediment filter or an excavated impounding area around a storm drain drop inlet or curb inlet.

Purpose: To reduce sediment from entering storm drainage systems prior to permanent stabilization of disturbed areas.



Special Application

This method of inlet protection is applicable where heavy concentrated flows are expected, but not where ponding around the structure might cause excessive inconvenience or damage to adjacent structures and unprotected areas.

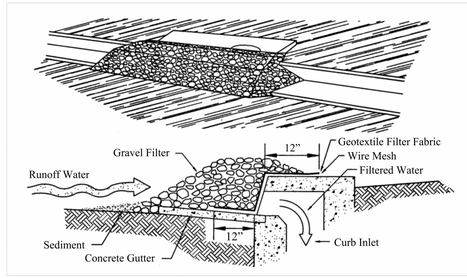
Note: Alternate design could utilize gravel-filled bags.

IP

4. Curb Inlet Protection

Definition: A sediment filter or an excavated impounding area around a storm drain or curb inlet.

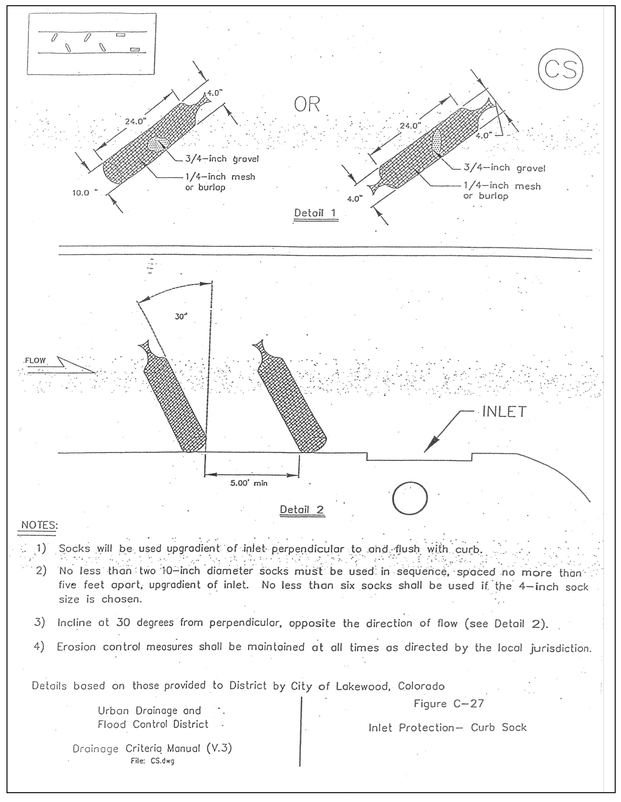
Purposes: To reduce sediment from entering storm drainage systems prior to permanent stabilization of disturbed area.



Special Application

This method of inlet protection is applicable at curb inlets where ponding in front of the structure is not likely to cause inconvenience or damage to adjacent structures and unprotected areas..

Note: Alternate design could utilize gravel filled bags.



NOTES:

1) Socks will be used upgradient of inlet perpendicular to and flush with curb.
2) No less than two 10-inch diameter socks must be used in sequence, spaced no more than five feet apart, upgradient of inlet. No less than six socks shall be used if the 4-inch sock size is chosen.
3) Incline at 30 degrees from perpendicular, opposite the direction of flow (see Detail 2).
4) Erosion control measures shall be maintained at all times as directed by the local jurisdiction.

Details based on those provided to District by City of Lakewood, Colorado

Urban Drainage and Flood Control District
Drainage Criteria Manual (V.3)
File: CS.dwg

Figure C-27
Inlet Protection- Curb Sock

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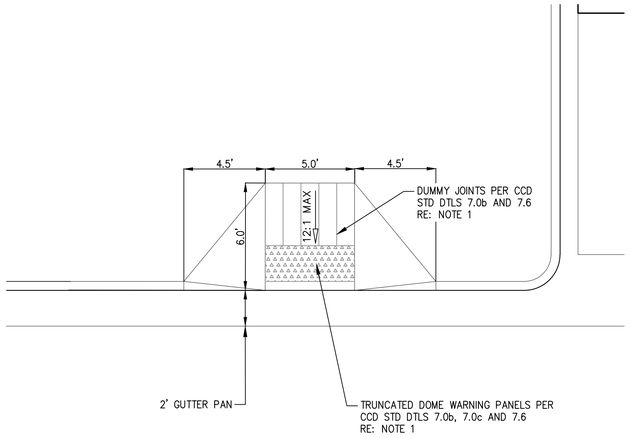
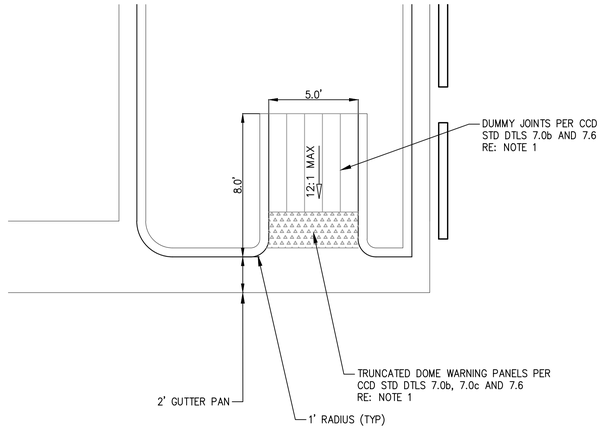


REFER TO CITY AND COUNTY OF DENVER STANDARD DETAILS 7.0a, 7.0b, 7.0c, 7.1 AND 7.6 FOR MORE INFORMATION.

CURB RAMP TYPE 1

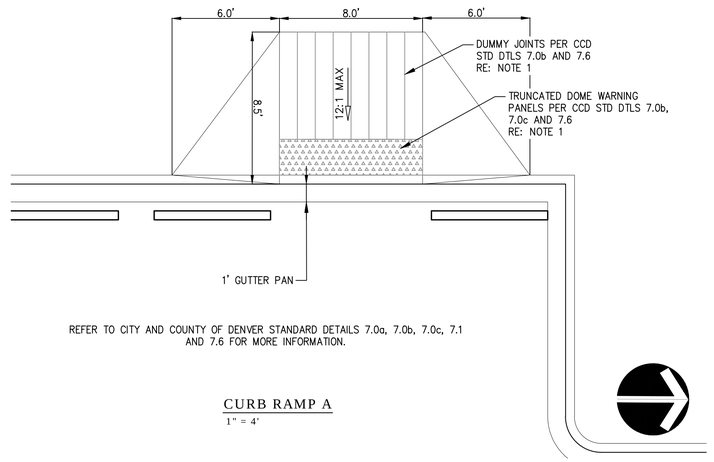
1" = 4'



REFER TO CITY AND COUNTY OF DENVER STANDARD DETAILS 7.0a, 7.0b, 7.0c, 7.1 AND 7.6 FOR MORE INFORMATION.

CURB RAMP TYPE 2

1" = 4'



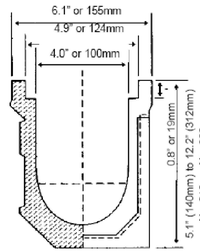
REFER TO CITY AND COUNTY OF DENVER STANDARD DETAILS 7.0a, 7.0b, 7.0c, 7.1 AND 7.6 FOR MORE INFORMATION.

CURB RAMP A

1" = 4'

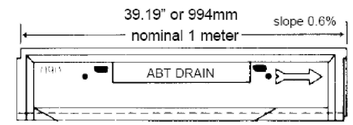
NOTES

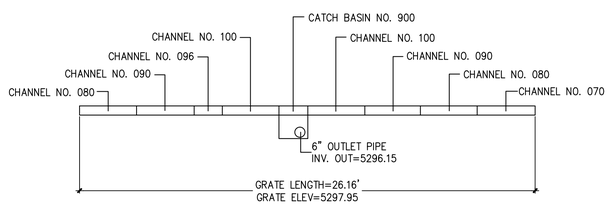
1. PLEASE REFER TO THE MOST CURRENT VERSION OF THE "TRANSPORTATION STANDARDS AND DETAILS FOR THE ENGINEERING DIVISION" FOR ANY REFERENCES TO STANDARD DETAILS.



Minimum overall depth (No. 010)	5.1 in. (128 mm)
Maximum overall depth (No. 300)	12.2 in. (309 mm)
Inside top width (all channels)	4.0 in. (100 mm)
Maximum cross section flow area	39.9 sq. in. (25,400 mm^2)
Length of slope system	98.1 feet (30 m)
Channel bottom thickness	1.0 in. (nom.) (20 mm)

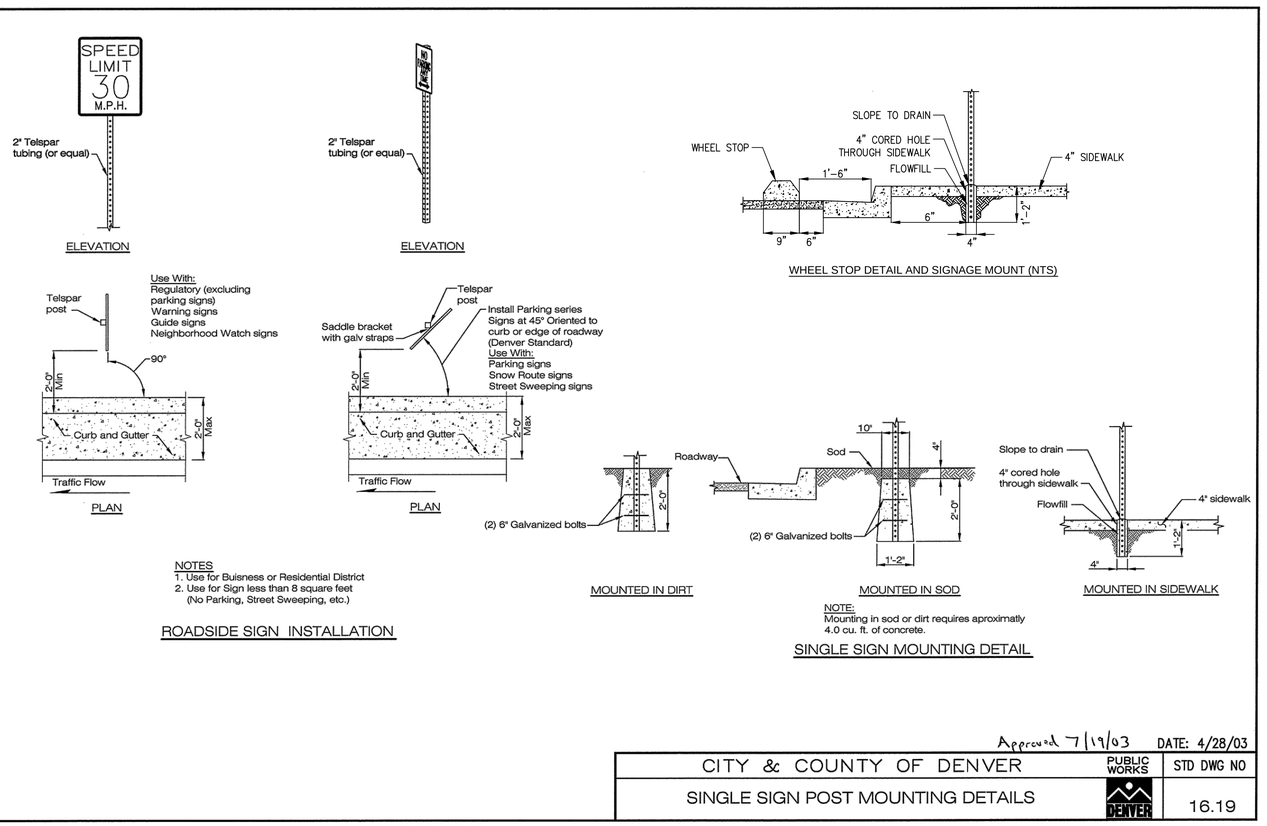
PolyDrain systems can be extended to greater lengths by insertion of any number of non-slope channels (No. 021, 091, 096, 191, and 291) at the appropriate locations, or by the addition of PolyWall sidewall extensions.





NOTE: REFERENCE POLYDRAIN SPECIFICATION FOR MORE DETAILS

TRENCH DRAIN



Approved 7/19/03 DATE: 4/28/03

CITY & COUNTY OF DENVER	PUBLIC WORKS	STD DWG NO
SINGLE SIGN POST MOUNTING DETAILS	DENVER	16.19

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CCOD PROJECT NO: CE 02089

ISSUE DATE	PHASE
1/12/2012	100% CD

SITE DETAILS

C-503

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San Engineering LLC
Civil and Structural Engineering

1. Sub-Slab Vent System

Sub-Slab Vent System shall consist of Enkavent Mat, Gravel Blanket Under Impervious Membrane and Enkavent Mat and Vent Risers.

a. Enkavent Radon & Moisture Control Matting or Equivalent
   i. Enkavent 6128, manufactured by Colbond
      Core Material: Nylon
      Thickness: 0.8 inches
      Width: 18 inches
      Geotextile Fabric constructed of PET
   ii. Enkavent Mat shall be installed as follows:
      - Spacing and location of Enkavent Mat shall be per Sheet 2.
      - Enkavent Mats are used only as vents and must be installed in the horizontal position.
      - Undulations in the Enkavent Mats, which may impede the passage of gas, shall be avoided.
      - Enkavent Mats located around the perimeter of the slab are to be nailed to the foundation at the Enkavent hinge. Adhere expansion joint stripping above the Enkavent matting.
      - Connecting Enkavent Mats must be overlapped a minimum of 12-inches.

b. Gravel Blanket Thickness Under Impervious Membrane and Enkavent Mats:
   i. The thickness of the Gravel Blanket under the Impervious Membrane and Enkavent Mat shall be a minimum of 4 inches in all locations.
   ii. The composition of gravel shall be washed particles that have no more than one fractured face.
   iii. The gravel shall conform to ASTM #5 aggregate or equivalent. If ASTM #5 is not readily available ASTM #4 aggregate can be substituted.

Grading Requirements for Coarse Aggregates per ASTM C33-03	
ASTM #5 - nominal size is 1 to 1/2-in (25.0 to 12.5 mm) (sieves with square openings)	
Sieve Size	Amounts Passing Sieve (Mass Percent)
1-1/2-in (37.5 mm)	100
1-in (25.0 mm)	90-100
3/4-in (19.0 mm)	20-55
1/2-in (12.5 mm)	0-10
3/8-in (9.5 mm)	0-5

c. Vent Risers:
   i. Vent Risers shall pass through a cut opening in the Impervious Membrane and constructed of 4-inch diameter schedule 40 solid or foam core PVC pipe and must be in direct contact with the Enkavent Mat under the impervious membrane.
   ii. Vent Risers shall be located as indicated on Sheet 3. The placement may be changed to co-locate with other vent chases or interior walls upon engineering approval. Vent risers must not pass through return air plenums. Fire rating must be maintained through vent riser penetrations in floors/ceilings.
   iii. The sealed pipe system may pass through an unconditioned attic before exiting the building; but the sealed pipe shall be located inside the thermal envelope of the building in order to enhance passive stack venting.

2. Impervious Membrane

a. Refer to project manual for specification.

b. Impervious Membrane Installation:
   i. Installation shall comply with the manufacturer's specification of the Impervious Membrane.
   ii. Impervious Membrane shall be installed at the following locations:
      - Below the building slab surrounded by the inner face of the exterior foundation walls.
      - As shown on detail sheet 3.
   iii. Impervious Membranes at elevator and sump pits shall be installed as follows:
      - Wrap Impervious Membrane around walls of elevator and sump pit and continue under both slabs.
      - Add additional layer of Impervious Membrane below elevator and sump pit slabs for a total of two layers at these locations.
      - Impervious Membrane can be EPDM (ethylene propylene diene M-class rubber) below the elevator and sump pit slabs.
   iv. Proper installation of the Impervious Membrane must be verified by an engineer. Owner will pay for inspection. General Contractor to notify owner three weeks in advance of scheduled inspection to avoid impacting construction schedule.

c. Seals at Impervious Membrane Penetrations:
   i. Where footings, plumbing pipes, electrical conduits and other materials penetrate the Impervious Membrane, the penetrations shall be sealed by using sleeves or boots composed of the same material or other approved materials and methods (such as Stego mastic or taping with butyl adhesive tape all penetrations to achieve a gas-tight seal) in accordance with the specifications of the manufacturer for the Impervious Membrane.
   ii. A gas tight seal shall be provided where the Impervious Membrane is attached to all exterior foundation walls.
   iii. All elevator piston shaft casings shall be constructed of a material allowed by the elevator code and sealed at the elevator pit floor slab level in accordance with the specifications of the Impervious Membrane manufacturer.
   iv. The bottom of the elevator piston casing shall be sealed to prevent gas migration into the building.

3. Miscellaneous Systems

a. Trench Dam

Trench dams are intended to prevent travel of underground gas into buildings or structures along the trench backfill.
   i. A Trench Dam shall be installed in all electrical, plumbing, gas, or other trenches beneath the building foundation.
   ii. If piping and conduits are placed before certified compacted soil as part of the site preparation for the building pad, then trench dams will not be required.
   iii. Trench Dams shall be installed in the trench immediately adjacent to the exterior perimeter of the building foundation.
   iv. A Trench Dam shall have a minimum length of twice the width of the trench or a minimum of 36 inches in length.
   v. Trench Dams may be of the following:
      - Bentonite Cement Slurry - A mixture of 4% Type II Cement, and 2% Powdered Bentonite, or
      - Compacted Native Soil Backfill - Native soil shall be compacted to at least 90% relative compaction in accordance with ASTM D-698 or 1557 Testing Procedures, depending on soil type.
   vi. The entire cross section of trenches shall be backfilled to provide a minimum of 6 inches of trench dam material around all conduits and pipes.

   v. Trench Dams may be of the following:
      - Bentonite Cement Slurry - A mixture of 4% Type II Cement, and 2% Powdered Bentonite, or
      - Compacted Native Soil Backfill - Native soil shall be compacted to at least 90% relative compaction in accordance with ASTM D-698 or 1557 Testing Procedures, depending on soil type.
   vi. The entire cross section of trenches shall be backfilled to provide a minimum of 6 inches of trench dam material around all conduits and pipes.

b. Conduit Seal Fittings and Cable Seal Fittings
(Conduit Seal Fittings and Cable Seal Fittings are designed to prevent the passage of gases, vapors, or flames inside the electrical conduits)
   i. Conduit or Cable Seal Fittings are required where conduits or cables pass through a Vapor Mitigation System.
   ii. Any conduit or cable that penetrates the Impervious Membrane shall be provided with a conduit or cable seal.
   iii. Conduit Seal Fittings shall be installed in the vertical portion of conduit where the PVC conduit emerges into a vapor protected area. Rigid material shall be rigid metal that has the same trade size as conduit runs.

4. System Protection Notification

a. This notification is to be permanently stamped or etched in a location visible by maintenance workers.
b. All letters 1/2" (min.) in height.
c. At least one required per building.

WARNING

THIS BUILDING IS PROTECTED WITH A VAPOR GAS CONTROL BARRIER. ANY PROPOSED PENETRATION OR ALTERATION OF FLOOR SLAB REQUIRES NOTIFICATION OF THE BUILDING OFFICIAL AND INSPECTION BY AN ENGINEER

5. Electrical

a. An area for location of an in-line fan shall be provided as close as practicable to the vent pipes point of exit from the building. This area must be accessible for future fan maintenance and/or replacement as required.
b. A one hundred ten volt power supply shall be provided at a junction box near every fan location/vertical vent exit.

6. Gas/Vapor Extraction Powered Devices

a. Gas/vapor extraction powered devices shall consist of in-line fans to exhaust the space below the impervious membrane and shall be capable of ventilating the gravel blanket and Enkavent spaces at a rate of three air changes per hour.
b. The porosity of the gravel blanket is assumed to be 25%.
c. One in-line fan shall be provided for each vertical vent.
d. Location of T.O. fan will be approximately 124'-0".
e. Minimum fan specifications: Inline Radon Gas Mitigation Fan, Volts: 115, Wattage: 85 -152, Max Pressure: 2.46" - 2.5" wc, Typical Flow: 327-344 cfm @ 0" wc, 193-207 cfm @ 1" wc 57-58 cfm @ 2" wc.
f. Flexible coupling required for attaching fan to PVC pipe.
g. Access to fans will be provided by access panels.

7. System Operation Verification

a. A manometer will be mounted on each vent below the inline fan.
b. Upon activation of the fans, manometer shall register a non-zero reading to verify proper system operation.
c. Verification of system operation as outlined in (b) will be conducted on a regular basis, yearly at a minimum.
d. After activation of radon fans in a building containing combustion equipment, the combustion equipment shall be tested for back-drafting. Any backdrafting condition that results from the vapor ventilation system shall be corrected before the ventilation system is placed in operation.

References: This design is based on standards found in the following:

The City of Los Angeles, 2006. Methane hazard mitigation standard plan. Department of Building and Safety, 2006.

EPA, 1994. Radon prevention in the design and construction of schools and other large buildings. 3rd printing, U.S. Environmental Protection Agency, 1994.

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SUB-SLAB VAPOR VENTILATION DESIGN

EV-101

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NOTES:

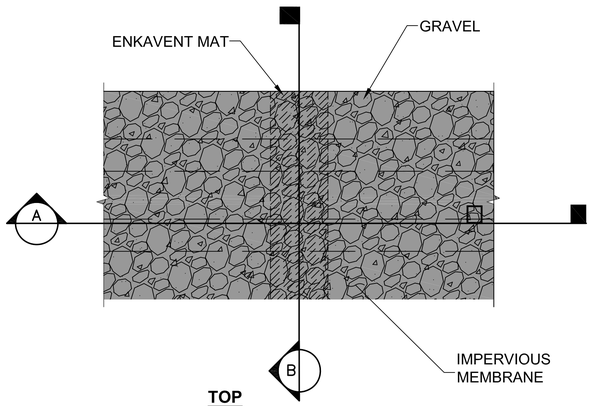
1. THE IMPERVIOUS MEMBRANE IS TO BE INSTALLED IN THE ENTIRE BUILDING FOOTPRINT, BOUND BY THE FOUNDATION WALLS.

2. THE IMPERVIOUS MEMBRANE IS TO BE INSTALLED ABOVE THE GRAVEL LAYER AND ENKAVENT MAT AND BELOW THE SLAB.

3. THE IMPERVIOUS MEMBRANE MUST BE SEALED TO THE FOUNDATION WALL AS SHOWN ON SHEET EV-103.

LEGEND

- CONCRETE
- GRAVEL
- STRUCTURAL FILL
- EARTH
- MEMBRANE



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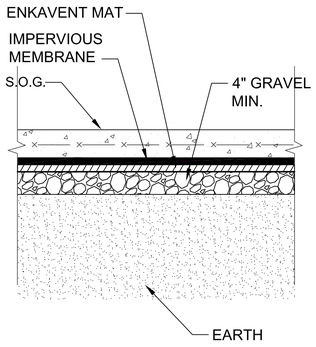
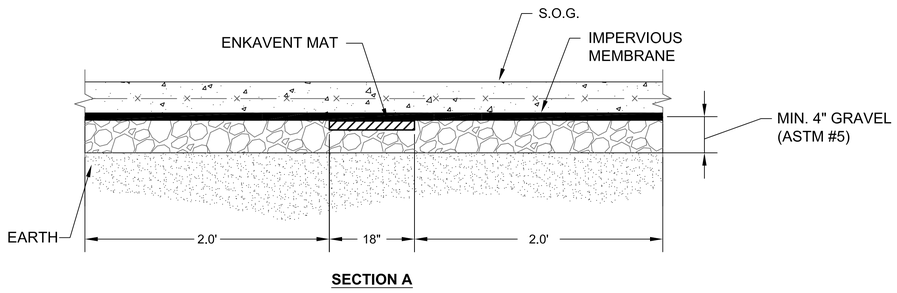
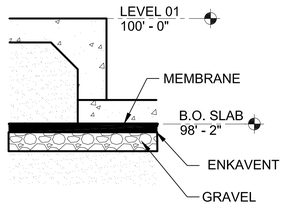


SECTION B

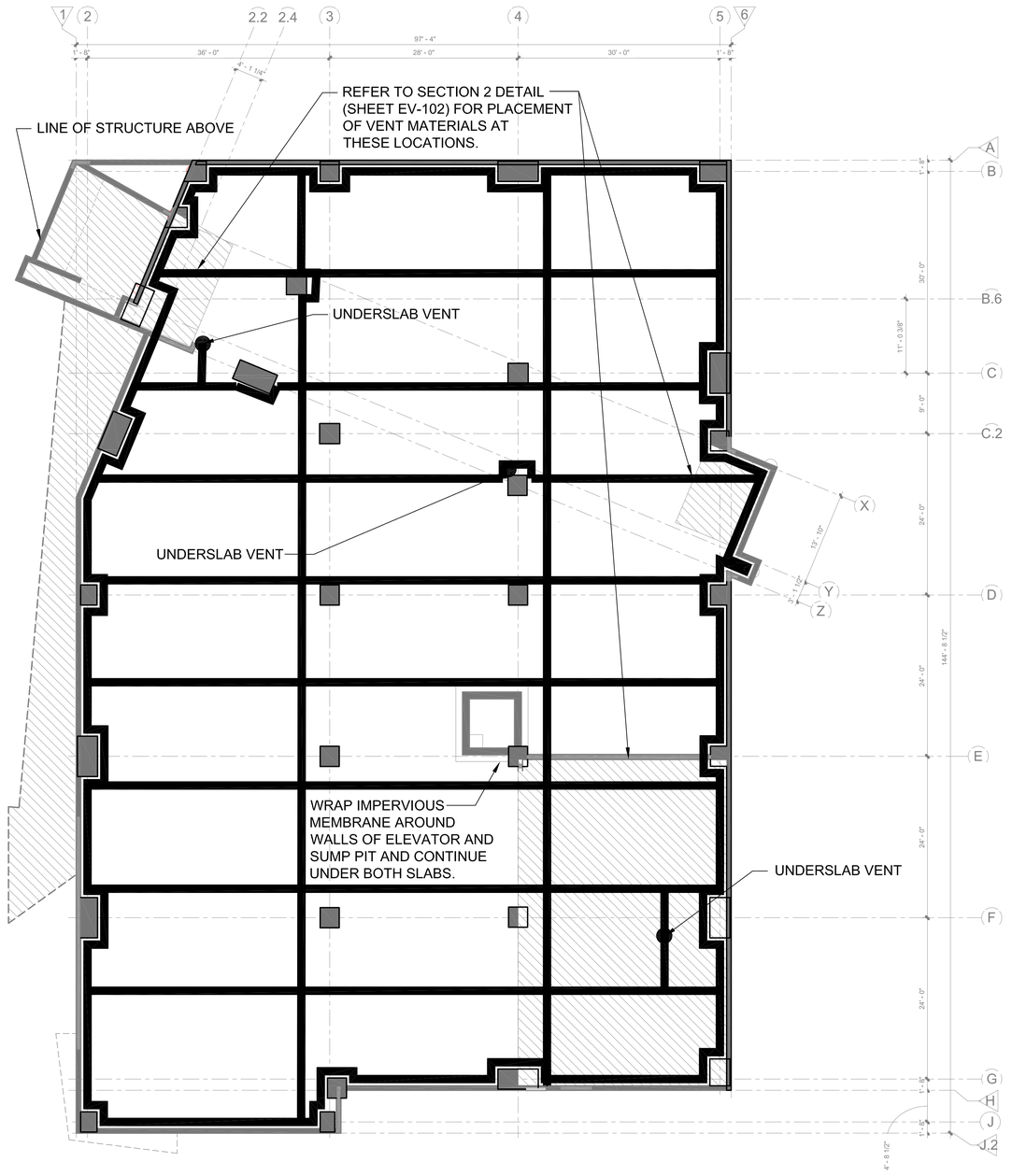


SECTION A

SECTION 1 - UNDER SLAB DETAIL - TYP.



SECTION 2 - SLAB TRANSITION DETAIL - TYP.



FOUNDATION VENTING PLAN

NOTES:

1. THE VENT PIPE MUST MEET THE ENKAVENT MAT UNDER THE SLAB AS SHOWN ON VAPOR RISER VENT CROSS-SECTION DETAIL ON SHEET 3. THE ENKAVENT MAT IS TO GO AROUND THE COLUMNS.

2. ONE 4-INCH DIA VERTICAL VENT IS REQUIRED AT EACH LOCATION IDENTIFIED FOR A TOTAL OF THREE VENTS IN THE BUILDING.

LEGEND

- 18-INCH ENKAVENT MAT
- 4-INCH DIAMETER VENT RISER PIPE (DIAMETER NOT SHOWN TO SCALE FOR EASE OF VIEWING). SEE NOTE 1.c.ii ON SHEET 1 ADDITIONAL DETAILS.

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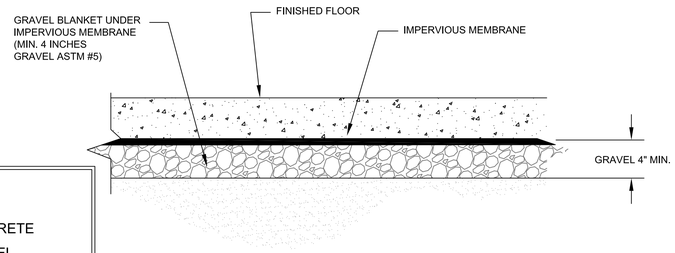
NOTES:

1. IMPERVIOUS MEMBRANE SHALL CONSIST OF ONE LAYER OF STEGO 10 MIL WRAP CLASS A VAPOR RETARDER OR EQUIVALENT.
2. SEAMS SHALL OVERLAP AT LEAST ONE FOOT AND BE SEALED WITH STEGO TAPE OR BUTYL-ADHESIVE TAPE.

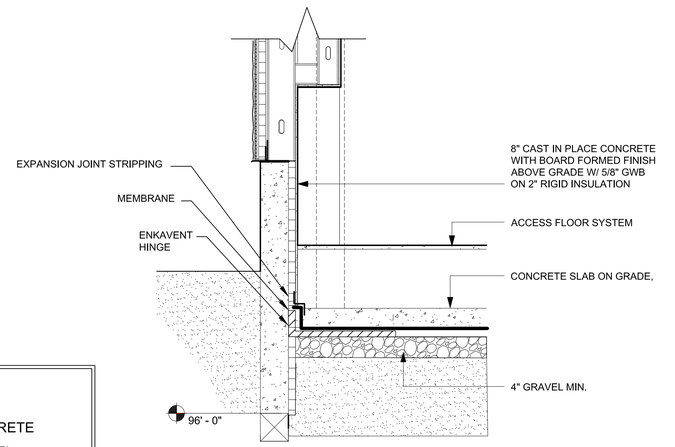


LEGEND
- CONCRETE
- GRAVEL
- STRUCTURAL FILL
- EARTH
- MEMBRANE

SUB-SLAB VENT SYSTEM DETAIL

Notes:

1. A GAS TIGHT SEAL SHALL BE PROVIDED WHERE THE IMPERIOUS MEMBRANE IS ATTACHED TO THE FOUNDATION WALL.
2. NAIL ENKAVENT MAT TO THE FOUNDATION WALL AT THE ENKAVENT HINGE.
3. EXTEND IMPERVIOUS MEMBRANE UP TO THE WALL - ON TOP OF THE ENKAVENT MAT AND HINGE.
4. ADHERE EXPANSION JOINT STRIPPING OVER HINGE AND IMPERVIOUS MEMBRANE.

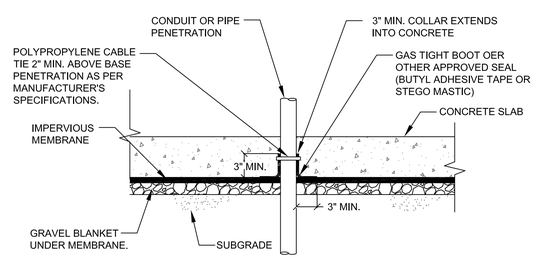


LEGEND
- CONCRETE
- GRAVEL
- STRUCTURAL FILL
- EARTH
- MEMBRANE

SECTION THROUGH MEMBRANE TERMINATION AND ENKAVENT MAT ATTACHMENT AT FOUNDATION WALL

NOTE:

1. WHERE FOOTINGS, PLUMBING PIPES, ELECTRICAL CONDUIT AND OTHER MATERIALS PENETRATE THE IMPERVIOUS MEMBRANE, THE PENETRATIONS SHALL BE SEALED BY USING SLEEVES OR BOOTS COMPOSED OF THE SAME MATERIAL OR OTHER APPROVED MATERIALS AND METHODS (SUCH AS CAULKING OR BUTYL ADHESIVE TAPE OR STEGO MASTIC) IN ACCORDIANCE WITH THE SPECIFICATIONS OF THE MANUFACTURER FOR THE IMPERVIOUS MEMBRANE.



LEGEND
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- STRUCTURAL FILL
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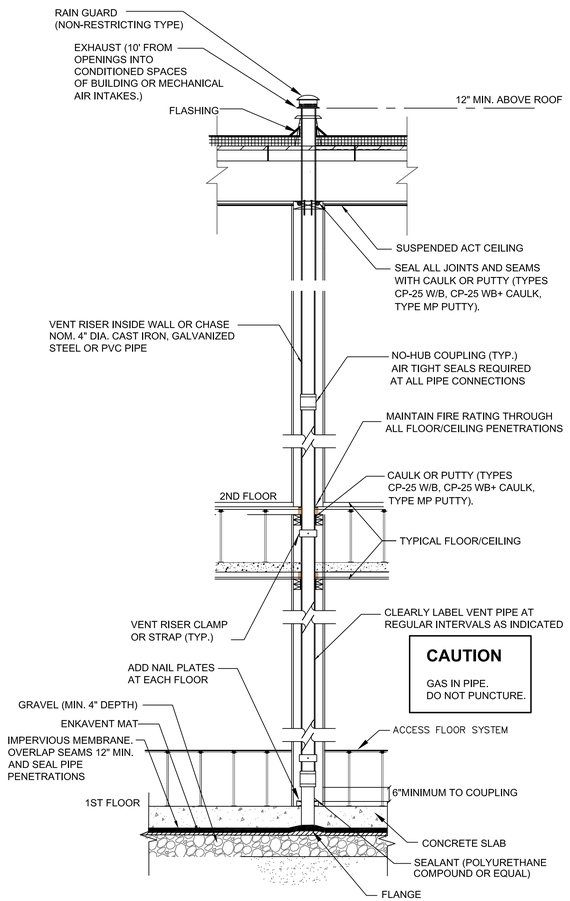
- MEMBRANE

MEMBRANE PENETRATION

NOTES

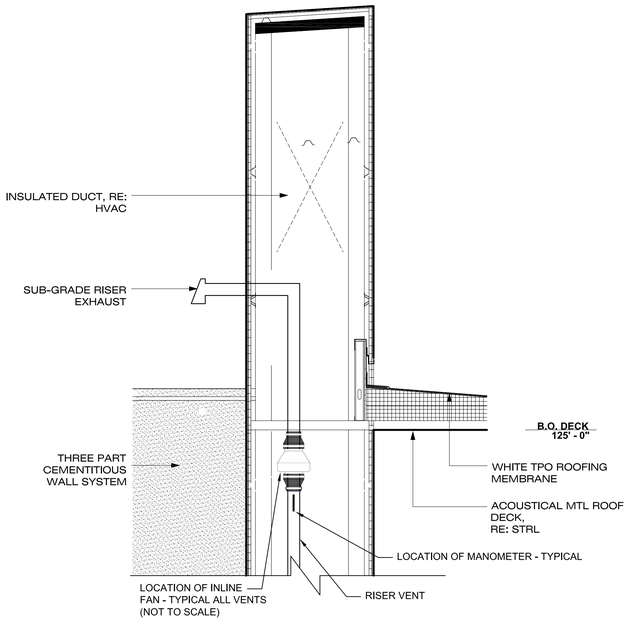
1. ALL CONCRETE SLABS THAT COME IN CONTACT WITH THE GROUND SHALL BE LAID OVER A GAS IMPERMEABLE MEMBRANE AS SHOWN ON SHEET 3 DESIGNED TO ALLOW THE LATERAL FLOW OF SOIL GASES.
2. ALL OPENINGS, GAPS, AND JOINTS IN FLOOR AND WALL ASSEMBLIES IN CONTACT WITH SOIL OR GAPS AROUND PIPES, TOILETS, BATHTUBS OR DRAINS PENETRATING THESE ASSEMBLIES SHALL BE FILLED OR CLOSED WITH MATERIALS THAT PROVIDE A PERMANENT AIRTIGHT SEAL. SEAL LARGE OPENINGS WITH NON-SHRINK MORTAR, GROUTS OR EXPANDING FOAM MATERIALS AND SMALLER GAPS WITH AN ELASTOMERIC JOINT SEALANT, AS DEFINED IN ASTM C920-87.
3. VENT PIPES SHALL BE INSTALLED SO THAT ANY RAINWATER OR CONDENSATION DRAINS DOWNWARD INTO THE GROUND BENEATH THE SLAB OR SOIL-GAS-RETARDER MEMBRANE.
4. TERMINATION OF PASSIVE VENT RISER SHALL BE AS FOLLOWS:
   A. 10' MIN. AWAY FROM OR AT LEAST 3' ABOVE ANY OPENABLE WINDOW, DOOR OPENING OR AIR INTAKE OR VENT SHAFT
   B. 4' MIN. IN EVERY DIRECTION FROM ANY LOT LINE, ALLEY, AND STREET
   C. EXTEND THROUGH THE VENT FLASHING, 12" MIN. ABOVE THE ROOF AND FROM ANY PARAPET OR BUILDING WALL
5. 4" DIA OPEN VENT RISER PIPE STARTS ABOVE ENKAVENT MAT AND BELOW MEMBRANE, SEAL FLANGE TO MEMBRANE
6. WRAP ALL PIPING WITH APPROVED MATERIAL THROUGH CONCRETE SLAB FLOOR
7. A 110 VOLT POWER SUPPLY SHALL BE PROVIDED AT A JUNCTION BOX NEAR EVERY VERTICAL VENT EXIT
8. NAIL PLATES TO BE ADDED AT EACH FLOOR/WALL INTERFACE FOR PROTECTION OF VENT PIPE.



TYPICAL VENT CROSS-SECTION (VENT 1)

NOTES:

1. EXHAUST 12" MIN. FROM WALL AND 10" FROM OPENINGS INTO CONDITIONED SPACES OR AIR HANDLING EQUIPMENT.
2. CONSTRUCTION NOTES FOR RISER VENT CROSS-SECTION VENT 1 ALSO APPLY TO VENTS 2 AND 3, EXCEPTING EXHAUST LOCATION.



RISER VENT CROSS-SECTION VENTS 2 AND 3

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SUB-SLAB VAPOR VENTILATION DESIGN

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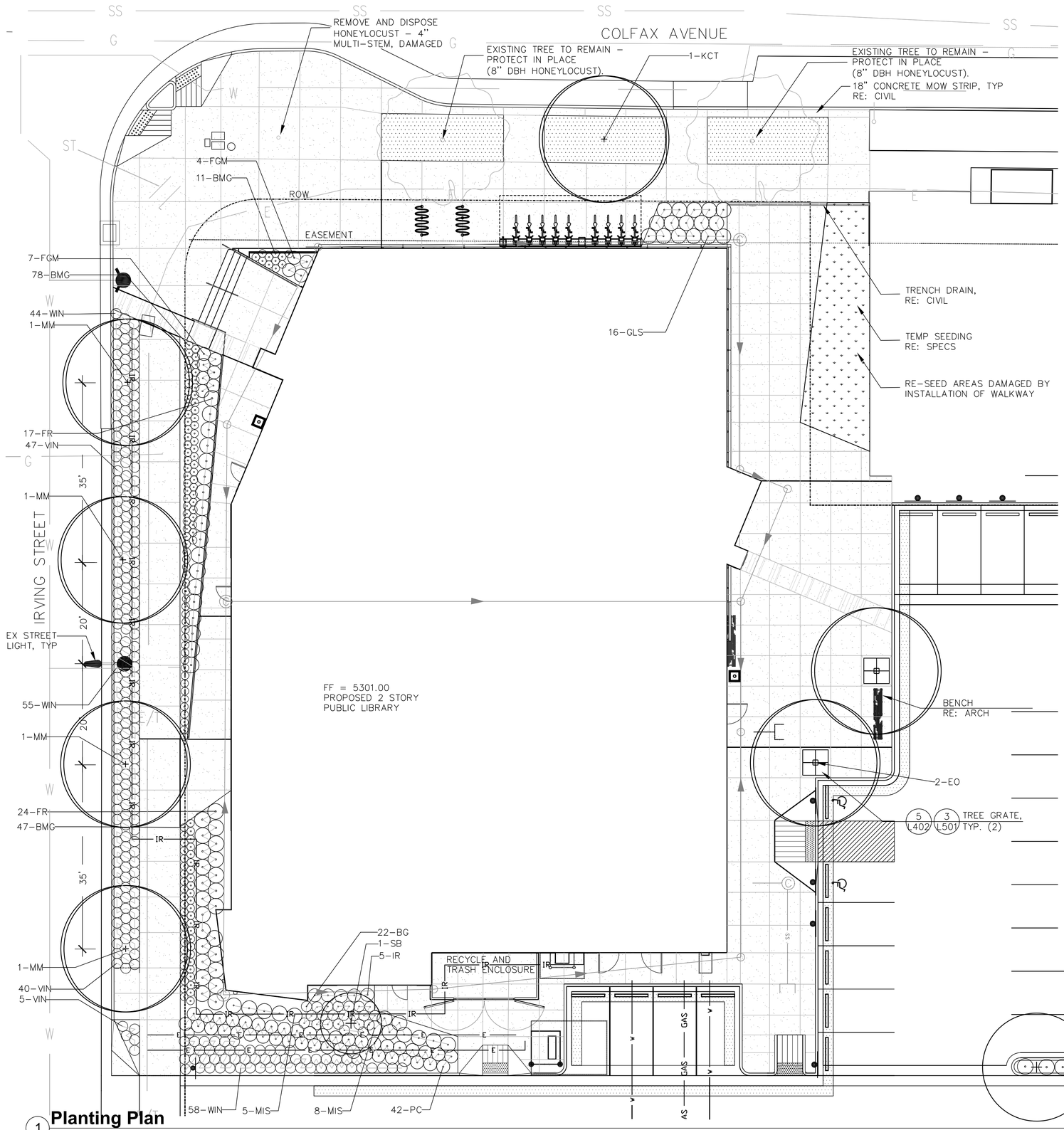

1 **Planting Plan**
1" = 10'-0"

LEGEND

DECIDUOUS TREE

DECIDUOUS SHRUB
ORNAMENTAL GRASS

SOD

PERENNIAL GROUNDCOVER

TEMPORARY SEEDING

PLANTING NOTES

1. ALL LANDSCAPE AREAS SHALL RECEIVE 6" TOPSOIL AND SOIL PREPARATION AS SPECIFIED.

2. CONTRACTOR SHALL COORDINATE IRRIGATION AND PLANTING WORK SUCH THAT INSTALLED IRRIGATION EQUIPMENT SHALL NOT CAUSE ADJUSTMENT OF PLANTING LOCATIONS CONTRARY TO THE PLANS. IF IRRIGATION EQUIPMENT IS INSTALLED IN LOCATIONS OBSTRUCTING THE INTENDED LOCATIONS OF THE PLANTINGS, THE IRRIGATION EQUIPMENT SHALL BE RELOCATED.

3. EXISTING TREES IN COLFAX ROW SHALL BE PROTECTED AS INDICATED ON THE PLANS AND WATERED THROUGHOUT THE CONSTRUCTION PERIOD. WATERING FREQUENCY SHALL BE WEEKLY (APRIL–OCTOBER) AND MONTHLY (NOV–MARCH). APPLY WATER BY HAND APPLICATION, 20 GALLONS PER WATERING/TREE. INSURE SOIL PERCOLATION, DO NOT ALLOW WATER TO RUNOFF SOIL.

4. ALL PLANT MATERIAL SHALL BE STAKED OR PLACED BY THE CONTRACTOR AND OBSERVED BY THE OWNER PRIOR TO PLANTING OPERATIONS.

5. CONTRACTOR SHALL HAND DIG ALL PLANTING PITS ADJACENT TO UTILITIES. IF UTILITIES ARE DAMAGED REPAIRS SHALL BE MADE AT NO ADDITIONAL COST TO OWNER.

6. ALL PLANT MATERIAL SHALL MEET OR EXCEED CURRENT AMERICAN STANDARD FOR NURSERY STOCK ANSI Z60.1 AND THE COLORADO NURSERY ACT AND ACCOMPANYING RULES AND REGULATIONS.

7. IRRIGATION – ALL LANDSCAPE PLANTINGS SHALL BE IRRIGATED W/ A PERMANENT AUTOMATIC IRRIGATION SYSTEM. SEE IRRIGATION PLAN. ALL TREES IN TURF ROW SHALL HAVE SEPARATE IRRIGATION ZONING (BUBBLER/ROOT WATERING).

8. ALL PLANTING BEDS SHALL BE MULCHED WITH A 4" LAYER OF WOOD MULCH AND LANDSCAPE FABRIC.

9. SEE CIVIL GRADING PLAN FOR FINISH GRADE IN ALL LANDSCAPE AREAS – MAINTAIN 10% SLOPE AWAY FROM BUILDING, IN FIRST 5' ADJACENT TO BUILDING RE: GEOTECH REPORT.

PLANTING SCHEDULE

DECIDUOUS TREES
Deciduous trees shall be balled and burlapped with full heads, straight trunks, and single leaders unless otherwise noted. All shade trees shall have their first branch 5'–7' above the top of the rootball.

ABBR	QTY	COMMON NAME	BOTANIC NAME	SIZE	NOTES
EO	2	English Oak	Quercus robur	3" cal.	
ER	1	Eastern Redbud	Cercis canadensis	6' clump	in Courtyard
JPT	4	Japanese Pagoda Tree	Styphnolobium japonica	3" cal.	
KCT	1	Kentucky Coffee Tree	Gymnocladus dioicus	3" cal.	in ROW
MM	4	Miyabei Maple	Acer miyabei 'State Street'	3" cal.	in ROW
SB	1	Shadblow Serviceberry	Amelanchier canadensis	3" cal.	

DECIDUOUS SHRUBS
All shrubs shall be containerized stock (#5 container, unless otherwise noted).

ABBR	QTY	COMMON NAME	BOTANIC NAME	SPACING	NOTES
GLS	16	Grow Lo Sumac	Rhus aromatica 'Grow Lo'	36" O.C.	

PERENNIALS
All perennials shall be containerized stock (#1 container, unless otherwise noted).

ABBR	QTY	COMMON NAME	BOTANIC NAME	SPACING	NOTES
PC	42	Purple Coneflower	Echinacea purpurea	30" O.C.	

GROUNDCOVERS
(#1 container, unless otherwise noted).

ABBR	QTY	COMMON NAME	BOTANIC NAME	SPACING	NOTES
VIN	92	Vinca Minor	Vinca minor 'Bowles'	24" O.C.	
WIN	157	Wintercreeper	Euonymus coloratus	24" O.C.	

ORNAMENTAL GRASSES

ABBR	QTY	COMMON NAME	BOTANIC NAME	SPACING	NOTES
BG	22	Blue Gramma	Bouteloua gracilis	24" OC	(#1 CONT)
BMG	136	Black Mondo Grass	Ophiopogon planiscapus	18" OC	(#1 CONT)
FGM	11	Moudry Fountain Grass	Pennisetum alopecuroides 'Moudry'	30" OC	(#1 CONT)
FR	61	Feather Reed Grass	Calamagrostis x acutiflora 'Karl Forester'	36" OC	(#5 CONT)
IR	5	Indian Ricegrass	Oryzopsis hymenoides	30" OC	(#1 CONT)
MIS	13	Miscanthus	Miscanthus sinensis 'Purpurascens'	36" CO	(#5 CONT)

*SEE SPECIFICATIONS FOR COURTYARD PLANTER SEDUM TRAYS

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COOD PROJECT NO: CE 02089

ISSUE DATE 1/12/2012
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PLANTING PLAN

L-101

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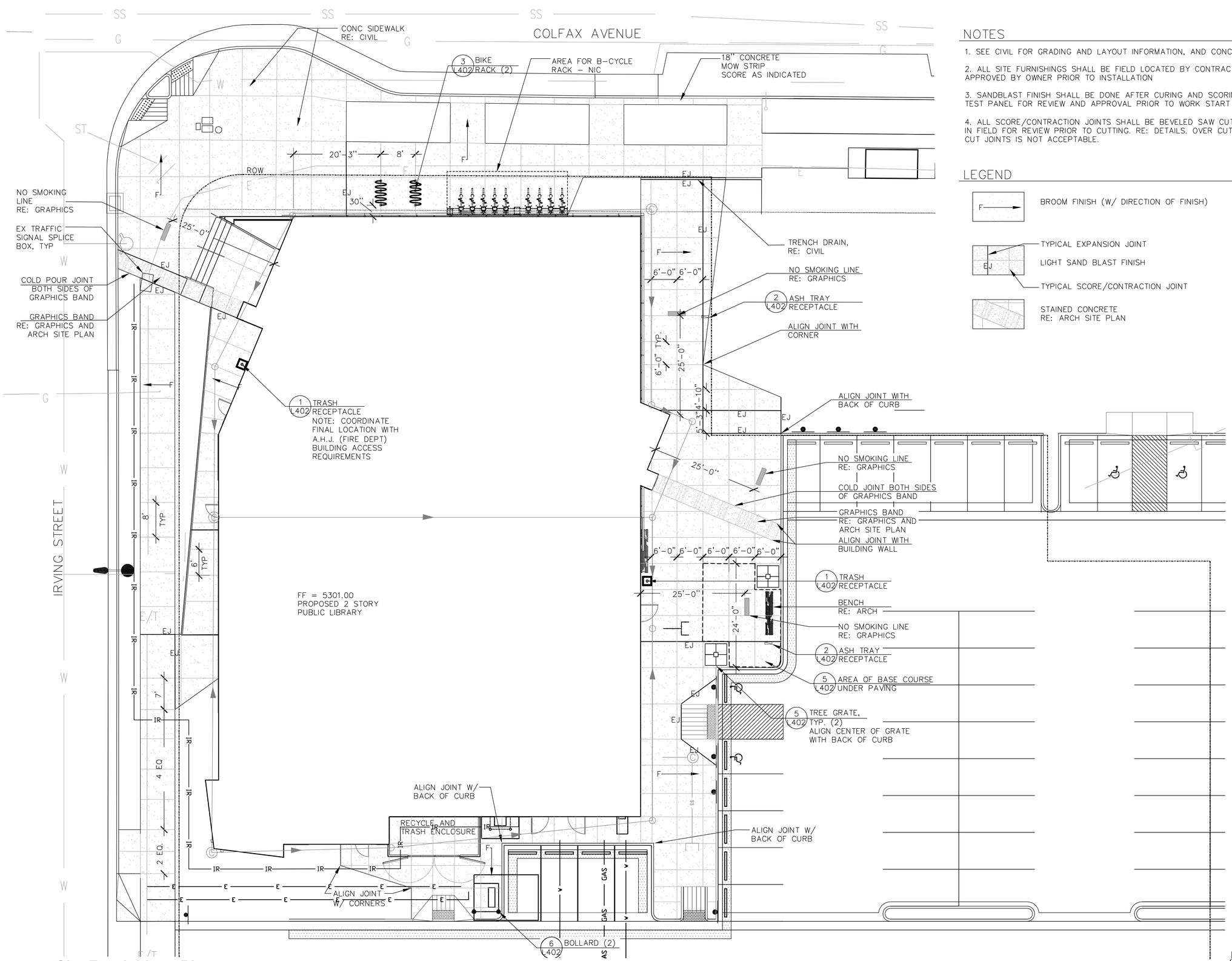

NOTES

1. SEE CIVIL FOR GRADING AND LAYOUT INFORMATION, AND CONCRETE DETAILS.
2. ALL SITE FURNISHINGS SHALL BE FIELD LOCATED BY CONTRACTOR AND APPROVED BY OWNER PRIOR TO INSTALLATION
3. SANDBLAST FINISH SHALL BE DONE AFTER CURING AND SCORING. PROVIDE TEST PANEL FOR REVIEW AND APPROVAL PRIOR TO WORK START UP
4. ALL SCORE/CONTRACTION JOINTS SHALL BE BEVELED SAW CUT. MARK JOINTS IN FIELD FOR REVIEW PRIOR TO CUTTING. RE: DETAILS. OVER CUTTING OF SAW CUT JOINTS IS NOT ACCEPTABLE.

LEGEND

F — BROOM FINISH (W/ DIRECTION OF FINISH)

EJ — TYPICAL EXPANSION JOINT
LIGHT SAND BLAST FINISH
TYPICAL SCORE/CONTRACTION JOINT

STAINED CONCRETE
RE: ARCH SITE PLAN

1 **Site Furnishings Plan**
1" = 10'-0"

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SITE FURNISHINGS PLAN

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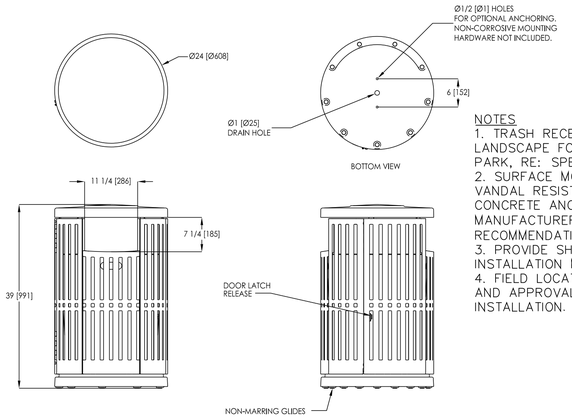
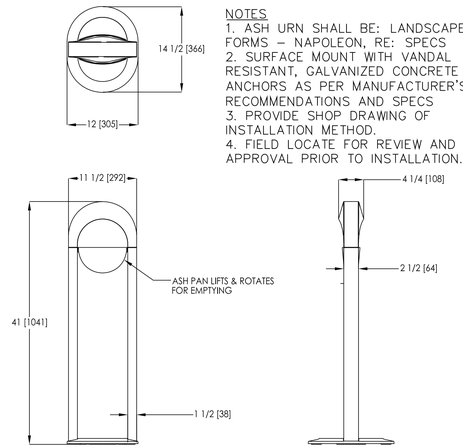


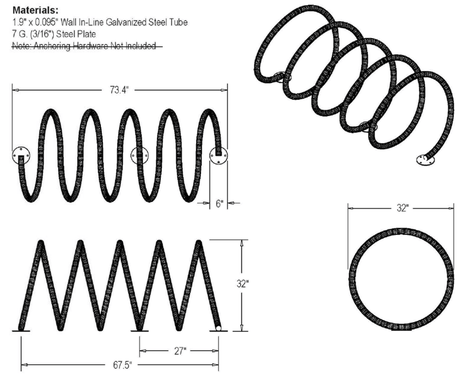
NOTES
1. TRASH RECEPTACLE SHALL BE: LANDSCAPE FORMS – CHASE PARK, RE: SPECS
2. SURFACE MOUNT WITH WITH VANDAL RESISTANT, GALVANIZED CONCRETE ANCHORS AS PER MANUFACTURER'S RECOMMENDATIONS AND SPECS
3. PROVIDE SHOP DRAWING OF INSTALLATION METHOD.
4. FIELD LOCATE FOR REVIEW AND APPROVAL PRIOR TO INSTALLATION.

1 Trash Receptacle
NTS



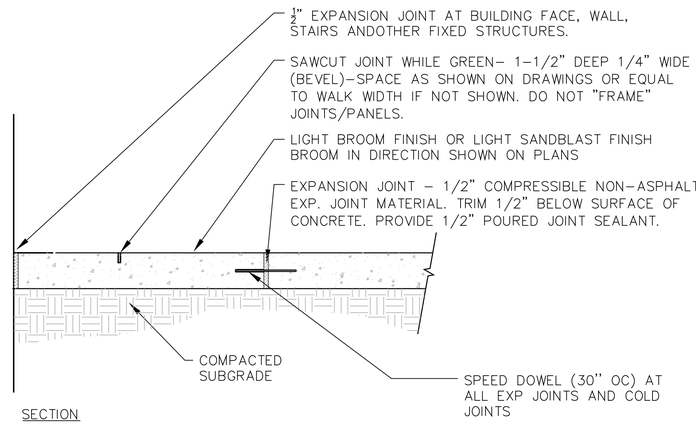
NOTES
1. ASH URN SHALL BE: LANDSCAPE FORMS – NAPOLEON, RE: SPECS
2. SURFACE MOUNT WITH VANDAL RESISTANT, GALVANIZED CONCRETE ANCHORS AS PER MANUFACTURER'S RECOMMENDATIONS AND SPECS
3. PROVIDE SHOP DRAWING OF INSTALLATION METHOD.
4. FIELD LOCATE FOR REVIEW AND APPROVAL PRIOR TO INSTALLATION.

2 Ash Tray Receptacle
NTS



NOTES
1. BIKE RACK SHALL BE: BELSON OUTDOORS MODEL: BRBC–10, RE: SPECS
2. SURFACE MOUNT WITH VANDAL RESISTANT, GALVANIZED CONCRETE ANCHORS AS PER MANUFACTURER'S RECOMMENDATIONS.
3. PROVIDE SHOP DRAWING OF INSTALLATION METHOD.
4. FIELD LOCATE FOR REVIEW AND APPROVAL PRIOR TO INSTALLATION.

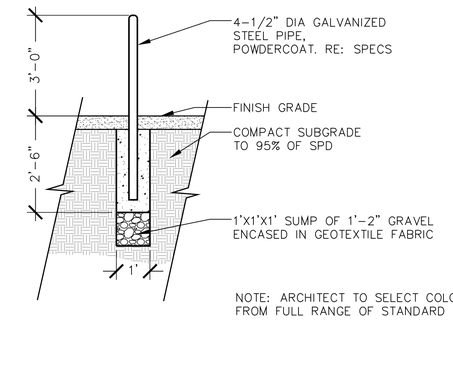
3 Bike Rack
NTS



SECTION

NOTES
1. SEE CIVIL FOR CONCRETE PAVING DETAILS.
2. PROVIDE EXPANSION JOINTS AS INDICATED ON DRAWINGS AND IN SPECIFICATIONS.
3. ALL SCORE/CONTRACTION AND EXPANSION JOINTS SHALL MARKED IN FIELD AND OBSERVED BY OWNER/ARCHITECT PRIOR TO SAWCUTTING OR CONCRETE PLACEMENT (EXP JOINTS).

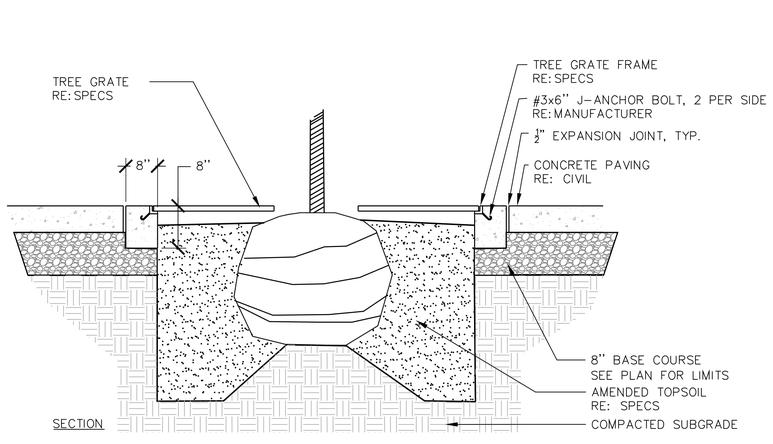
4 Concrete Paving - Scoring and Finish
NTS



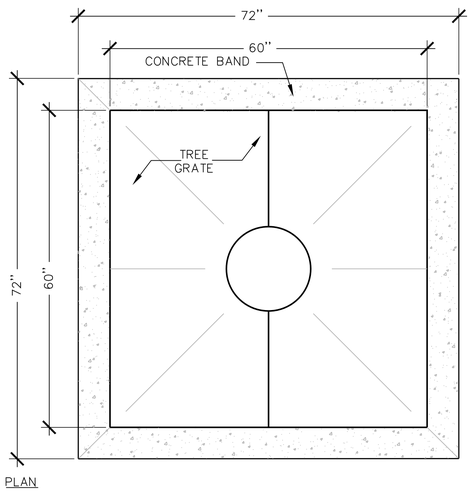
NOTE: ARCHITECT TO SELECT COLOR FROM FULL RANGE OF STANDARD COLORS.

PIPE BOLLARD SECTION

6 Bollard
NTS



SECTION



PLAN

NOTES
1. INSTALL TREE GRATE PER MANUFACTURER'S RECOMMENDATIONS.
2. ALL GRADES SHALL BE AS INDICATED ON DRAWINGS, RE: CIVIL. ALL TREE GRATES SHALL BE INSTALLED CONTINUOUS WITH THE ADJACENT SLOPE OF THE PAVING AND CURBS.
3. INSTALL GRATE IN FRAME DURING CONCRETE POUR.
4. SUBMIT SHOP DRAWINGS FOR REVIEW AND APPROVAL PRIOR TO WORK.
5. FOR PLANTING SEE TREE GRATE PLANTING DETAIL.

5 Tree Grate
NTS

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SITE FURNISHINGS DETAILS

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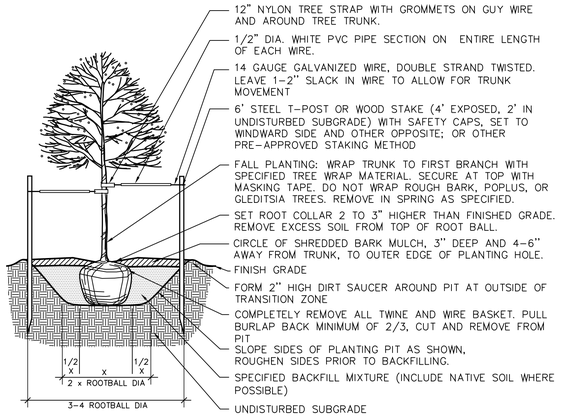
1 Tree Planting
NTS



ANY BROKEN, CRUMBLING OR OTHERWISE DAMAGED ROOTBALL WILL BE REJECTED. DAMAGE DURING PLANTING OPERATIONS WILL NOT BE EXCUSED

TREES PLANTED IN THE PUBLIC RIGHT OF WAY (PRW) ARE SUBJECT TO THE FOLLOWING RESTRICTIONS:

1. A PERMIT IS REQUIRED TO PLANT IN THE PRW; PERMITS ARE FREE FROM THE CITY FORESTER'S OFFICE
2. ONLY TREES FROM DENVER FORESTRY'S APPROVED SREET TREE LIST OR TREES APPROVE BY THE CITY FORESTER'S OFFICE SHALL BE PLANTED IN THE PRW.
3. FOR A LIST OF PROHIBITED OR SUSPENDED PRW TREES, SEE DENVER FORESTRY WEBSITE OR CALL THE FORESTRY OFFICE.
4. IF OVERHEAD UTILITY WIRES EXIST IN THE PRW PLANT ONLY ORNAMENTAL TREES MATURING AT 20' MAX.
5. DO NOT PLANT TREES IN TREE LAWNS LESS THAN 5' WIDE.
6. WHERE THERE ARE NO SIDEWALKS, TREES SHOULD BE LOCATED AS DESIGNATED BY DENVER FORESTRY.
7. DO NOT PLANT IN CORNER TRIANGLE FORMED BY THE FIRST 30' ALONG THE PRW LINE IN EACH DIRECTION FROM THE CORNER.
8. DO NOT PLANT WITHIN 10' OF ALLEYS, DRIVEWAYS, OR FIRE HYDRANTS.
9. DO NOT PLANT WITHIN 20' OF STOP SIGNS OR STREET LIGHTS.
10. DO NOT PLANT WITHIN 5' OF WATER METERS OR PITS.
11. SPACE LARGE SHADE TREES 35' APART AND ORNAMENTAL TREES 25' APART, OR AS DESIGNATED BY FORESTRY.
12. TREES MUST BE PRUNED TO MAINTAIN A CLEARANCE OF 13.5' OVER THE STREETS AND ALLEYS AND 8' OVER REMAINING PORTIONS OF PRW INCLUDING THE SIDEWALK.

2 Tree Protection
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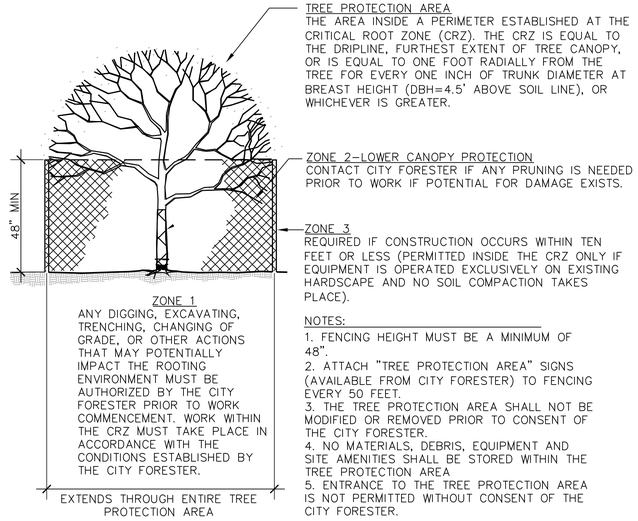

NOTES:

1. FENCING HEIGHT MUST BE A MINIMUM OF 48".
2. ATTACH "TREE PROTECTION AREA" SIGNS (AVAILABLE FROM CITY FORESTER) TO FENCING EVERY 50 FEET.
3. THE TREE PROTECTION AREA SHALL NOT BE MODIFIED OR REMOVED PRIOR TO CONSENT OF THE CITY FORESTER.
4. NO MATERIALS, DEBRIS, EQUIPMENT AND SITE AMENITIES SHALL BE STORED WITHIN THE TREE PROTECTION AREA
5. ENTRANCE TO THE TREE PROTECTION AREA IS NOT PERMITTED WITHOUT CONSENT OF THE CITY FORESTER.

3 Tree Planting in Grate
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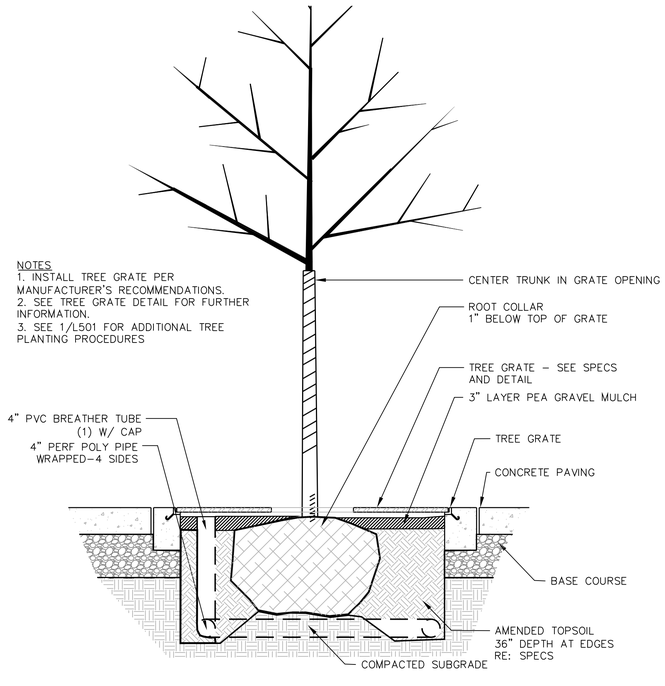

4 Shrub Planting
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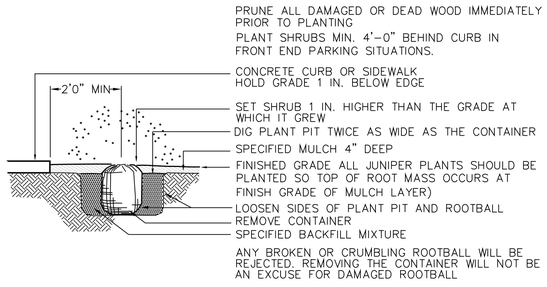

5 Plant Spacing
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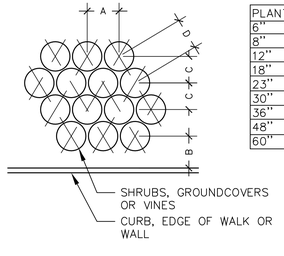
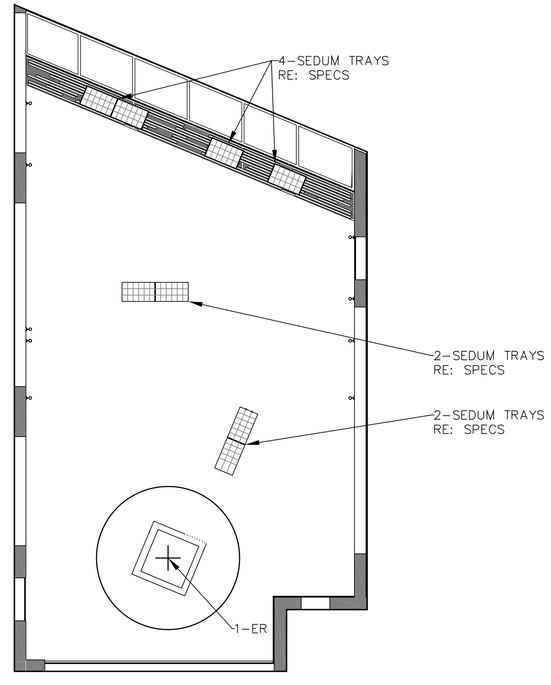


PLANT SPACING	A	B	C	D
6"	6"	6"	5"	6"
8"	8"	6"	7"	8"
12"	12"	6"	10"	12"
18"	18"	8"	15"	18"
23"	24"	18"	20"	24"
30"	30"	18"	26"	30"
36"	36"	24"	31"	36"
48"	48"	24"	41"	48"
60"	60"	36"	52"	60"

6 Courtyard Planting Plan
1" = 5'-0"



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CCOD PROJECT NO: CE 02089

ISSUE DATE 1/12/2012
PHASE 100% CD

LANDSCAPE DETAILS

L-501

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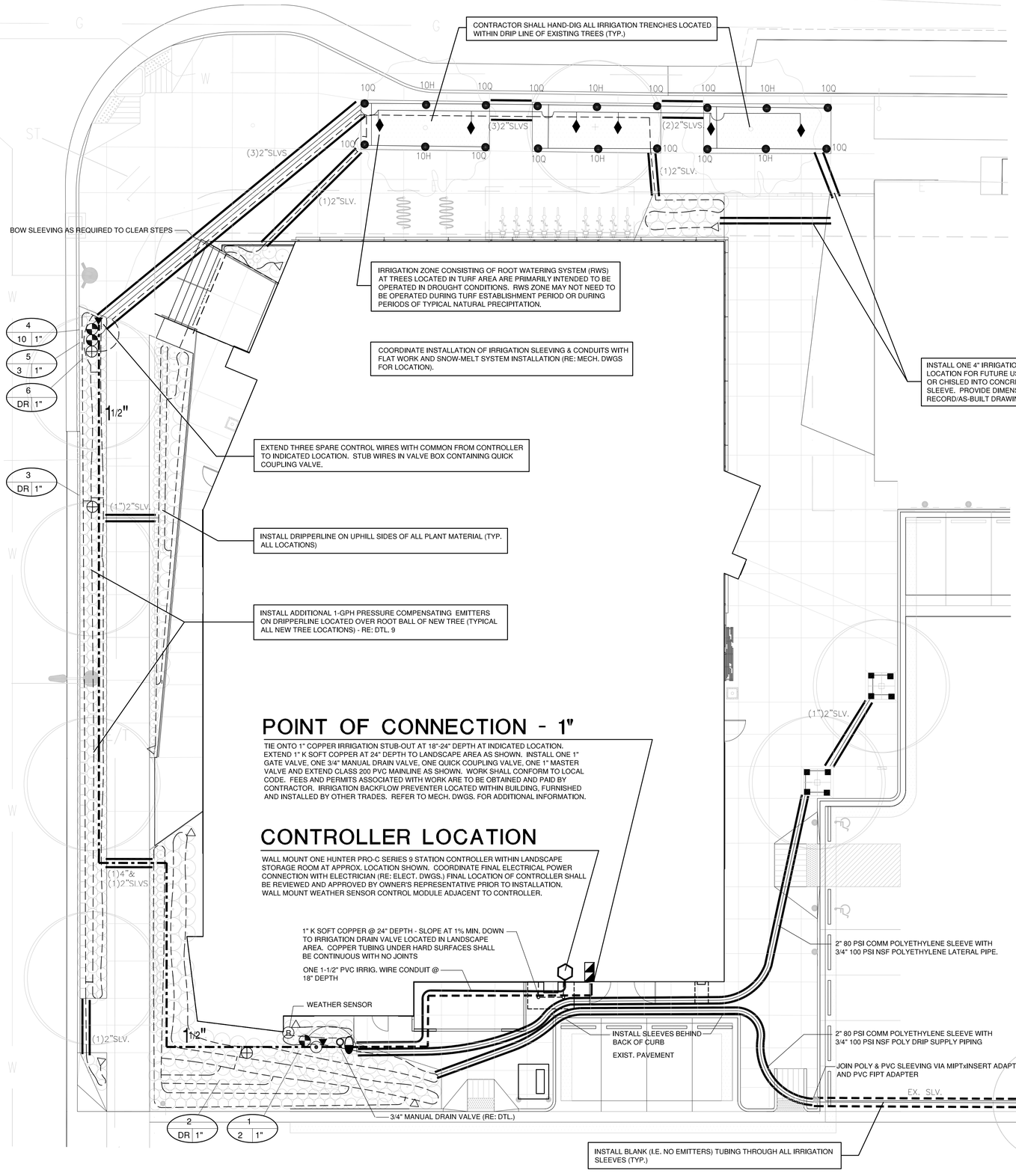

Irrigation Equipment and Materials Schedule

SYMBOL	MANUFACTURER	MODEL NO.	DESCRIPTION	DETAIL NO.	COMMENTS
● x	RAIN BIRD	1806 SAM PRS W/ SPEC'D. U-SERIES NOZZ.	POP-UP SPRAY HEAD	1	
■	RAIN BIRD	1402	PRESS. COMP. BUBBLER	14	
⊕	RAIN BIRD	XCZ-LF-100-PRF	DRIP VALVE ASSEMBLY	8	
▽		LINE SIZE	DRIP BLOW-OUT W/ OPERATIONAL INDICATOR	10	
▼	RAIN BIRD	44 NP	QUICK COUPLING VALVE	3	
◔	RAIN BIRD	PEB SERIES	ELECTRIC CONTROL VALVE	2	
⬡	HUNTER	PC-900 (PRO-C SERIES)	ELECTRIC CONTROLLER	12	
◗		LINE SIZE	GATE VALVE	4	
⊙	RAIN BIRD	PEB SERIES - 1"	MASTER VALVE	5	
Ⓡ	HUNTER	WSS	SOLAR SYNC WEATHER SENSOR	13	
———		100 PSI NSF - 1" DIA.	POLYETHYLENE LATERAL	7	
— · — · —		CLASS 200 SOLVENT WELD	PVC MAINLINE	6 & 7	
— — —	NETAFIM	TLCV-04-12	POLY DRIPPERLINE	9 & 11	
═══		SCH. 40 SOLVENT WELD	PVC SLEEVING		
♦	RAIN BIRD	RWS-B-C-1402	ROOT WATERING SYSTEM	15	
◥◣		1" (BY OTHER TRADES)	IRRIG. BACKFLOW PREVENTER		

CONTROLLER & STATION NO.
CONTROL VALVE SIZE

Irrigation Construction Notes

1. ALL BASE INFORMATION HAS BEEN TAKEN FROM DRAWINGS PREPARED BY MUNDUS BISHOP DESIGN.
2. REFER TO TECHNICAL SPECIFICATIONS AND CONSTRUCTION DETAILS FOR INSTALLATION PROCEDURES.
3. CONTRACTOR SHALL FIELD VERIFY PRESSURE AT BACKFLOW PREVENTER LOCATION FOR EACH TAP PRIOR TO ORDERING MATERIALS OR STARTING ANY IRRIGATION INSTALLATION AND NOTIFY CONSULTANT OF ANY DIFFERENCES FROM STATED PRESSURE. IF CONTRACTOR FAILS TO NOTIFY CONSULTANT HE ASSUMES FULL RESPONSIBILITY FOR ANY SYSTEM ALTERATIONS. EACH SYSTEM HAS BEEN DESIGNED FOR A STATIC PRESSURE OF 80 PSI.

TAP LOCATION/NUMBER	REQUIRED PRESSURE
1	59 PSI

4. CONTRACTOR SHALL COORDINATE INSTALLATION OF SLEEVING WITH INSTALLATION OF CONCRETE FLATWORK AND PAVING. ALL SLEEVING IS BY CONTRACTOR UNLESS OTHERWISE NOTED. UNLESS NOTED OTHERWISE ON IRRIGATION PLANS INSTALL SLEEVING BASED ON SLEEVE SIZING GUIDE BELOW:

PIPE SIZE OR WIRE QUANTITY	REQUIRED SLEEVE
3/4" - 1" PIPING	1-2" PVC SLEEVE
1-1/2" - 2" PIPING	1-4" PVC SLEEVE
1-25 CONTROL WIRES	1-2" PVC SLEEVE

NOTE: EACH LENGTH OF SLEEVED PIPE SHOWN SHALL BE ROUTED THROUGH SEPARATE SLEEVE. IRRIGATION WIRE BUNDLE SHALL BE ROUTED IN SEPARATE SLEEVE/CONDUIT WITHOUT IRRIGATION PIPING

5. WHERE NOT NOTED ON IRRIGATION PLANS CONTRACTOR TO INSTALL PLASTIC 15 SERIES NOZZLES ON POP-UP SPRAY HEADS SPACED GREATER THAN 12 FEET. INSTALL 12 SERIES NOZZLES ON POP-UP SPRAY HEADS SPACED 10-12 FEET. INSTALL 10 SERIES NOZZLES NOZZLES ON ALL POP-UP SPRAY HEADS SPACED 8-10 FEET. INSTALL 8 SERIES NOZZLES ON POP-UP SPRAY HEADS SPACED 8 FEET AND LESS.
6. REFER TO PLANTING PLAN FOR EXACT TREE LOCATIONS AND QUANTITIES, TREES SHOWN ON IRRIGATION PLANS ARE APPROXIMATE.
7. CONTRACTOR SHALL REPAIR OF REPLACE ANY EXISTING IRRIGATION EQUIPMENT, TURF, PLANT MATERIAL OR SITE FEATURES DAMAGED DURING NEW INSTALLATION. REPLACEMENT OR REPAIR OF DAMAGED EQUIPMENT OR MATERIAL SHALL BE DETERMINED BY THE OWNER AND THE CONSULTANT.
8. VALVE BOXES SHALL BE LOCATED 36" MINIMUM FROM CENTERLINE OF ALL SWALES, 24" MINIMUM FROM EDGES OF ALL WALKS, CURBS, DRIVES AND OTHER HARD SURFACE AREAS.
9. REFER TO IRRIGATION TECHNICAL SPECIFICATIONS FOR PLANTING AND IRRIGATION LAY-OUT REQUIREMENTS, COORDINATION AND PRIORITIES.
10. LATERAL PIPING DIAMETERS SHALL INCLUDE 1". 3/4" DIAMETER LATERAL PIPE IS NOT ACCEPTABLE.

N W E S

0 10 20

Avocet IRRIGATION DESIGN
7114 W. JEFFERSON AVENUE, SUITE 201
LAKEWOOD, COLORADO 80235
VOICE: 303.986.2175
FAX: 303.989.5814

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IRRIGATION PLAN

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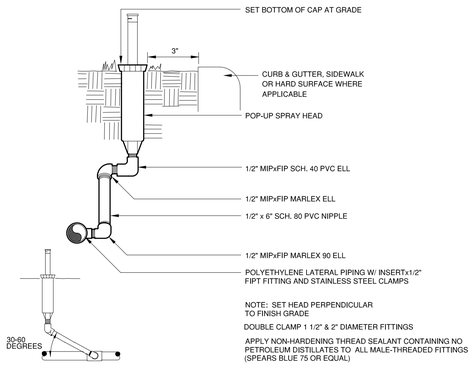
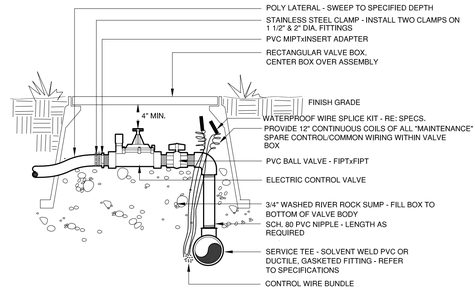


NOTE: SET HEAD PERPENDICULAR TO FINISH GRADE

DOUBLE CLAMP 1 1/2" & 2" DIAMETER FITTINGS

APPLY NON-HARDENING THREAD SEALANT CONTAINING NO PETROLEUM DISTILLATES TO ALL MALE-THREADED FITTINGS (SPEARS BLUE 75 OR EQUAL)

POP-UP SPRAY HEAD 1

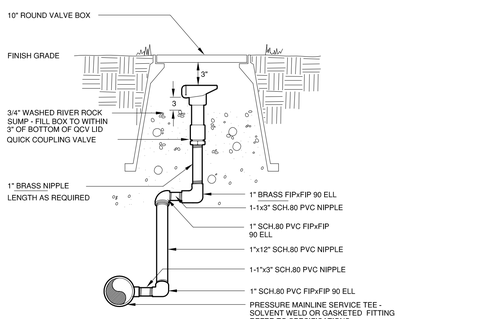


NOTE: DIAMETERS OF BALL VALVES, PVC FITTINGS AND NIPPLES SHALL EQUAL ELECTRIC CONTROL VALVE DIAMETER

VALVE BOXES SHALL BE INSTALLED PARALLEL, OR PERPENDICULAR TO ADJACENT SIDEWALKS AND HARD SURFACES WHERE APPLICABLE

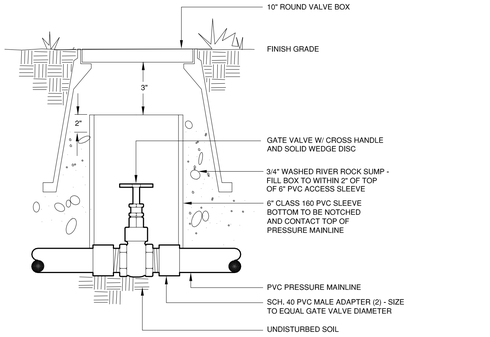
APPLY NON-HARDENING THREAD SEALANT CONTAINING NO PETROLEUM DISTILLATES TO ALL MALE-THREADED FITTINGS (SPEARS BLUE 75 OR EQUAL)

ELECTRIC CONTROL VALVE 2



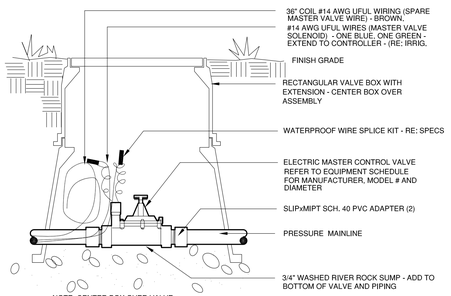
APPLY NON-HARDENING THREAD SEALANT CONTAINING NO PETROLEUM DISTILLATES TO ALL MALE-THREADED FITTINGS (SPEARS BLUE 75 OR EQUAL)

QUICK COUPLING VALVE 3



APPLY NON-HARDENING THREAD SEALANT CONTAINING NO PETROLEUM DISTILLATES TO ALL MALE-THREADED FITTINGS (SPEARS BLUE 75 OR EQUAL)

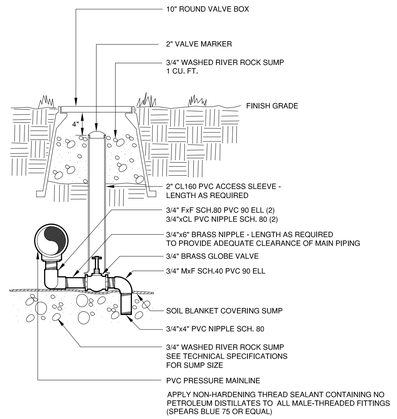
GATE VALVE 4



NOTE: CENTER BOX OVER VALVE ASSEMBLY.

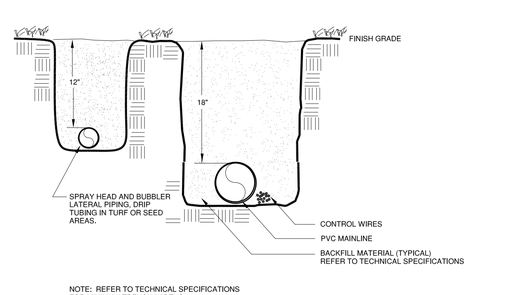
APPLY NON-HARDENING THREAD SEALANT CONTAINING NO PETROLEUM DISTILLATES TO ALL MALE-THREADED FITTINGS (SPEARS BLUE 75 OR EQUAL)

MASTER VALVE 5



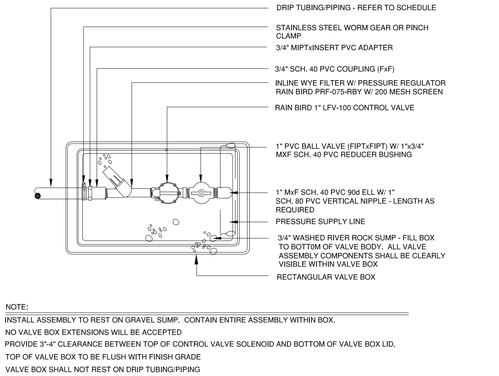
APPLY NON-HARDENING THREAD SEALANT CONTAINING NO PETROLEUM DISTILLATES TO ALL MALE-THREADED FITTINGS (SPEARS BLUE 75 OR EQUAL)

MANUAL DRAIN VALVE 6



NOTE: REFER TO TECHNICAL SPECIFICATIONS FOR MINIMUM TRENCH WIDTHS.

TRENCH 7



NOTE:

INSTALL ASSEMBLY TO REST ON GRAVEL SUMP. CONTAIN ENTIRE ASSEMBLY WITHIN BOX.

NO VALVE BOX EXTENSIONS WILL BE ACCEPTED

PROVIDE 3"-4" CLEARANCE BETWEEN TOP OF CONTROL VALVE SOLENOID AND BOTTOM OF VALVE BOX LID.

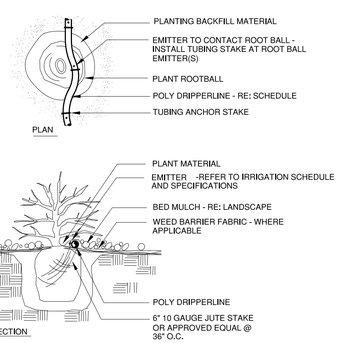
TOP OF VALVE BOX TO BE FLUSH WITH FINISH GRADE

VALVE BOX SHALL NOT REST ON DRIP TUBING/PIPING

POSITION VALVE BOX TO PERMIT REMOVAL OF FILTER SCREEN FOR MAINTENANCE PURPOSES.

APPLY NON-HARDENING THREAD SEALANT CONTAINING NO PETROLEUM DISTILLATES TO ALL MALE-THREADED FITTINGS (SPEARS BLUE 75 OR EQUAL)

DRIP VALVE ASSEMBLY 8



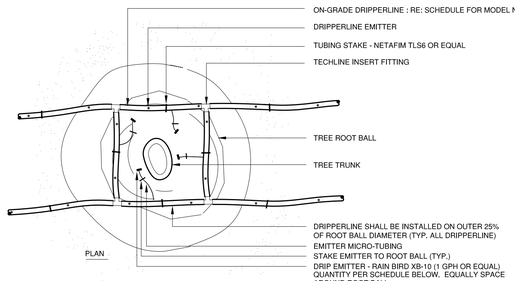
NOTE:

FLUSH ALL LINES THOROUGHLY PRIOR TO CAPPING DRIPPLERLINE

IF PLANTING ON A 5:1 SLOPE OR GREATER, INSTALL EMITTERS ON UPHILL SIDE OF ROOTBALL.

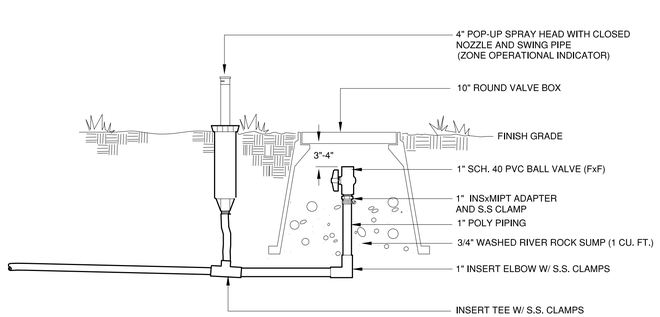
ALL TECHLINE INSERT FITTINGS SHALL BE SECURED WITH STAINLESS STEEL CLAMPS (ONE PER JOINT)

ON-SURFACE DRIPPERLINE 9



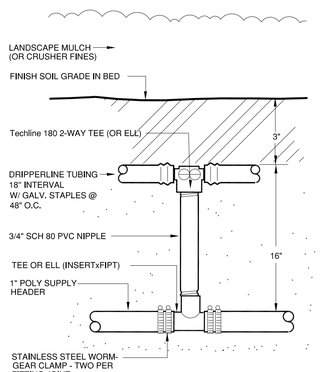
SUPPLEMENTAL "PUNCH-IN" EMITTERS		
PLANT SIZE	FLOW RATE	QUANTITY
6 FT. CONIFEROUS/1-1/2" DECIDUOUS TREE	1.0 GPH	THREE EACH
8 FT. CONIFEROUS/2"-21/2" DECIDUOUS TREE	1.0 GPH	FOUR EACH
10 FT. CONIFEROUS/3" DECIDUOUS TREE	1.0 GPH	SIX EACH
12 FT. CONIFEROUS/31/2" DECIDUOUS TREE	1.0 GPH	SEVEN EACH
14 FT. CONIFEROUS/4" DECIDUOUS TREE	1.0 GPH	EIGHT EACH

DRIP ZONE FLUSH-OUT and OPERATIONAL INDICATOR 10



BALL VALVE HANDLE TO BE EASILY ACCESSIBLE FOR FLUSHING OPERATIONS

DRIPPLERLINE START CONNECTION 11



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IRRIGATION DETAILS

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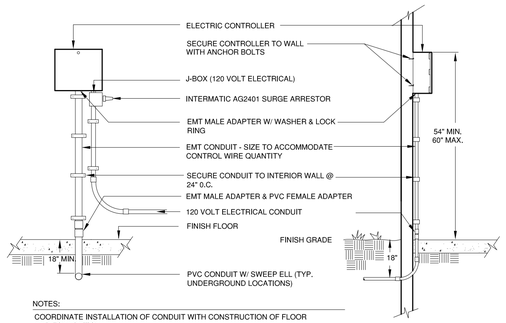


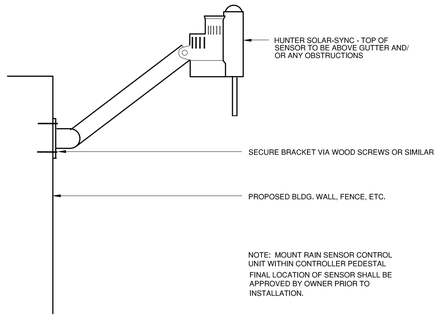
NOTES:

COORDINATE INSTALLATION OF CONDUIT WITH CONSTRUCTION OF FLOOR AND FOUNDATION

IRRIGATION CONTROL WIRE CONDUIT(S) SHALL TERMINATE WITHIN LANDSCAPE AREA. CONDUIT(S) SHALL BE CONTINUOUS.

120 VOLT ELECTRICAL WIRING SHALL NOT BE ROUTED THROUGH IRRIGATION WIRE CONDUIT

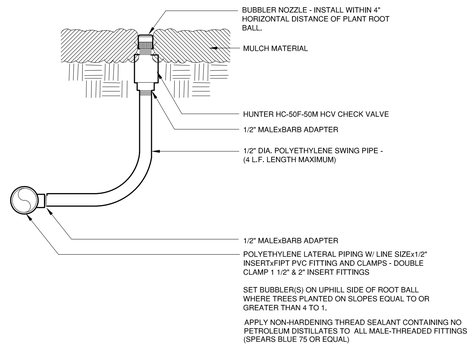
ELECTRIC CONTROLLER 12



NOTE: MOUNT RAIN SENSOR CONTROL UNIT WITHIN CONTROLLER PEDESTAL

FINAL LOCATION OF SENSOR SHALL BE APPROVED BY OWNER PRIOR TO INSTALLATION.

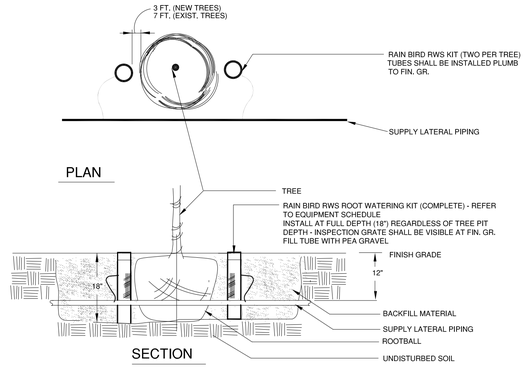
WEATHER SENSOR 13



SET BUBBLER(S) ON UPHILL SIDE OF ROOT BALL WHERE TREES PLANTED ON SLOPES EQUAL TO OR GREATER THAN 4 TO 1.

APPLY NON-HARDENING THREAD SEALANT CONTAINING NO PETROLEUM DISTILLATES TO ALL MALE-THREADED FITTINGS (SPEARS BLUE 75 OR EQUAL)

BUBBLER 14



NOTE:

ALL PERFORATED PIPE SHALL BE INSTALLED PLUMB

INSTALL BUBBLERS ON OPPOSING SIDES OF ROOT BALL

ROOT WATERING SYSTEM 15

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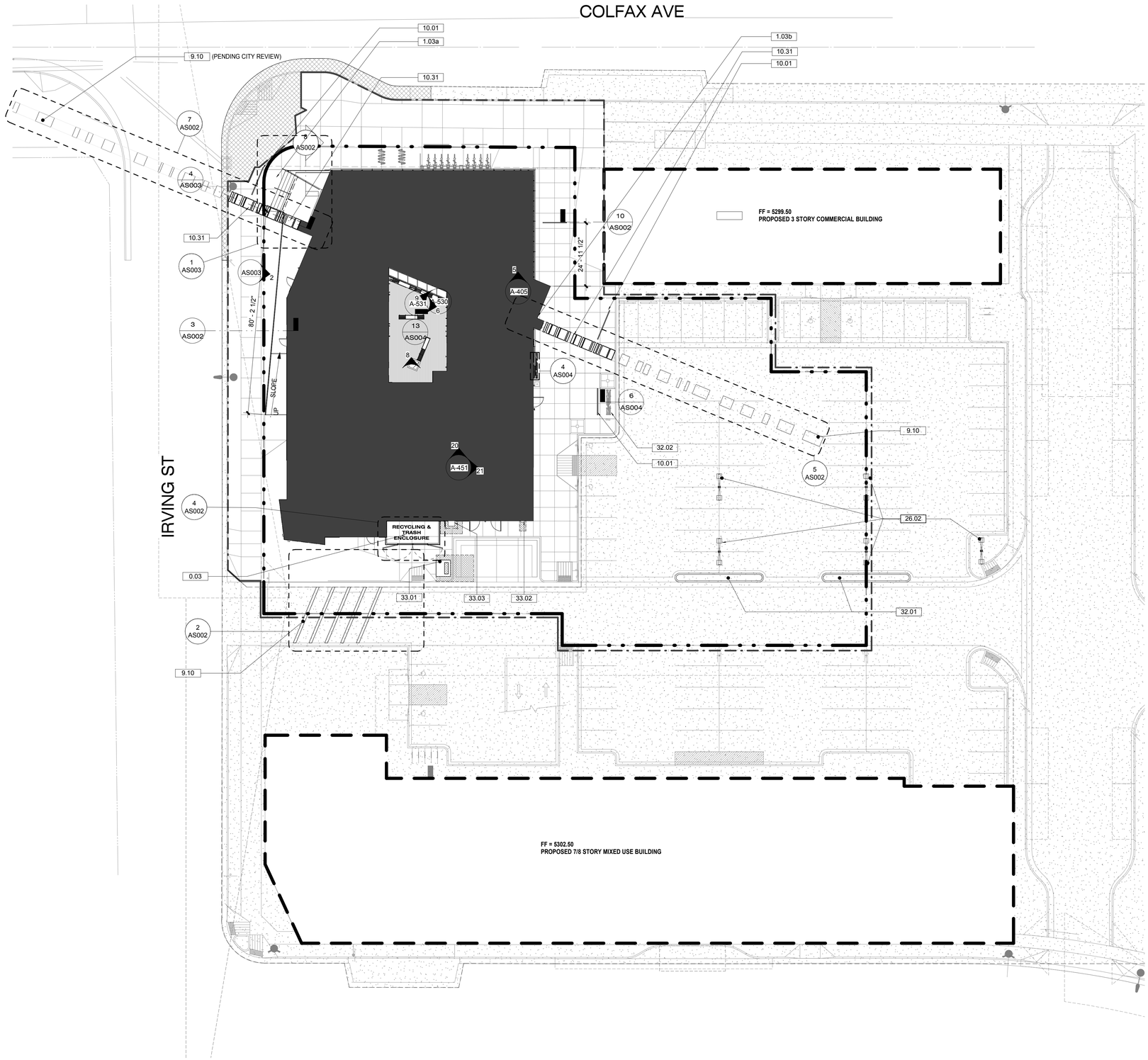

1 AS001 SITE PLAN
1" = 20'-0"

KEYNOTES

0.03	TRASH ENCLOSURE 175 SF RE: AS002
1.03a	ADDITIVE ALTERNATE 3a: SNOWMELT REFER TO M-100
1.03b	ADDITIVE ALTERNATE 3b: SNOWMELT REFER TO M-100
9.10	HIGH PERFORMANCE COATINGS: PROVIDE IN BOXED AREAS. B.O.D. 3M LIQUID PAVEMENT MARKINGS SERIES 1200, TRANTEEX TRAFFIC PAINT ALSO ACCEPTABLE. ARCH TO SELECT FROM FULL RANGE OF STANDARD COLORS
10.01	SIGNAGE NO SMOKING REFER TO LANDSCAPE FOR EXACT LOCATION
10.31	SIGNAGE : STAINED CONCRETE
26.02	EXTERIOR LIGHTING, ALL PARKING LOT LIGHT FIXTURES INCLUDE: LIGHT POLE, FIXTURE AND WIRING AS INDICATED ON ELECTRICAL SITE PLAN ES001, BASE AND CONDUIT PROVIDED BY OTHERS
32.01	PLANTS AND PLANTING IRRIGATION: PLANTING FOR PARKING LOT ISLANDS 32'-0" x 2'-6". AS FOLLOWS: TOPSOIL(6" MIN); SOIL PREP; GROUNDCOVERS (#1 CONTAINER, 15PER ISLAND); DECIDUOUS SHADE TREES (2-1/2" CALIPER, 2 PER ISLAND); GRAVEL MULCH EACH ISLAND; IRRIGATION SHALL BE NETAFIM SUBSURFACE IRRIGATION. PROVIDE IRRIGATION AND POWER FOR (2) PARKING LOT ISLANDS. CONDUIT TO ISLANDS N.I.C., CONDUIT, CURB AND GUTTER BY OTHERS
32.02	SITE FURNISHINGS: SITE BENCH
33.01	TRANSFORMER
33.02	ELECTRIC METER, SIZE & LOCATION TBD
33.03	GAS METER, SIZE & LOCATION TBD

LEGEND - SITE PLAN

SHADED AREA REPRESENTS EXTENTS OF WORK

SHADED WITH STIPPLE AREA REPRESENTS EXTENTS OF WORK TO BE COORDINATED WITH OTHERS

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sDC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02089

ISSUE DATE: 01-12-2012
PHASE: 100% CD

ARCHITECTURAL SITE PLAN

AS001

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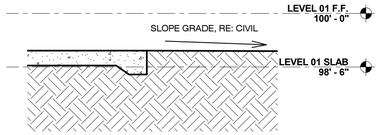
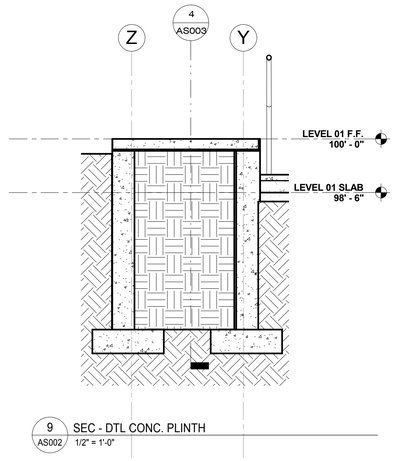
1/13/2012 3:00:09 AM



10 AS002 SEC - SITE EAST WALK
1/2" = 1'-0"



9 AS002 SEC - DTL CONC. PLINTH
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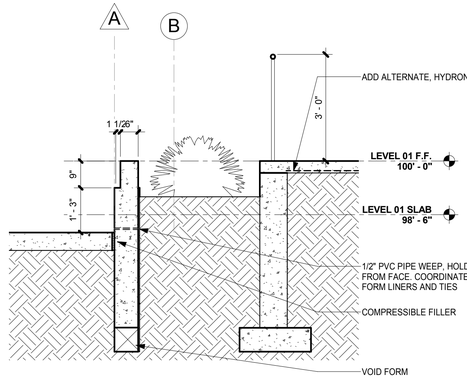
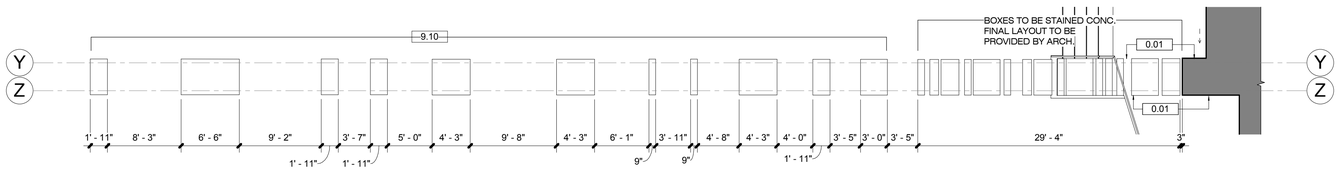


8 AS002 SEC - DTL SITE PLANTER
1/2" = 1'-0"

KEYNOTES

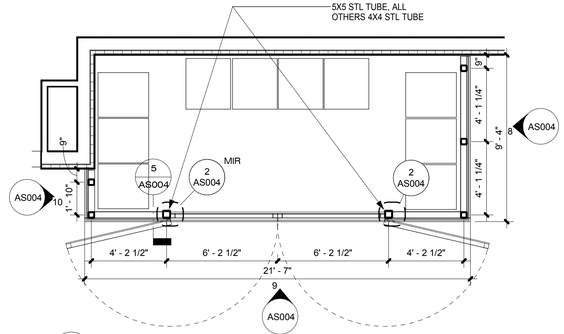
0.01 ALIGN

9.10 HIGH PERFORMANCE COATINGS: PROVIDE IN BOXED AREAS. B.O.D. 3M LIQUID PAVEMENT MARKINGS SERIES 1200, TRANTEEX TRAFFIC PAINT ALSO ACCEPTABLE. ARCH TO SELECT FROM FULL RANGE OF STANDARD COLORS

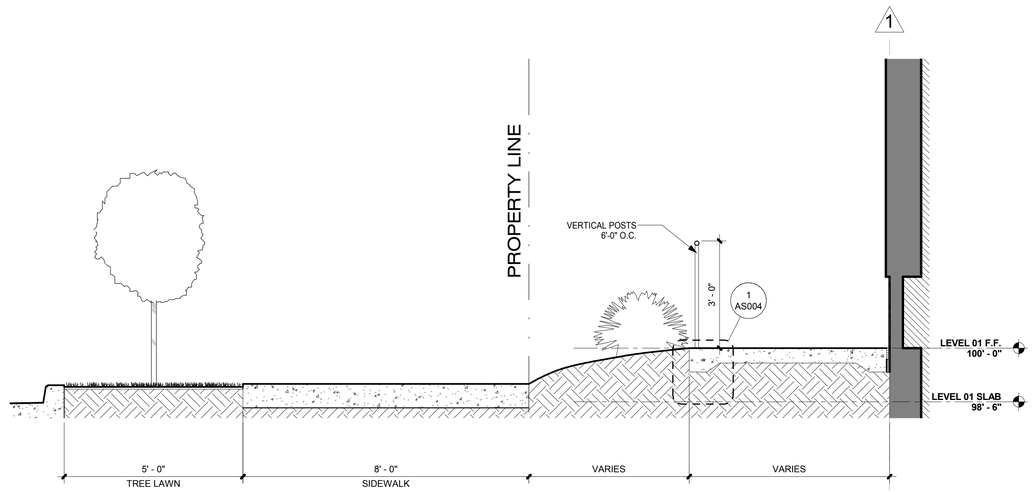


7 AS002 ENLARGED PLAN SITE WEST
1/8" = 1'-0"

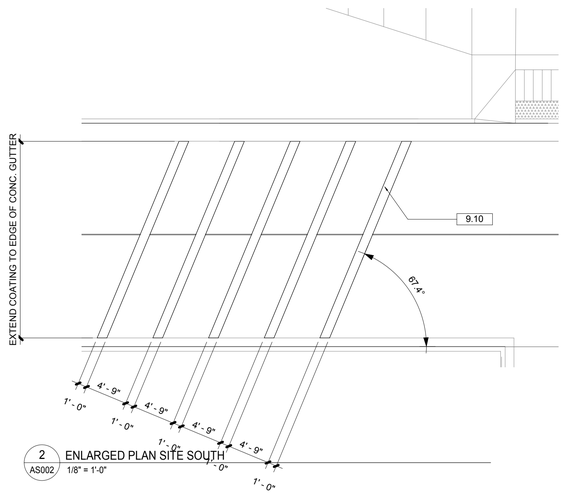
5 AS002 ENLARGED PLAN SITE EAST
1/8" = 1'-0"



4 AS002 ENLARGED PLAN TRASH-RECYCLING ENCLOSURE
1/4" = 1'-0"



3 AS002 SEC - @ SITE RAMP
1/2" = 1'-0"



2 AS002 ENLARGED PLAN SITE SOUTH
1/8" = 1'-0"

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ENLARGED SITE PLANS

AS002

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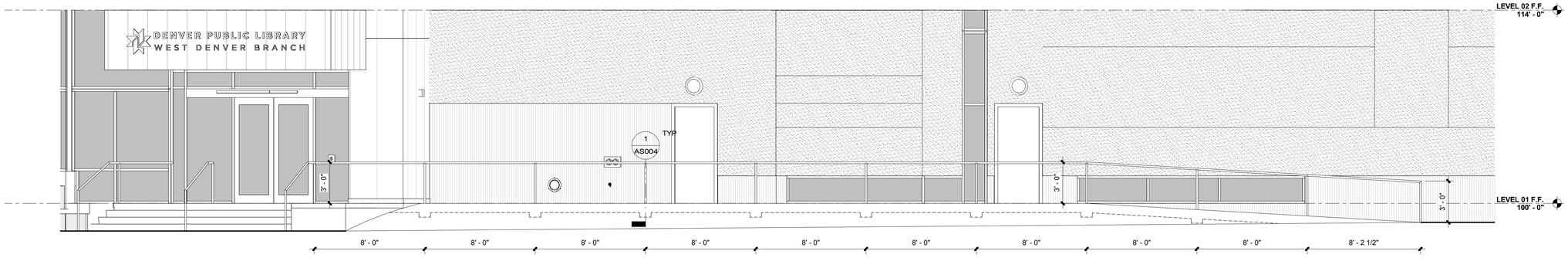
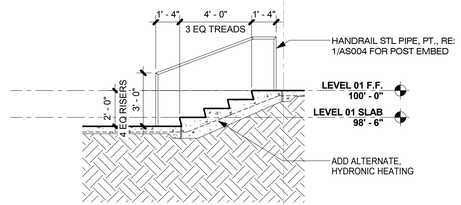
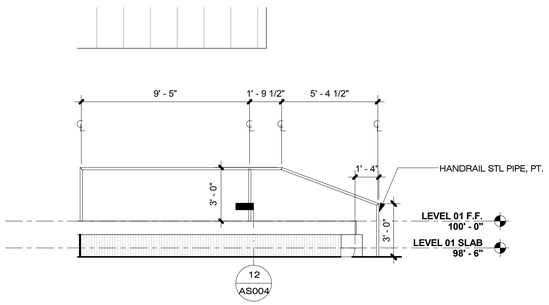


2 AS003 SITE ELEVATION - HANDRAIL
1/4" = 1'-0"

2.1

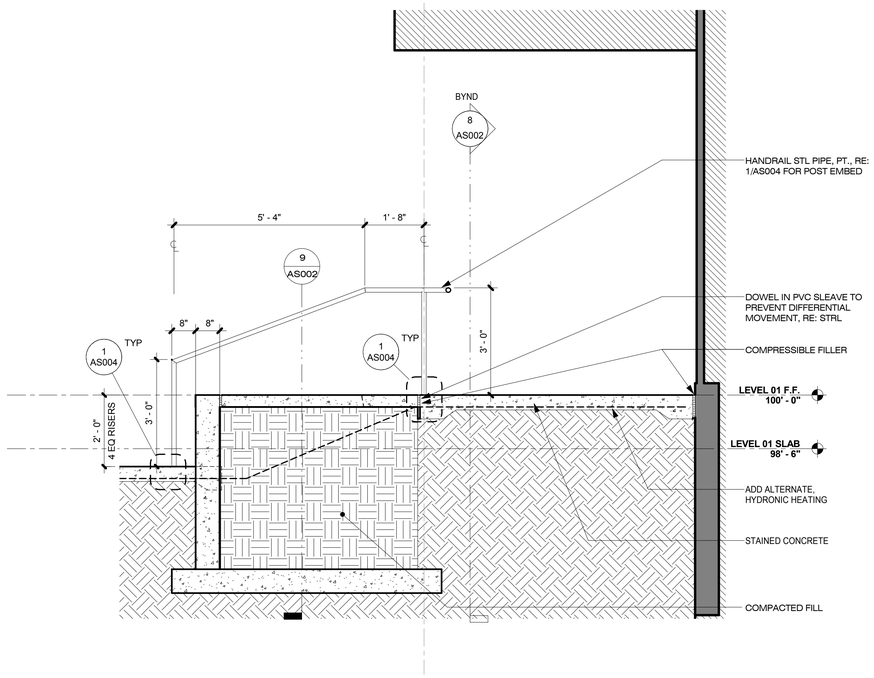


3 AS003 SITE SEC - STAIR AND HANDRAIL
1/4" = 1'-0"

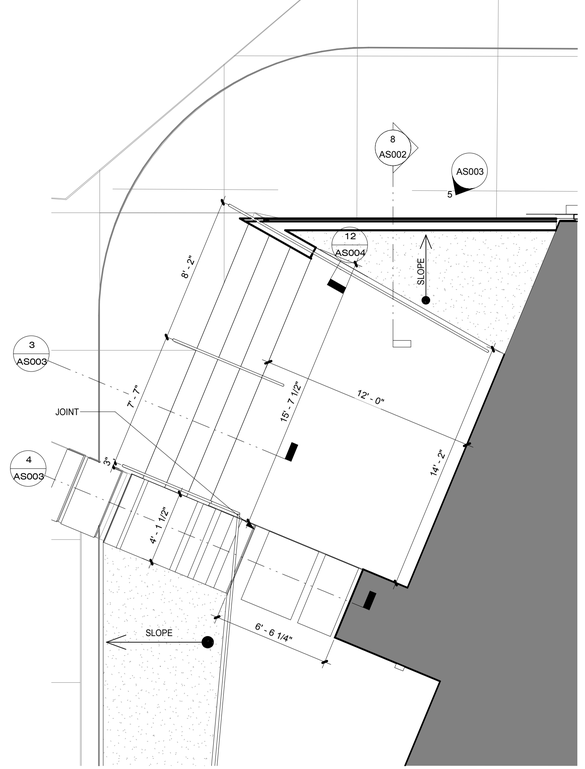


5 AS003 SITE ELEVATION - SITE HANDRAIL NORTH
1/4" = 1'-0"

2.1



4 AS003 SEC @ OUTSIDE LANDING
1/2" = 1'-0"



1 AS003 ENLARGED PLAN SITE ENTRANCE
1/4" = 1'-0"

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ENLARGED SITE PLANS
AND ELEVATIONS

AS003

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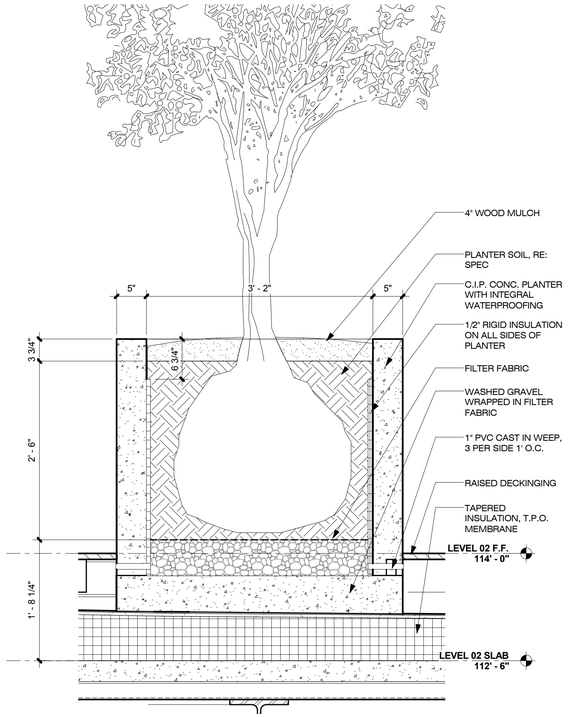
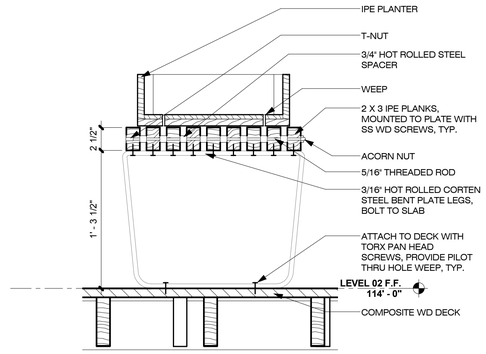
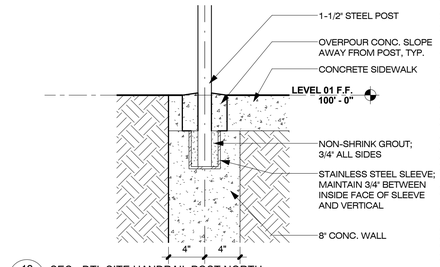


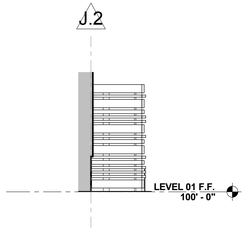
11 AS004 SEC - DTL ROOF PLANTER
1" = 1'-0"



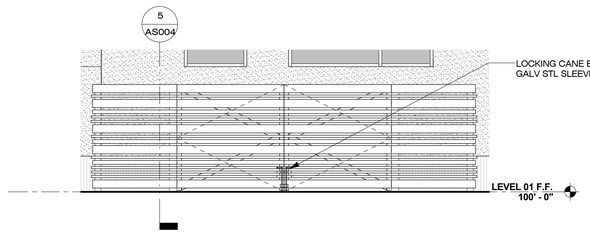
13 AS004 SEC - DTL COURTYARD BENCH
1 1/2" = 1'-0"



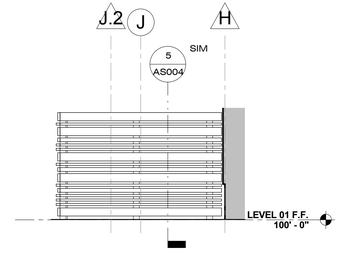
12 AS004 SEC - DTL SITE HANDRAIL POST NORTH
1 1/2" = 1'-0"



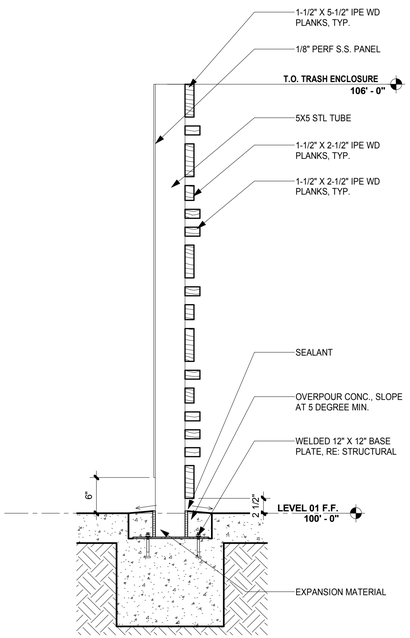
10 AS004 ELEV TRASH - RECYCLING ENCLOSURE WEST
1/4" = 1'-0"



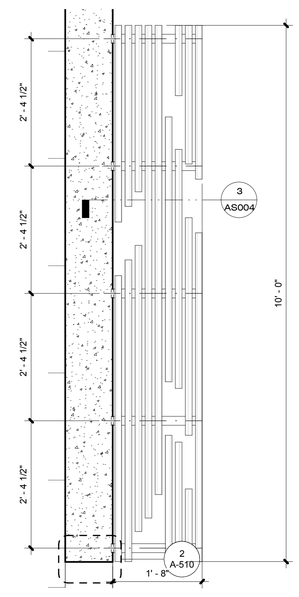
9 AS004 ELEV TRASH - RECYCLING ENCLOSURE SOUTH
1/4" = 1'-0"



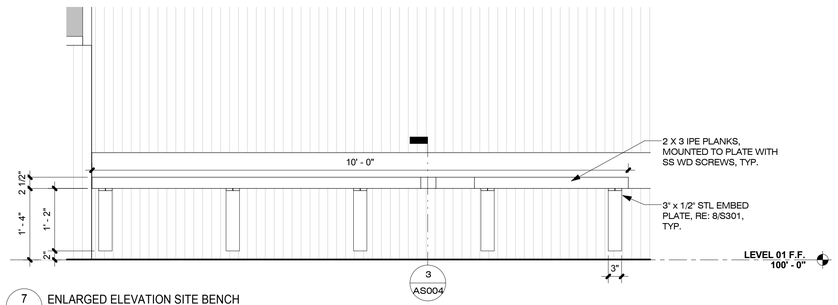
8 AS004 ELEV TRASH - RECYCLING ENCLOSURE EAST
1/4" = 1'-0"



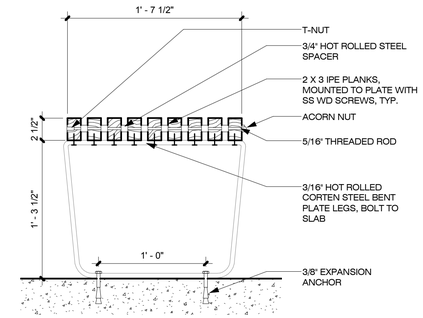
5 AS004 SEC - DTL @ TRASH ENCLOSURE
1" = 1'-0"



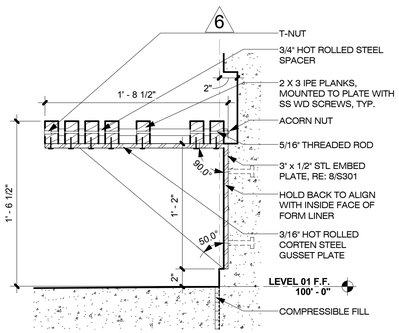
4 AS004 ENLARGED PLAN - BENCH
3/4" = 1'-0"



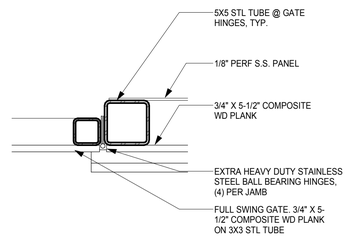
7 AS004 ENLARGED ELEVATION SITE BENCH
3/4" = 1'-0"



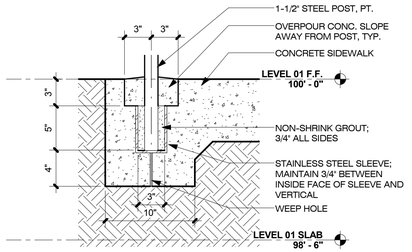
6 AS004 SEC - DTL SITE BENCH
1 1/2" = 1'-0"



3 AS004 SECTION DTL - WALL MOUNTED BENCH
1 1/2" = 1'-0"



2 AS004 PLAN - DTL DOOR @ TRASH ENCLOSURE
1 1/2" = 1'-0"



1 AS004 SEC - DTL SITE HANDRAIL POST
1 1/2" = 1'-0"

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11-23-2011	75% CD
12-19-2011	99% CD

ARCHITECTURAL SITE DETAILS

AS004

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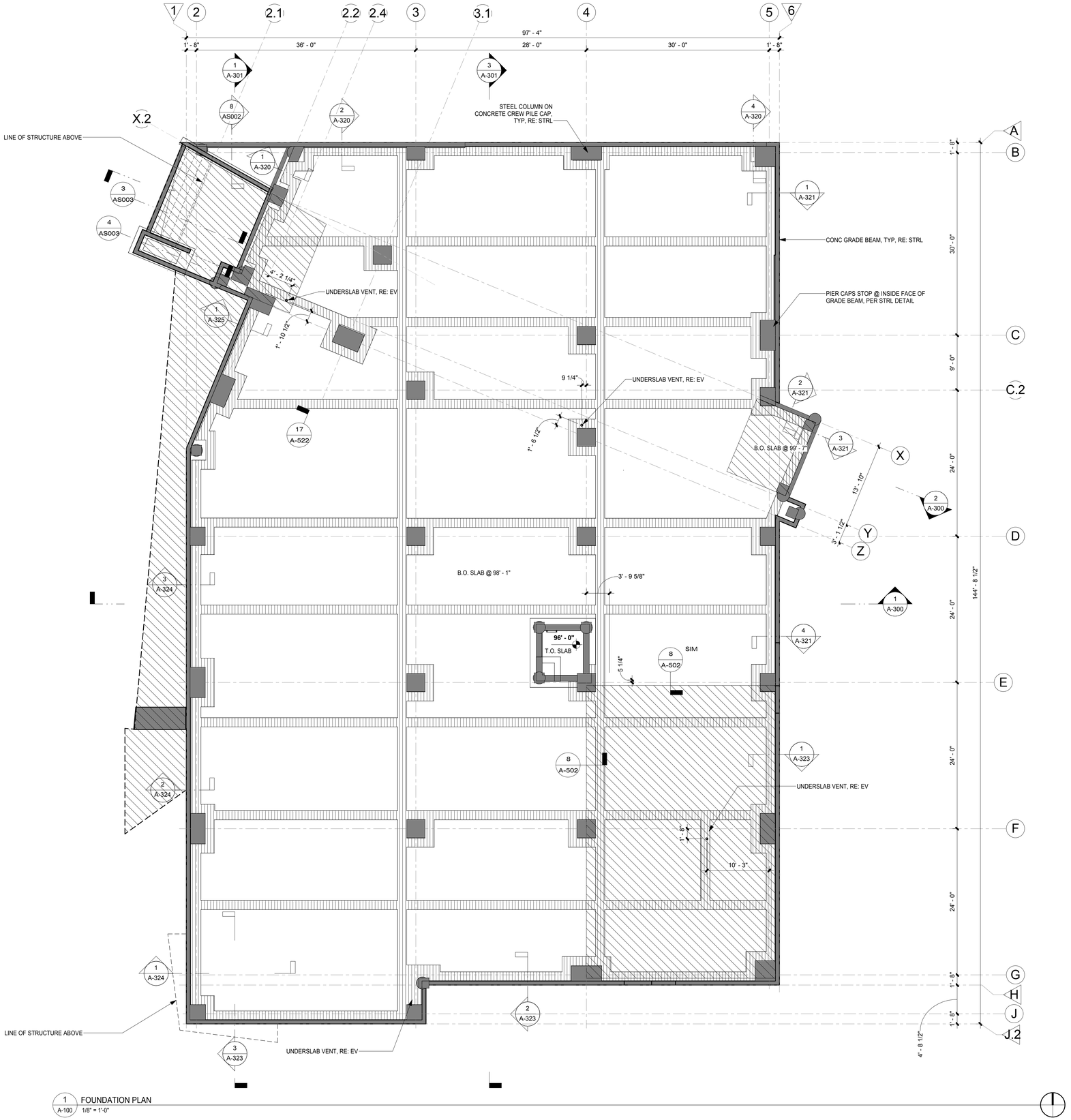

1 FOUNDATION PLAN
A-100 1/8" = 1'-0"

GENERAL NOTES

1. DO NOT SCALE DRAWINGS. SCALES ON DRAWINGS ARE FOR FULL SIZE DRAWINGS, PRINTED ON 24X36 SIZE SHEETS. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE. IF ADDITIONAL DIMENSIONS ARE REQUIRED, CONTACT ARCHITECT.

2. CONTRACTOR TO VERIFY ALL FIELD CONDITIONS AND DIMENSIONS AND LAY OUT PROPOSED WORK PRIOR TO COMMENCEMENT WITH CONSTRUCTION. REPORT DISCREPANCIES TO ARCHITECT FOR RESOLUTION.

3. IN THE EVENT OF CONFLICTING OR UNCLEAR INFORMATION, CONTRACTOR SHALL CONTACT ARCHITECT FOR CLARIFICATION BEFORE COMMENCING WITH THE WORK AFFECTED.

4. CONTRACTOR SHALL VERIFY ALL SITE CONDITIONS, LOCATION, AND DISPOSITION OF EXISTING UTILITIES AND EASEMENTS.

5. ALL WORK SHALL CONFORM TO APPLICABLE CODES. NOTIFY ARCHITECT OF ANY CONDITIONS OR DETAILS WHICH ARE DEEMED TO BE NONCONFORMING.

6. CONTRACTOR SHALL SET DOORS TO MEET ADA REQUIRED CLEARANCES WITH THE LATCH SIDE OF DOOR TO HAVE 12" ON PUSH SIDE AND 18" ON PULL SIDE U.O.N. ON DRAWINGS.

7. DIMENSIONS TO FACE/STUDS IN SHELVING ALCOVE LOCATIONS SHALL BE COORDINATED WITH SHELVING MANUFACTURER/SUPPLIER.

GENERAL FOUNDATION NOTES

1) OVEREXCAVATE NATIVE SOILS BENEATH ALL INTERIOR SLABS ON GRADE: REMOVE AND DISPOSE EXISTING SOILS 36" BENEATH B.O.SLAB, REPLACE WITH COMPACTED STRUCTURAL FILL.

2) PROVIDE SUB-SURFACE DRAINS AND ENVIRONMENTAL VENTING SYSTEMS PER CIVIL + EV. ENG. DOCUMENTS

LEGEND

SLAB ON GRADE

VAPOR VENTILATION, RE: EV

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PROJECT:
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1498 NORTH IRVING STREET
DENVER, COLORADO 80204

sDC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02089

ISSUE DATE	PHASE
11-23-2011	75% CD
12-19-2011	99% CD

FOUNDATION PLAN

A-100

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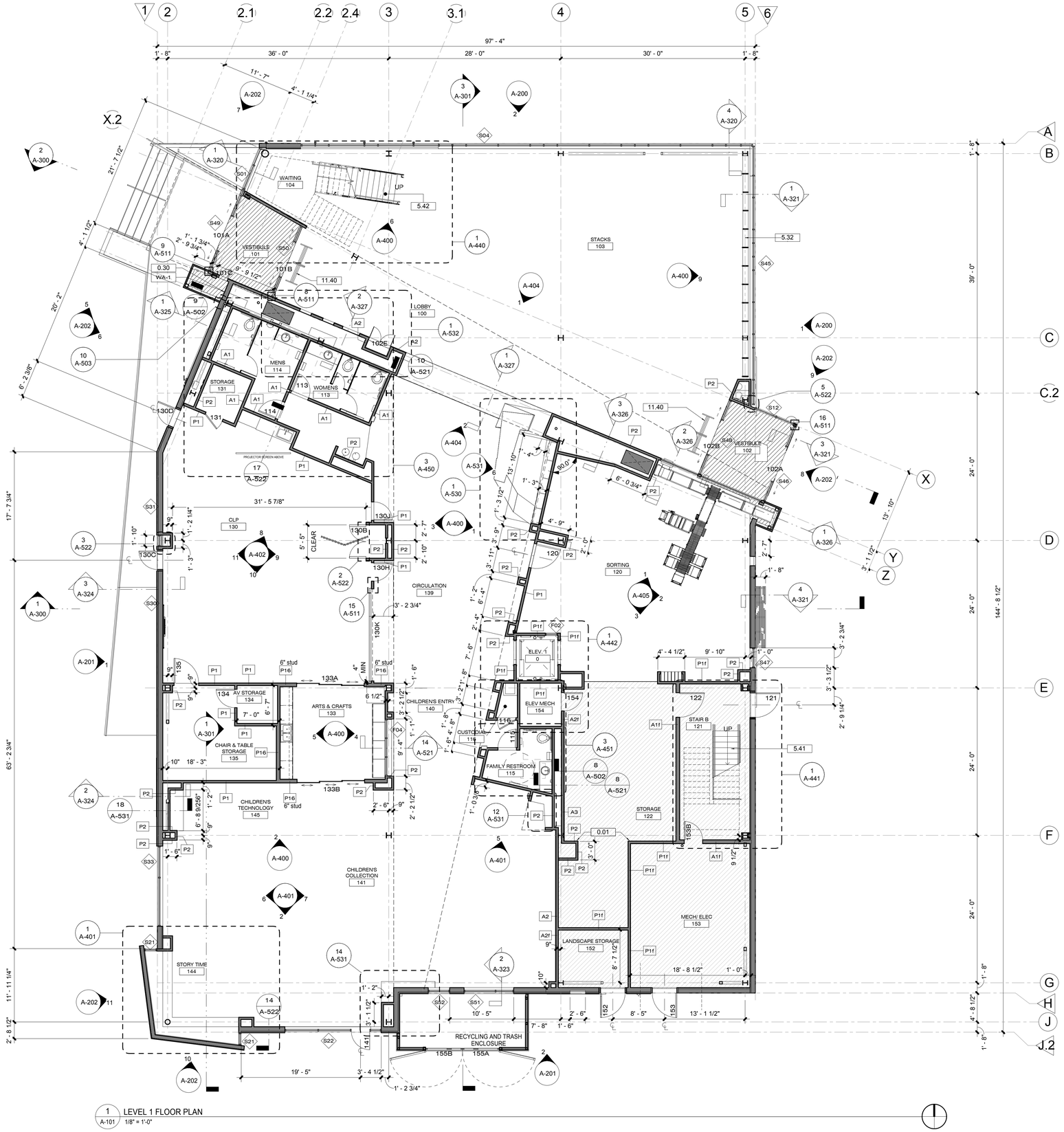

GENERAL NOTES

1. DO NOT SCALE DRAWINGS. SCALES ON DRAWINGS ARE FOR FULL SIZE DRAWINGS, PRINTED ON 24X36 SIZE SHEETS. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE. IF ADDITIONAL DIMENSIONS ARE REQUIRED, CONTACT ARCHITECT.

2. CONTRACTOR TO VERIFY ALL FIELD CONDITIONS AND DIMENSIONS AND LAY OUT PROPOSED WORK PRIOR TO COMMENCEMENT WITH CONSTRUCTION. REPORT DISCREPANCIES TO ARCHITECT FOR RESOLUTION.

3. IN THE EVENT OF CONFLICTING OR UNCLEAR INFORMATION, CONTRACTOR SHALL CONTACT ARCHITECT FOR CLARIFICATION BEFORE COMMENCING WITH THE WORK AFFECTED.

4. CONTRACTOR SHALL VERIFY ALL SITE CONDITIONS, LOCATION, AND DISPOSITION OF EXISTING UTILITIES AND EASEMENTS.

5. ALL WORK SHALL CONFORM TO APPLICABLE CODES. NOTIFY ARCHITECT OF ANY CONDITIONS OR DETAILS WHICH ARE DEEMED TO BE NONCONFORMING.

6. CONTRACTOR SHALL SET DOORS TO MEET ADA REQUIRED CLEARANCES WITH THE LATCH SIDE OF DOOR TO HAVE 12" ON PUSH SIDE AND 18" ON PULL SIDE U.O.N. ON DRAWINGS.

7. DIMENSIONS TO FACE/STUDS IN SHELVING ALCOVE LOCATIONS SHALL BE COORDINATED WITH SHELVING MANUFACTURER/SUPPLIER.

GENERAL PLAN NOTES

1. ALL WALLS TYPE P1 U.O.N.

2. EQUIPMENT SHOWN ON FFE PLAN

3. ALL UNMARKED PARTITIONS ARE P1

LEGEND - PLAN

SLAB ON GRADE

CEILING TRANSITION ABOVE

KEYNOTES

0.01	ALIGN
0.30	THIS WALL ONLY: NOT METAL PANEL, NO MINERAL WOOL INSULATION, NO FLUID APPLIED MOISTURE BARRIER
5.32	METAL FABRICATION, STEEL PLATE AND MDF SHELVING ASSEMBLY
5.41	METAL STAIRS, ASSEMBLY 2 EGRESS STAIR
5.42	METAL STAIRS, PRE MANUFACTURED CONCRETE PAN, RE: SPEC
6.02	INTERIOR ARCHITECTURAL WOODWORK, BUILT-IN DESK
10.03	KNOX BOX
11.40	EQUIPMENT, OWNER PROVIDED AND INSTALLED
26.03	EXTERIOR LIGHT FIXTURE, BUILDING MOUNTED, RE: ELEC

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eDC PROJECT NO: 1020.00
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LEVEL ONE FLOOR PLAN

A-101

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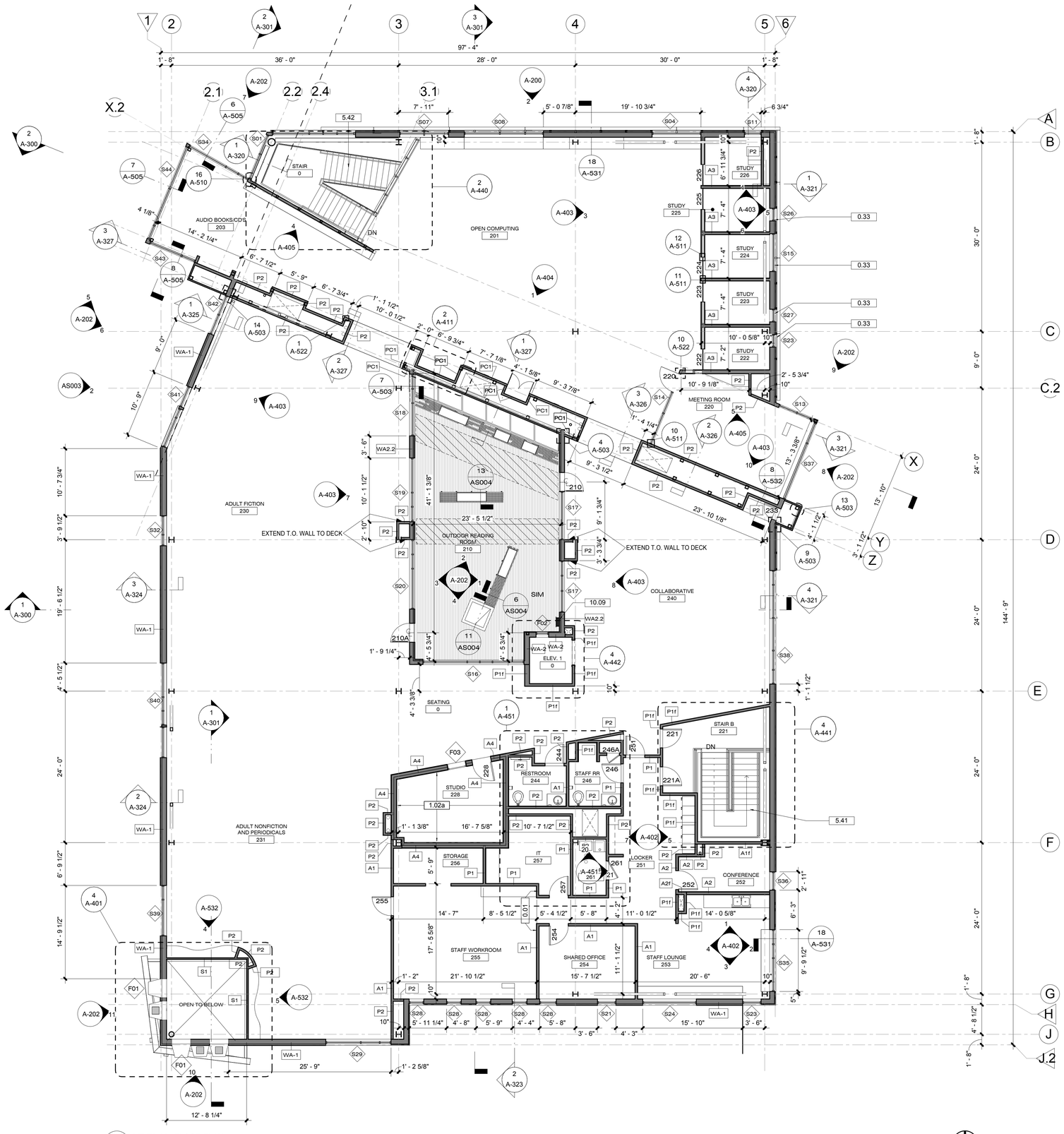

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GENERAL PLAN NOTES

1. ALL WALLS TYPE P1 U.O.N.

2. EQUIPMENT SHOWN ON FFE PLAN

3. ALL UNMARKED PARTITIONS ARE P1

KEYNOTES

0.01	ALIGN
0.33	WINDOWS ALIGN WITH BATTENS
1.02a	ADDITIVE ALTERNATE 7: ACOUSTICAL TREATMENTS IN THE STUDIO (50% FABRIC WRAPPED PANELS)
1.05	ADDITIVE ALTERNATE 6: WINDOWS IN CHILDREN'S AREA
5.41	METAL STAIRS, ASSEMBLY 2 EGRESS STAIR
5.42	METAL STAIRS, PRE MANUFACTURED CONCRETE PAN, RE: SPEC
6.05	INTERIOR ARCHITECTURAL WOODWORK, BUILT-IN COUNTER
10.04	VISUAL DISPLAY SURFACES, BOARD 1, PURCHASED BY DPL, INSTALLED BY DPL
10.09	LOCKABLE WALL MOUNTED HOSE REEL

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PROJECT: WEST DENVER BRANCH LIBRARY
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LEVEL TWO FLOOR PLAN

A-102

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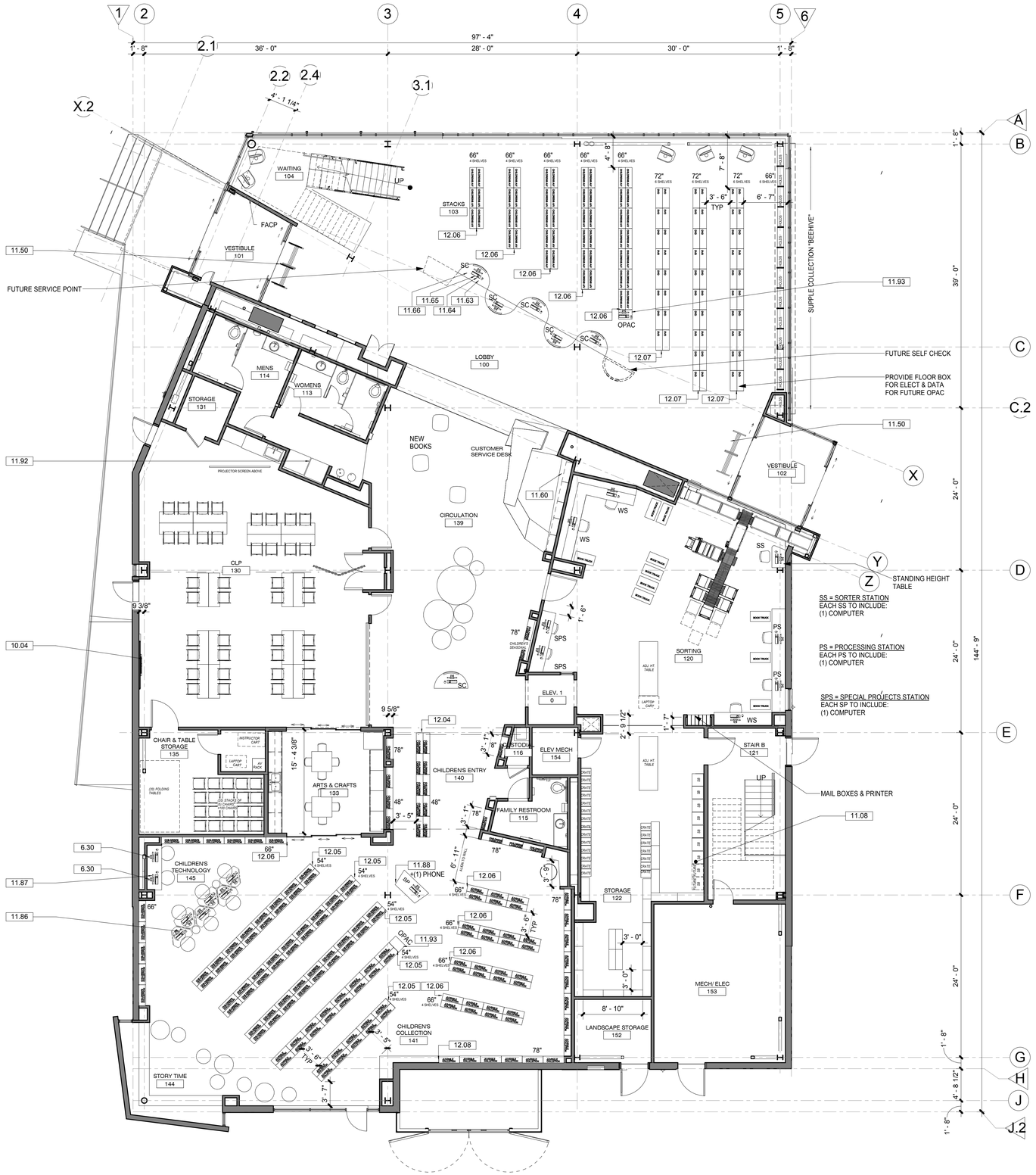

1 / A-110 LEVEL 1 FURNITURE PLAN 1/8" = 1'-0"

N.I.C.

GENERAL NOTES - FURNITURE

1. NOTE: MOVEABLE FURNISHINGS ARE P.B.O., I.B.O., SHOWN HERE FOR INFORMATION ONLY.
G.C. IS RESPONSIBLE FOR PROVIDING SOME OF THE EQUIPMENT SHOWN, COORDINATING ASSOCIATED ELECTRICAL AND TELECOM DEVICES, AND NECESSARY BLOCKING FOR BUILT-IN CABINETRY, ETC. REFER TO PROJECT MANUAL DIVISION 11 FOR EQUIPMENT LIST AND GENERAL CONTRACTOR'S RESPONSIBILITIES THEREWITH.
2. ⬚ FUTURE EQUIPMENT / FURNITURE.
3. ▭ PROVIDE POWER AND DATA TO HATCHED FURNITURE.
4. ALL WORKSTATIONS TO HAVE LED TASK LIGHT U.O.N.

KEYNOTES

6.30	GROMMET, CABLE TRAY BELOW
10.04	VISUAL DISPLAY SURFACES, BOARD 1, PURCHASED BY DPL, INSTALLED BY DPL
11.08	SMART BIN, PURCHASED BY DPL, INSTALLED BY DPL
11.50	RFID SECURITY GATE, PURCHASED BY DPL, INSTALLED BY TECH LOGIC
11.60	PRINTER, PURCHASED BY DPL, INSTALLED BY DPL
11.63	RECEIPT PRINTER, PURCHASED BY DPL, INSTALLED BY DPL
11.64	BARCODE SCANNER, PURCHASED BY DPL, INSTALLED BY DPL
11.65	RFID PAD, PURCHASED BY DPL, INSTALLED BY DPL
11.66	3M SELF CHECK STATION, PURCHASED BY DPL, INSTALLED BY 3M
11.86	PUBLIC COMPUTER, PURCHASED BY DPL, INSTALLED BY DPL
11.87	CHILDREN'S EARLY LEARNING PC'S, PURCHASED BY DPL, INSTALLED BY DPL
11.88	STAFF COMPUTER, PURCHASED BY DPL, INSTALLED BY DPL
11.92	VENDING MACHINES - LEASED BY DPL, INSTALLED BY VENDOR, N.I.C.
11.93	OPAC
12.04	END PANEL - 48" N.I.C.
12.05	END PANEL - 54" N.I.C.
12.06	END PANEL - 66" N.I.C.
12.07	END PANEL - 72" N.I.C.
12.08	END PANEL - 78" N.I.C.

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LEVEL 1 FF&E PLAN

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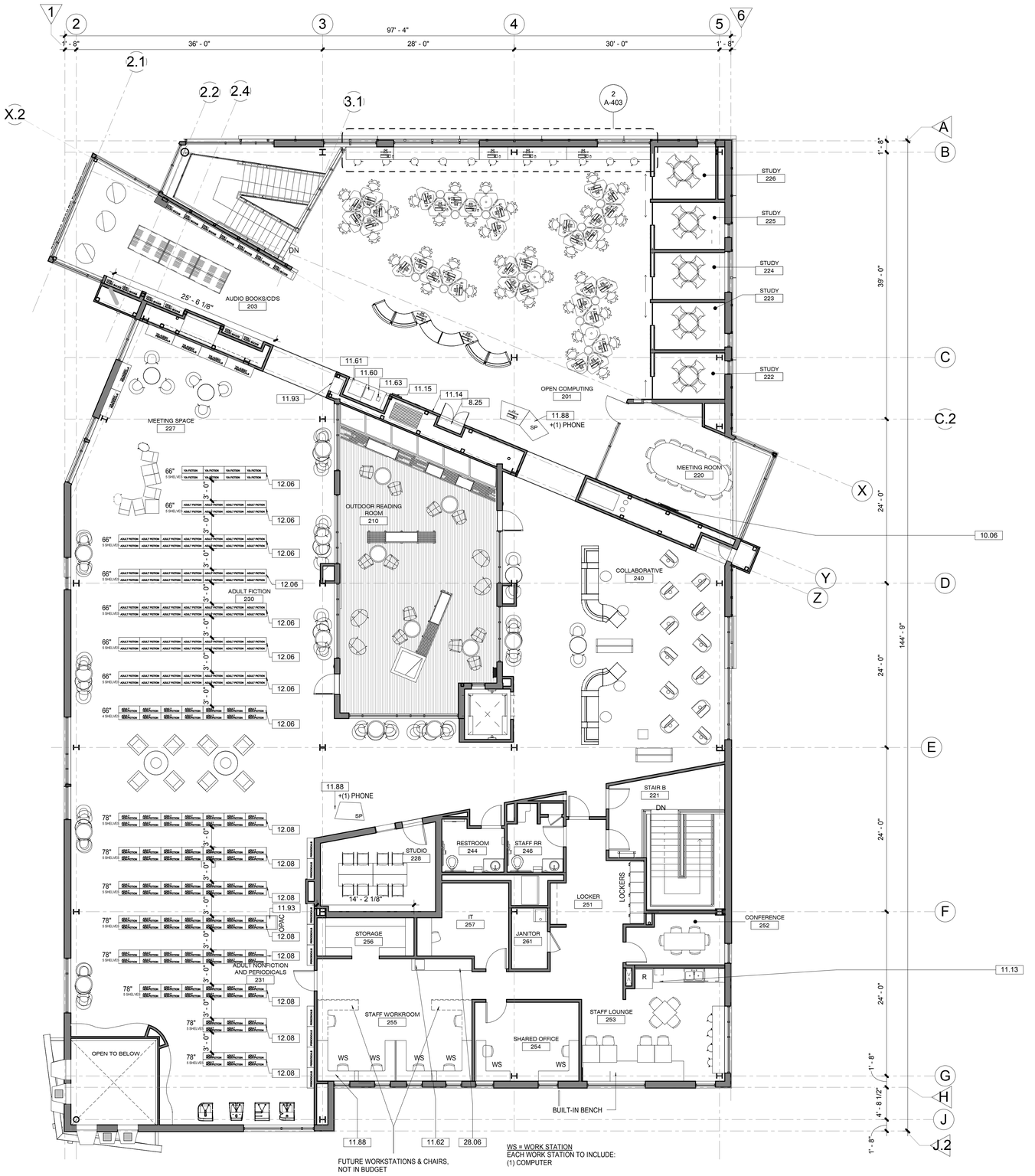

1 / A-111 LEVEL 02 - FURNITURE PLAN N.I.C.

1/8" = 1'-0"

GENERAL NOTES - FURNITURE

1. NOTE: MOVEABLE FURNISHINGS ARE P.B.O., I.B.O., SHOWN HERE FOR INFORMATION ONLY.
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2. ⬚ FUTURE EQUIPMENT / FURNITURE.
3. ▭ PROVIDE POWER AND DATA TO HATCHED FURNITURE.
4. ALL WORKSTATIONS TO HAVE LED TASK LIGHT U.O.N.

KEYNOTES

8.25	ALUMINUM FRAMED POLYCARBONATE DOORS WITH GROMMETED OPENINGS FOR TRASH
10.06	VISUAL DISPLAY SURFACES, BOARD 2
11.12	RESIDENTIAL APPLIANCES, MICROWAVE, PURCHASED BY GC, INSTALLED BY GC
11.13	RESIDENTIAL APPLIANCES, DISHWASHER, PURCHASED BY GC, INSTALLED BY GC
11.14	LCD DISPLAY, RE: AV/IT, PROVIDE WALL BLOCKING, PURCHASED BY DPL, INSTALLED BY GC
11.15	LCD TOUCH SCREEN WALL MOUNT - PURCHASED BY DPL, INSTALLED BY DPL, BACKING PROVIDED BY GC
11.60	PRINTER, PURCHASED BY DPL, INSTALLED BY DPL
11.61	COPIER - LEASED BY DPL
11.62	STAFF PRINTER/FAX/COPIER COMBO, 2ND FLOOR WORKROOM, PURCHASED BY DPL, INSTALLED BY DPL
11.63	RECEIPT PRINTER, PURCHASED BY DPL, INSTALLED BY DPL
11.88	STAFF COMPUTER, PURCHASED BY DPL, INSTALLED BY DPL
11.93	OPAC
12.06	END PANEL - 66" N.I.C.
12.08	END PANEL - 78" N.I.C.
28.06	SECURITY: DEDICATED MONITOR FOR VIEWING CAMERAS

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LEVEL 2 FF&E PLAN

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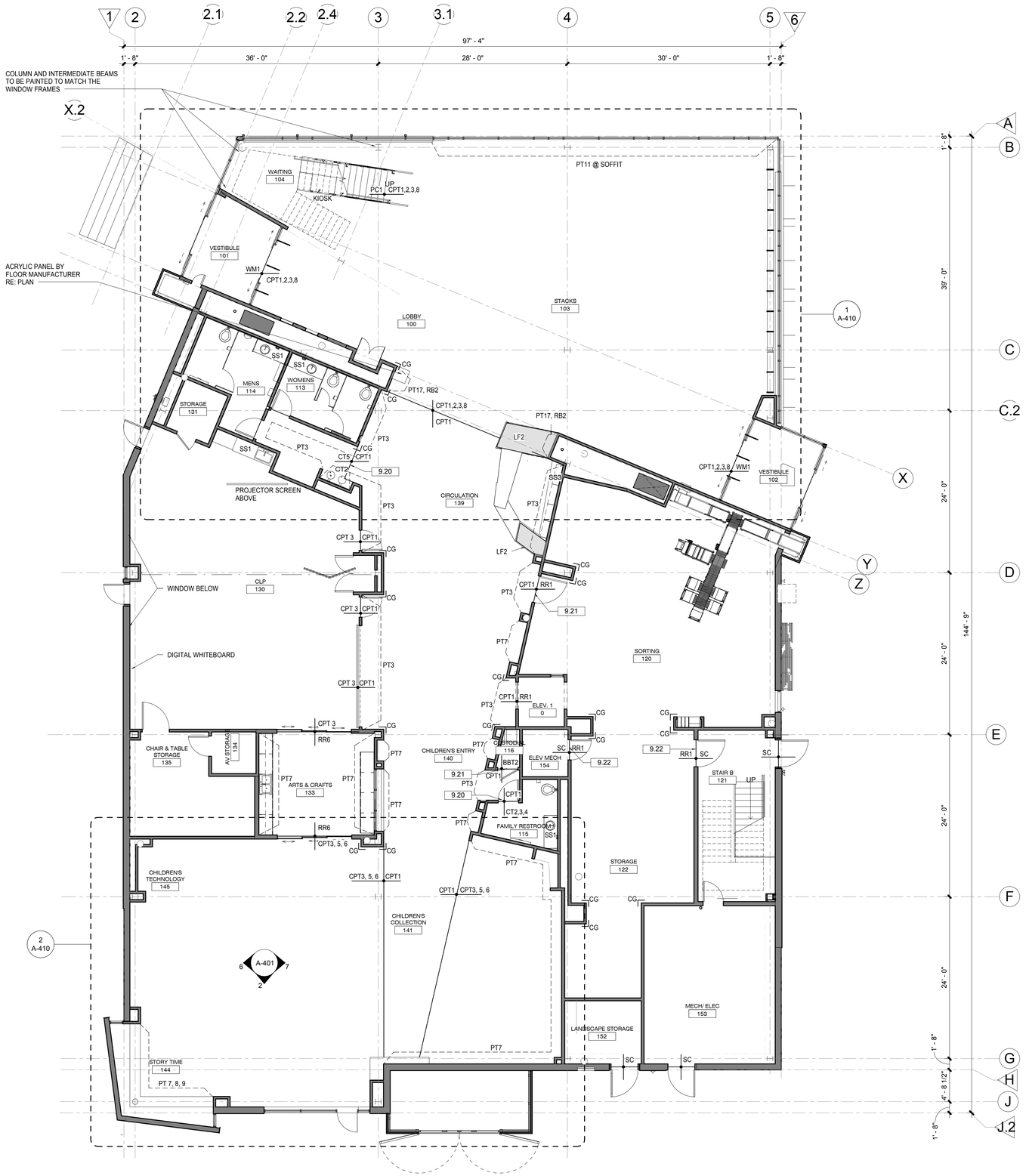

1 LEVEL 1 FINISH PLAN
A-112 1/8" = 1'-0"

GENERAL NOTES

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7. DIMENSIONS TO FACE/STUDS IN SHELVING ALCOVE LOCATIONS SHALL BE COORDINATED WITH SHELVING MANUFACTURER/SUPPLIER.

GENERAL NOTES - FINISHES

1. ALL INTERIOR WALL FINISHES TO BE PT1 UNLESS OTHERWISE NOTED.

2. ALL INTERIOR GWB CEILING FINISH TO BE PT12 UNLESS OTHERWISE NOTED.

3. ALL SOFFITS TO BE PAINTED SAME COLOR AS WALL BELOW (FACE AND UNDERSIDE).

4. WHERE MULTIPLE FLOOR FINISHES ARE INDICATED FOR ONE SPACE, REFER TO SHEET A410.

5. ALL EXPOSED CONCRETE FLOORS SHALL RECEIVE SEALER.

6. EXPOSED ACOUSTICAL DECK CEILINGS ARE FACTORY FINISHED.

7. NOT USED

8. ALL STRUCTURE TO BE PT11 UNLESS OTHERWISE NOTED.

9. WHERE MULTIPLE WALL FINISHES ARE INDICATED, REFER TO CORRESPONDING ELEVATIONS.

10. ALL DOORS, DOOR TRIM, CHAIR RAILS, ETC. TO BE PAINTED IN SEMI GLOSS FINISH IN SAME COLOR AS ADJACENT WALL.

11. PLEASE ALLOW RUBBER TILE IN ELEVATOR TO OFF-GAS BY LEAVING ELEVATOR DOOR OPEN DURING CONSTRUCTION AS MUCH AS POSSIBLE.

12. REFER TO PROJECT MANUAL FOR SCHEDULE OF FINISHES.

13. TILE IN RESTROOMS TO SLOPE AT FLOOR DRAINS.

14. FLOORING TRANSITIONS TO BE CENTERED AT DOOR UNLESS OTHERWISE NOTED.

LEGEND - FINISHES

BBT	- BIO-BASED TILE
CG	- CORNER GUARD - STAINLESS STEEL
CPT	- CARPET TILE
CT	- CERAMIC TILE
GL	- GLASS
LF	- LINOLEUM
PC	- POLISHED CONCRETE
RB	- RUBBER BASE
RR	- RECYCLED RUBBER
SC	- SEALED CONCRETE
SR	- STATIC CONTROL RESILIENT FLOORING
WM	- WALK OFF MAT
WD	- WOOD DECKING

KEYNOTES

9.20	TR-1: CPT TRANSITION TO CT
9.21	TR-2: CPT TRANSITION TO BBT, LF, RR
9.22	TR-3: SC TRANSITION TO RR

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LEVEL 1 FINISH PLAN

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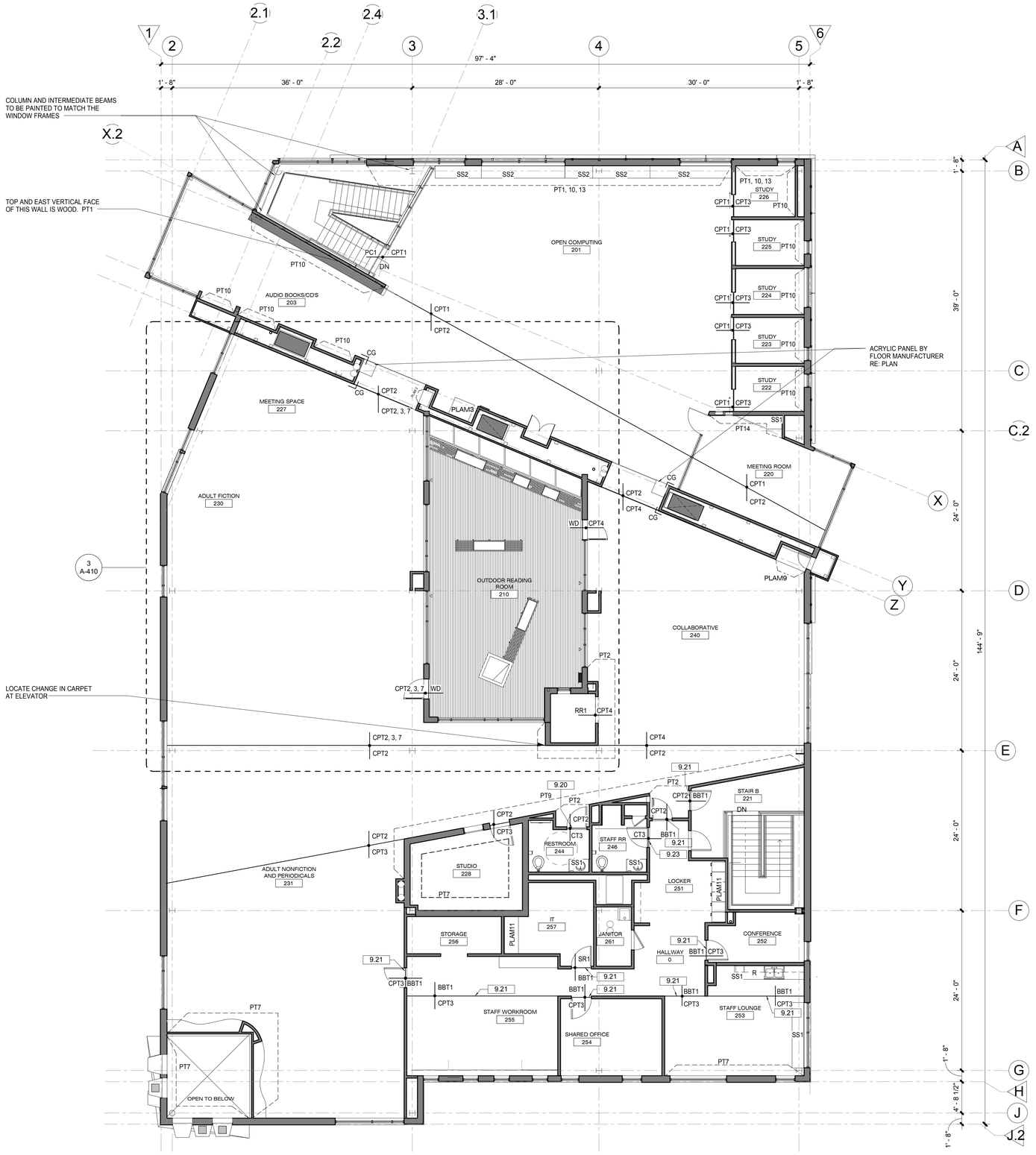

1 A-113 LEVEL 2 FINISH PLAN
1/8" = 1'-0"

GENERAL NOTES

1. DO NOT SCALE DRAWINGS. SCALES ON DRAWINGS ARE FOR FULL SIZE DRAWINGS, PRINTED ON 24X36 SIZE SHEETS. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE. IF ADDITIONAL DIMENSIONS ARE REQUIRED, CONTACT ARCHITECT.

2. CONTRACTOR TO VERIFY ALL FIELD CONDITIONS AND DIMENSIONS AND LAY OUT PROPOSED WORK PRIOR TO COMMENCEMENT WITH CONSTRUCTION. REPORT DISCREPANCIES TO ARCHITECT FOR RESOLUTION.

3. IN THE EVENT OF CONFLICTING OR UNCLEAR INFORMATION, CONTRACTOR SHALL CONTACT ARCHITECT FOR CLARIFICATION BEFORE COMMENCING WITH THE WORK AFFECTED.

4. CONTRACTOR SHALL VERIFY ALL SITE CONDITIONS, LOCATION, AND DISPOSITION OF EXISTING UTILITIES AND EASEMENTS.

5. ALL WORK SHALL CONFORM TO APPLICABLE CODES. NOTIFY ARCHITECT OF ANY CONDITIONS OR DETAILS WHICH ARE DEEMED TO BE NONCONFORMING.

6. CONTRACTOR SHALL SET DOORS TO MEET ADA REQUIRED CLEARANCES WITH THE LATCH SIDE OF DOOR TO HAVE 12" ON PUSH SIDE AND 18" ON PULL SIDE U.O.N. ON DRAWINGS.

7. DIMENSIONS TO FACE/STUDS IN SHELVING ALCOVE LOCATIONS SHALL BE COORDINATED WITH SHELVING MANUFACTURER/SUPPLIER.

GENERAL NOTES - FINISHES

1. ALL INTERIOR WALL FINISHES TO BE PT1 UNLESS OTHERWISE NOTED.

2. ALL INTERIOR GWB CEILING FINISH TO BE PT12 UNLESS OTHERWISE NOTED.

3. ALL SOFFITS TO BE PAINTED SAME COLOR AS WALL BELOW (FACE AND UNDERSIDE).

4. WHERE MULTIPLE FLOOR FINISHES ARE INDICATED FOR ONE SPACE, REFER TO SHEET A410.

5. ALL EXPOSED CONCRETE FLOORS SHALL RECEIVE SEALER.

6. EXPOSED ACOUSTICAL DECK CEILINGS ARE FACTORY FINISHED.

7. NOT USED

8. ALL STRUCTURE TO BE PT11 UNLESS OTHERWISE NOTED.

9. WHERE MULTIPLE WALL FINISHES ARE INDICATED, REFER TO CORRESPONDING ELEVATIONS.

10. ALL DOORS, DOOR TRIM, CHAIR RAILS, ETC. TO BE PAINTED IN SEMI GLOSS FINISH IN SAME COLOR AS ADJACENT WALL.

11. PLEASE ALLOW RUBBER TILE IN ELEVATOR TO OFF-GAS BY LEAVING ELEVATOR DOOR OPEN DURING CONSTRUCTION AS MUCH AS POSSIBLE.

12. REFER TO PROJECT MANUAL FOR SCHEDULE OF FINISHES.

13. TILE IN RESTROOMS TO SLOPE AT FLOOR DRAINS.

14. FLOORING TRANSITIONS TO BE CENTERED AT DOOR UNLESS OTHERWISE NOTED.

LEGEND - FINISHES

BBT	- BIO-BASED TILE
CG	- CORNER GUARD - STAINLESS STEEL
CPT	- CARPET TILE
CT	- CERAMIC TILE
GL	- GLASS
LF	- LINOLEUM
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SR	- STATIC CONTROL RESILIENT FLOORING
WM	- WALK OFF MAT
WD	- WOOD DECKING

KEYNOTES

9.20	TR-1: CPT TRANSITION TO CT
9.21	TR-2: CPT TRANSITION TO BBT, LF, RR
9.23	TR-4: CT TRANSITION TO BBT

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LEVEL 2 FINISH PLAN

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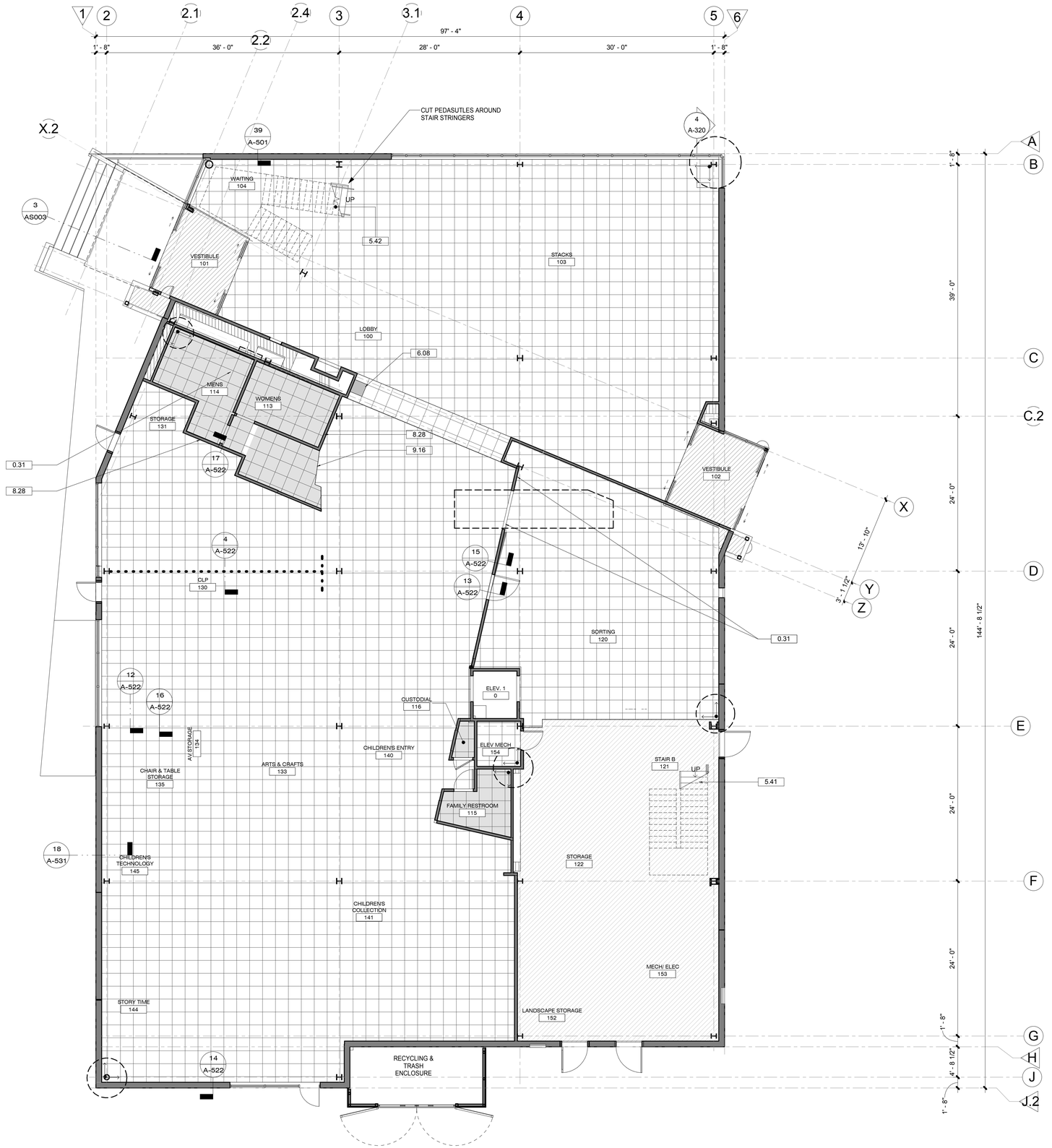

1 LEVEL 1 RAISED FLOOR PLAN
A-114 1/8" = 1'-0"

GENERAL NOTES

1. DO NOT SCALE DRAWINGS. SCALES ON DRAWINGS ARE FOR FULL SIZE DRAWINGS, PRINTED ON 24X36 SIZE SHEETS. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE. IF ADDITIONAL DIMENSIONS ARE REQUIRED, CONTACT ARCHITECT.

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6. CONTRACTOR SHALL SET DOORS TO MEET ADA REQUIRED CLEARANCES WITH THE LATCH SIDE OF DOOR TO HAVE 12" ON PUSH SIDE AND 18" ON PULL SIDE U.O.N. ON DRAWINGS.

7. DIMENSIONS TO FACE/STUDS IN SHELVING ALCOVE LOCATIONS SHALL BE COORDINATED WITH SHELVING MANUFACTURER/SUPPLIER.

KEYNOTES

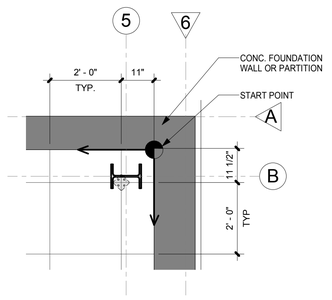
0.31	UNDER FLOOR MECHANICAL PLENUM INDICATED BY DASHED LINES. PROVIDE AIR TIGHT SEAL BETWEEN WALL AND PLENUM
5.32	METAL FABRICATION, STEEL PLATE AND MDF SHELVING ASSEMBLY
5.41	METAL STAIRS, ASSEMBLY 2 EGRESS STAIR
5.42	METAL STAIRS, PRE MANUFACTURED CONCRETE PAN, RE: SPEC
6.01	INTERIOR ARCHITECTURAL WOODWORK, BUILT-IN SHELVES
6.02	INTERIOR ARCHITECTURAL WOODWORK, BUILT-IN DESK
6.08	PLASTIC, POLYCARBONATE FLOOR
8.28	INSULATED EXTERIOR ACCESS DOOR 36 X 24, IN WALL BELOW ACCESS FLOOR
9.16	FLOORING TRANSITION STRIP, SCHLUTER T9/14E
10.03	KNOX BOX

ACCESS FLOOR LEGEND

- ACCESS FLOOR START POINT, BEGIN WITH 0' - 11" PANELS U.O.N. PLAN RE: 2-A114 SECTION RE: 522
- ACCESS FLOOR
- ACCESS FLOOR RECESSED TO PROVIDE FOR TILE RE:
- SLAB ON GRADE
- RAISED COMPOSITE WD DECK
- INDICATES WALL THAT EXTEND TO CONCRETE SLAB. PROVIDE CONTINUOUS SEPERATION BETWEEN UNDERFLOOR ASSEMBLY AND CONCRETE SLAB AT ALL OPENINGS
- INDICATES AREAS WHERE CONTINUOUS SEPARATION BETWEEN UNDERSIDE OF THE ACCESS FLOOR ASSEMBLY AND CONCRETE SLAB IS TO BE PROVIDED.
- INDICATES UNDER FLOOR MECHANICAL PLENUM. PROVIDE AIR TIGHT SEAL BETWEEN WALL AND PLENUM

ACCESS FLOOR NOTES:

ACCESS FLOOR IN WET AREAS WILL BE INDEPENDENT GRID STARTING IN A 90 DEGREE CORNER. RE: DETAIL 2/A114



2 RAISED FLOOR START POINT
A-114 1/2" = 1'-0"

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LEVEL 1 RAISED FLOOR PLAN

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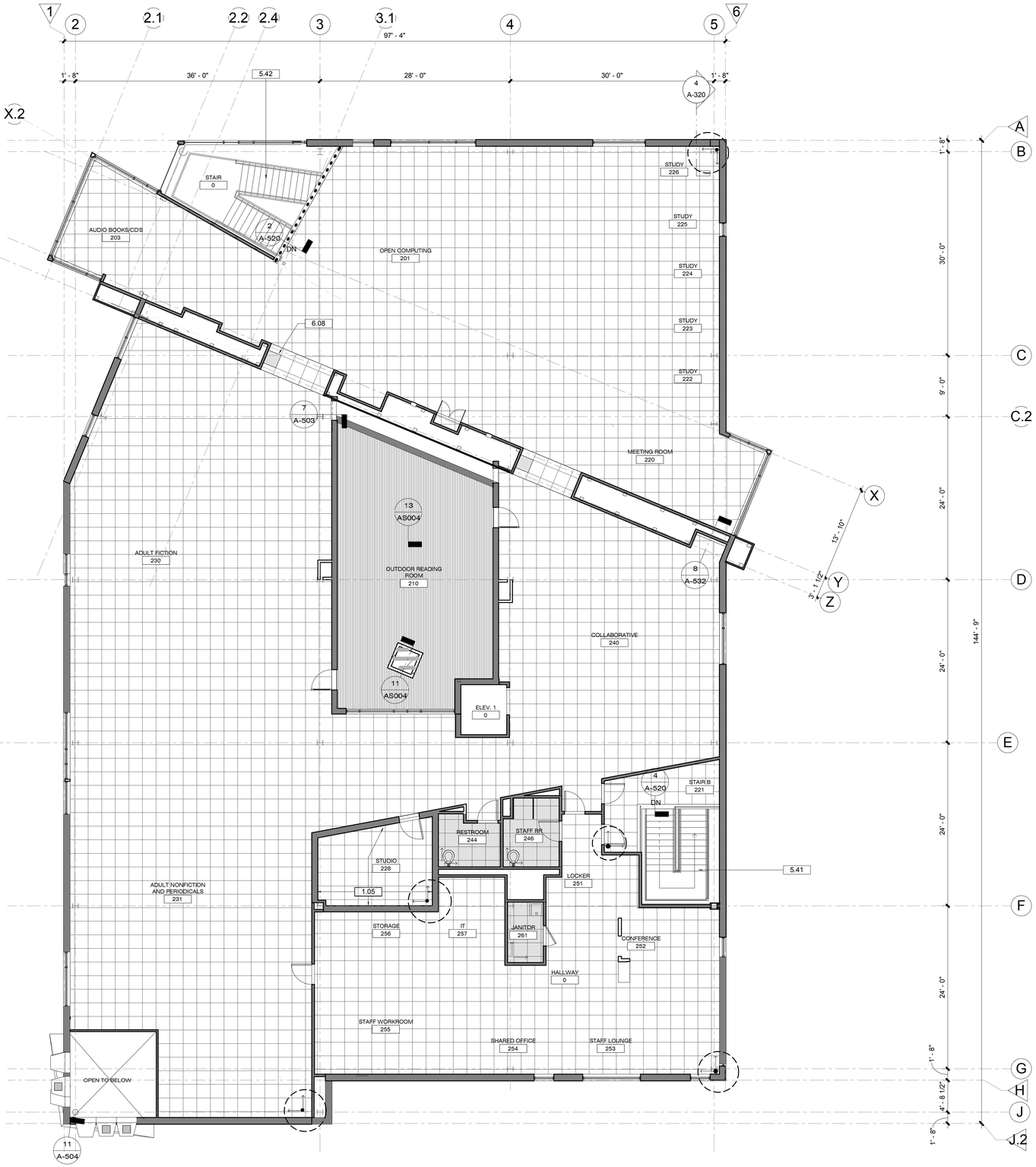

1 A-115 LEVEL 02 - RAISED FLOOR PLAN
1/8" = 1'-0"

GENERAL NOTES

1. DO NOT SCALE DRAWINGS. SCALES ON DRAWINGS ARE FOR FULL SIZE DRAWINGS, PRINTED ON 24X36 SIZE SHEETS. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE. IF ADDITIONAL DIMENSIONS ARE REQUIRED, CONTACT ARCHITECT.

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7. DIMENSIONS TO FACE/STUDS IN SHELVING ALCOVE LOCATIONS SHALL BE COORDINATED WITH SHELVING MANUFACTURER/SUPPLIER.

KEYNOTES

1.05	ADDITIVE ALTERNATE 6: WINDOWS IN CHILDREN'S AREA
5.41	METAL STAIRS, ASSEMBLY 2 EGRESS STAIR
5.42	METAL STAIRS, PRE MANUFACTURED CONCRETE PAN, RE: SPEC
6.03	INTERIOR ARCHITECTURAL WOODWORK, BUILT-IN CASEWORK
6.05	INTERIOR ARCHITECTURAL WOODWORK, BUILT-IN COUNTER
6.08	PLASTIC, POLYCARBONATE FLOOR
10.04	VISUAL DISPLAY SURFACES, BOARD 1, PURCHASED BY DPL, INSTALLED BY DPL

ACCESS FLOOR LEGEND

- ACCESS FLOOR START POINT, BEGIN WITH 0' - 11" PANELS U.O.N. PLAN RE: 2-A114 SECTION RE: 522
- ACCESS FLOOR
- ACCESS FLOOR RECESSED TO PROVIDE FOR TILE RE:
- SLAB ON GRADE
- RAISED COMPOSITE WD DECK
- INDICATES WALL THAT EXTEND TO CONCRETE SLAB. PROVIDE CONTINUOUS SEPERATION BETWEEN UNDERFLOOR ASSEMBLY AND CONCRETE SLAB AT ALL OPENINGS
- INDICATES AREAS WHERE CONTINUOUS SEPARATION BETWEEN UNDERSIDE OF THE ACCESS FLOOR ASSEMBLY AND CONCRETE SLAB IS TO BE PROVIDED.
- INDICATES UNDER FLOOR MECHANICAL PLENUM. PROVIDE AIR TIGHT SEAL BETWEEN WALL AND PLENUM

ACCESS FLOOR NOTES:

ACCESS FLOOR IN WET AREAS WILL BE INDEPENDENT GRID STARTING IN A 90 DEGREE CORNER. RE: DETAIL 2/A114

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LEVEL 2 RAISED FLOOR PLAN

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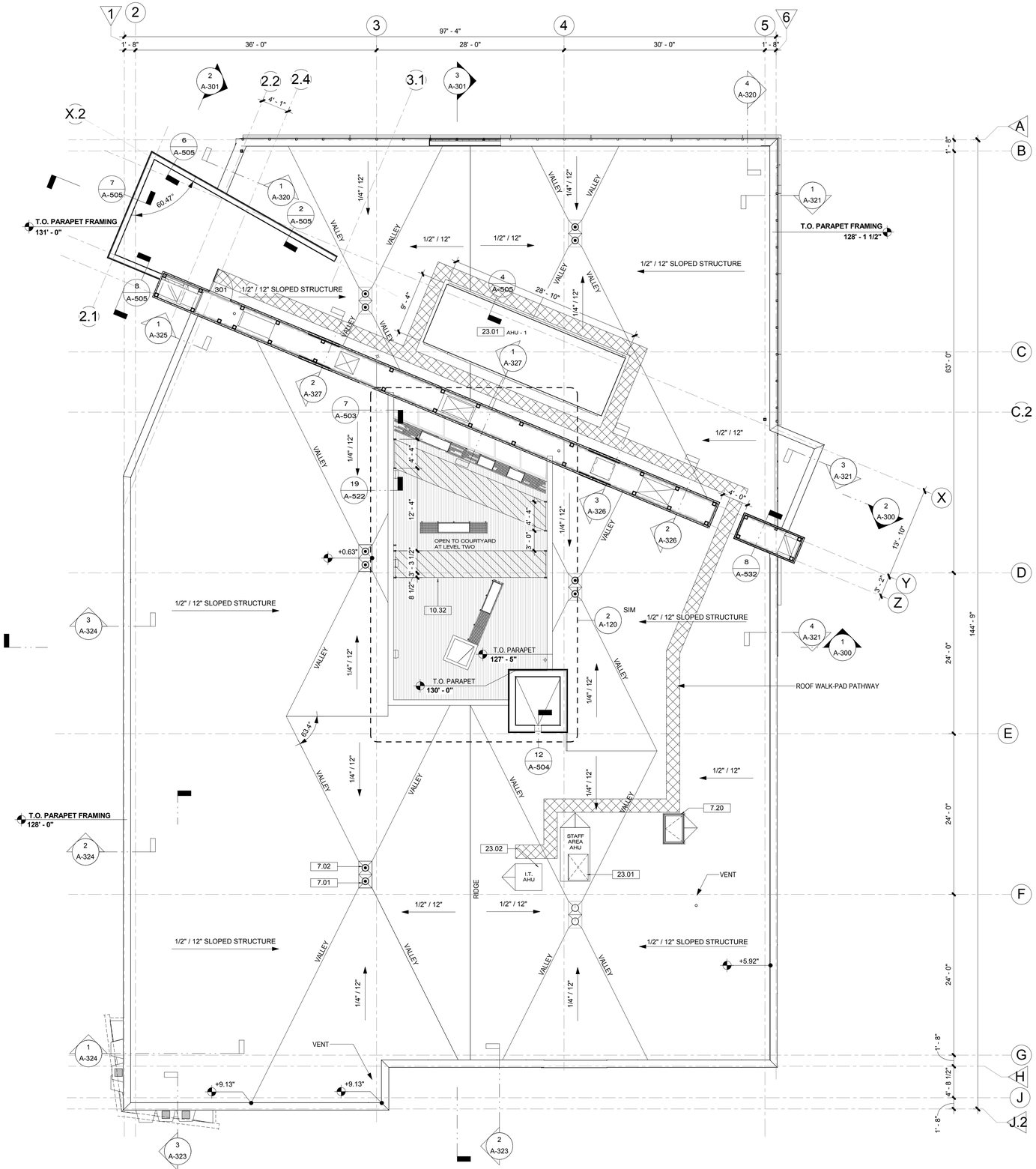

1 A-120 ROOF PLAN
1/8" = 1'-0"

SLOPE TO DRAIN 1/2" / 1'0"

2 A-120 ROOF DECK DRAINAGE
1/8" = 1'-0"

GENERAL NOTES

1. PARAPET HEIGHT = 128' U.O.N.
2. SPOT ELEVATIONS OF ROOF INSULATION ARE BASED ON "0" = 125'-9 1/2"

LEGEND - ROOF PLAN

- SLOPED STRUCTURE
- 1/2" / 12" — INDICATES DIRECTION OF SLOPE CREATED BY TAPPERED INSULATION
- TUBULAR DAYLIGHTING DEVICE
- ROOF DRAIN
- TAPERED INSULATION

KEYNOTES

7.01	ROOF DRAIN, RE: PLMB
7.02	ROOF OVERFLOW DRAIN, RE: PLMB
7.20	ROOF ACCESSORIES, ROOF HATCH
10.32	AWNING: BASIS OF DESIGN SUNBRELLA MARINE FABRIC, 46" WIDE, 9.25 OUNCES PER SQ/YD
23.01	RTU, RE: MECH
23.02	CONDENSER, RE: MECH

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ROOF PLAN

A-120

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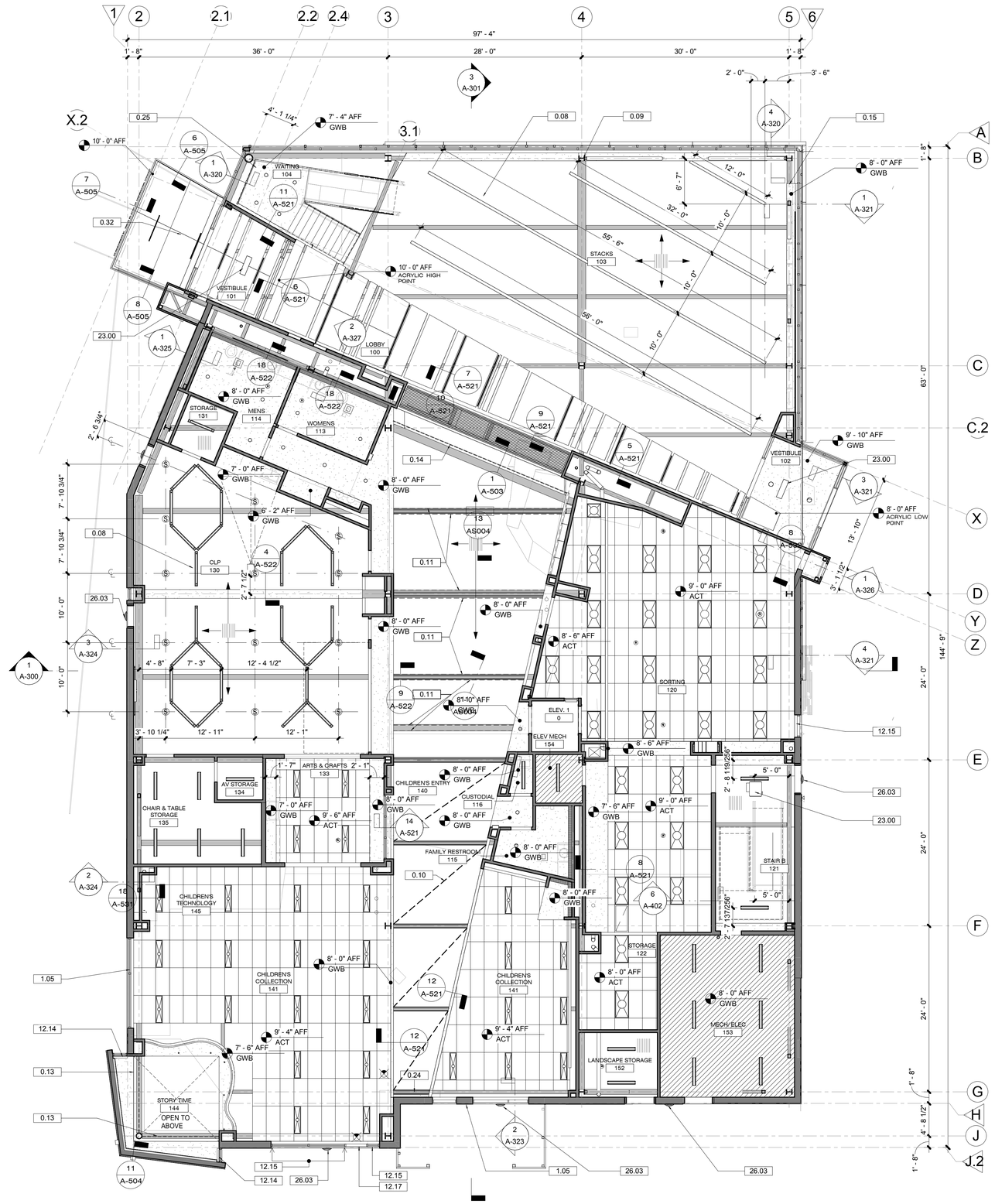

1 A-130 LEVEL 1 REFLECTED CEILING PLAN 1/8" = 1'-0"

GENERAL RCP NOTES

1. IN AREAS OF EXPOSED STRUCTURE CONDUIT SHALL BE ROUTED ABOVE DECK AND PENETRATE DECK AT DEVICE. ALL EXPOSED CONDUIT MUST BE ORDERLY AND APPROVED BY ARCH PRIOR TO WORK.

2. LOCATIONS OF MECHANICAL & ELECTRICAL ITEMS SHOWN ON THIS SHEET TAKE PRECEDENCE OVER MECHANICAL & ELECTRICAL DRAWINGS.

3. EXIT LIGHTS AND REMOTE INDICATOR LIGHTS LOCATED OVER DOORS SHALL BE CENTERED ON DOOR OPENING UON. EXIT LIGHTS AT CORRIDORSAND PASSAGEWAYS SHALL BE CENTERED ON CORRIDOR OR PASSAGEWAYS UON.

4. AT SOFFITS AND CEILINGS, COORDINATE LIGHT FIXTURE LOCATIONS WITH MECHANICAL WORK. IF THEIR IS INADEQUATE SPACE TO INSTALL ANY LIGHT WHERE SHOWN, REQUEST ALTERNATE LOCATION PRIOR TO START OF ANY OTHER WORK. (NOTE: THIS DOES NOT REDUCE CONTRACTOR'S OBLIGATION TO FULLY COORDINATE ALL WORK).

5. ITEMS INSTALLED AT CEILINGS NOT SHOWN ON THESE SHALL BE INSTALLED IN STRAIGHT UNIFORM ROWS ALIGHNED WITH LIGHT FIXTURES.

6. DO NOT CHANGE SOFFITS OR CEILINGS WITHOUT PRIOR APPROVAL OF ARCHITECT.

7. MULTIPLE LIGHTS WITHIN THE SAME CORRIDOR OR ROOM SHALL BE ALIGNED UON.

8. CENTER LIGHT FIXTURE IN ROOM OR SPACE AND/OR CENTER AS SHOWN, TYP. - UON.

9. CENTER CEILING GRID BOTH WAYS EXCEPT WHERE OTHERWISE SHOWN.

10. REFERENCE ROOM FINISH SCHEDULE FOR CEILING MATERIALS AND FINISH.

11. AT GRID CEILINGS, CENTER SPRINKLER HEADS, RECESSED LIGHTS , SPEAKERS, FIRE/SMOKE DETECTORS, ETC. ON 2X2 PANELS, UON. AT ALL OTHER CEILINGS, CENTER DEVICES WITHIN ROOM IN STRAIGHT UNIFORM ROWS.

12. COORDINATE ALL CEILING MOUNTED ITEMS WITH STRUCTURAL ELEMENTS.

13. REFERENCE WALLS SECTIONS FOR REQUIREMENTS AT PERIMETER OF CEILINGS AND AT EXTERIOR SOFFITS.

14. NOTE FIRE SPRINKLERS IN LOBBY 100 SHALL BE LOCATED BOTH ABOVE AND BELOW SUSPENDED PLASTIC PANELS. SHOW PROPOSED DETAIL AS PART OF SHOP DRAWING SUBMITTAL ARCH REVIEW AND APPROVAL

KEYNOTES

0.08	ROUTE SPRINKLER BRANCHES ABOVE LIGHTS AND BELOW BEAMS IN THESE ROOMS
0.09	INTERRUPT SOFFIT @ COLUMN
0.10	SIDEWALL SPRINKLER HEADS THESE BAYS
0.11	ROUTE FIRE PROTECTION LINES ALONG WEB OF BEAM, JUST BENEATH TOP FLANGE, TYP. THESE BAYS
0.13	LINEAR LIGHT ALONG TOP OF BEAM
0.14	LINEAR LIGHT LOCATED INSIDE WEB
0.15	NOTE: GWB (INT FACES OF EXT WALL) SHALL BE FINISHED BEHIND STRUCTURE ABOVE BEAMS
0.24	BEAM LIGHT CONT. FROM SOFFIT TO SOFFIT, TYP.
0.25	CONDUIT TO LIGHTING BENEATH LANDING SHALL BE ROUTED FROM VESTIBULE PARTITION THROUGH STL. SUPPORTS INTO AND THROUGH PLENUM, RE: STRL. FOR CRITERIA FOR DRILLING THROUGH STEEL BEAMS
0.32	PLASTIC PANELS CAN NOT EXCEED 10' L OR 30 S.F.
1.05	ADDITIVE ALTERNATE 6: WINDOWS IN CHILDREN'S AREA
12.14	ROLLER WINDOW SHADES - CEILING RECESSED MOUNTED - POWER SINGLE RE: A522 PROVIDED BY OWNER INSTALLED BY CONTRACTOR
12.15	ROLLER WINDOW SHADES - SURFACE MOUNTED - POWER SINGLE RE: A522 PROVIDED BY OWNER INSTALLED BY CONTRACTOR
12.17	DOOR SHADE TO BE PROVIDED
23.00	HEATING VENTILATING AND AIR CONDITIONING
26.03	EXTERIOR LIGHT FIXTURE, BUILDING MOUNTED, RE: ELEC

LEGEND -RCP

- SUSPENDED GWB CEILING, SEC 095123
- 2X4 ACT TILE AND GRID, SEC 092900
- EXPOSED STRUCTURE
- PERFORATED MTL DIFFUSER
- SUSPENDED SLOPING ACRYLIC PANELS WITH GAPS B/W PANELS AS SHOWN
- FIRE RATED GWB CEILING
- EXPOSED STRUCTURE
- EXIT SIGN
- FIRE SPRINKLER
- RECESSED COVE LIGHT
- FLUORESCENT FLUSH FIXTURE
- PENDANT FIXTURE
- LARGE PENDANT FIXTURE
- SMAL PENDANT FIXTURE
- SUSPENDED 8" LINEAR FIXTURE
- SUSPENDED 4 3/4" LINEAR FIXTURE
- SUSPENDED 2 3/4" LINEAR FIXTURE
- SUSPENDED LINEAR FIXTURE
- SUSPENDED FLORESCENT FIXTURE
- RECESSED LINEAR FIXTURE
- RECESSED CAN LIGHT
- RECESSED 2X4 TROFFER
- SUSPENDED PUCK LIGHTING
- SOLATUBE
- WALL WASHER
- 12" x 4' L LAY-IN PRISMATIC FIXTURE
- 2' x 2' PENDANT FIXTURE
- 4' x 4' PENDANT FIXTURE
- EXPOSED DECK
- SPEAKER

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sDC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02069

ISSUE DATE 01-12-2012
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LEVEL 1 RCP

A-130

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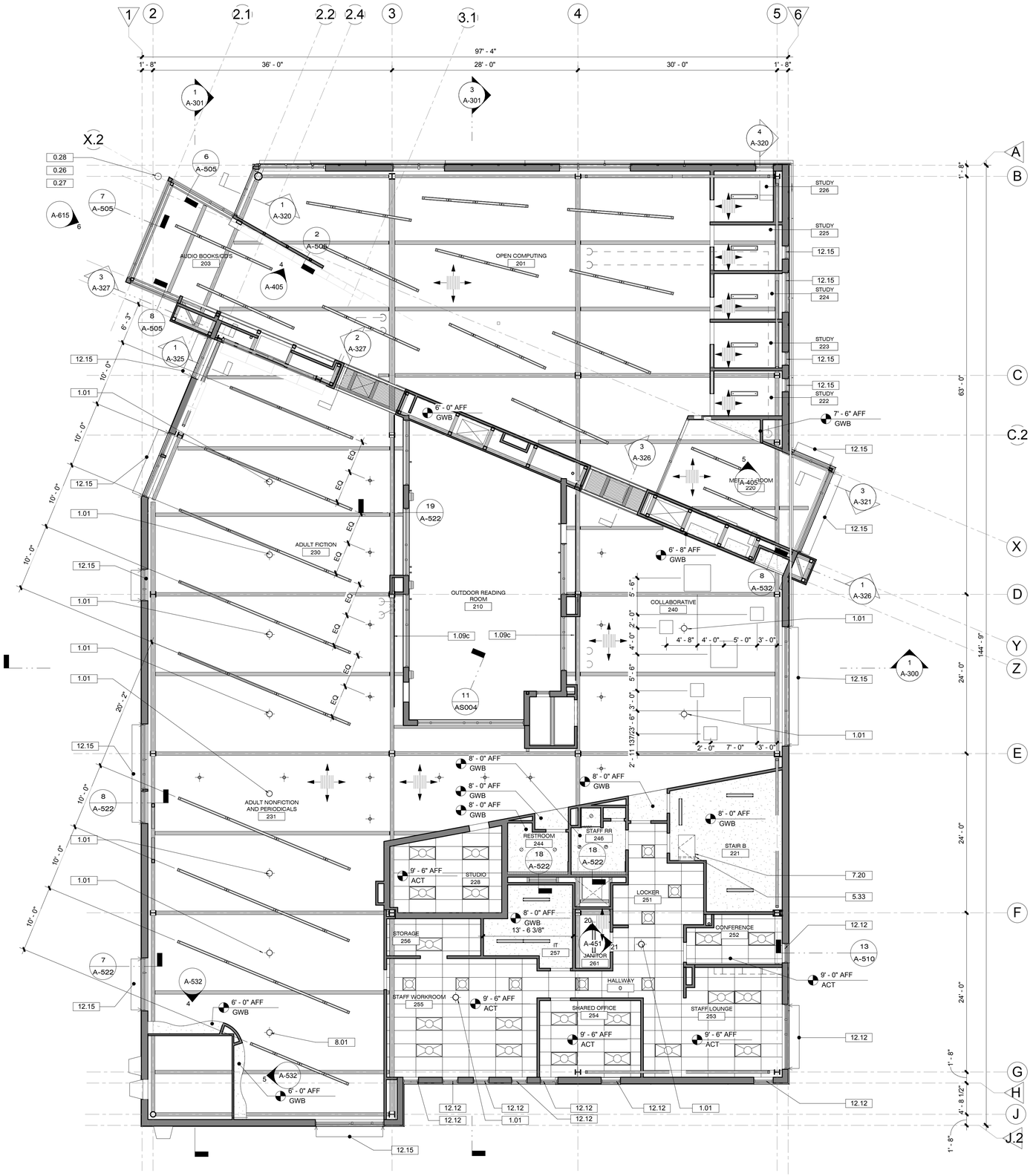

1 A-131 LEVEL 2 REFLECTED CEILING PLAN
1/8" = 1'-0"

GENERAL RCP NOTES

1. IN AREAS OF EXPOSED STRUCTURE CONDUIT SHALL BE ROUTED ABOVE DECK AND PENETRATE DECK AT DEVICE. ALL EXPOSED CONDUIT MUST BE ORDERLY AND APPROVED BY ARCH PRIOR TO WORK.

2. LOCATIONS OF MECHANICAL & ELECTRICAL ITEMS SHOWN ON THIS SHEET TAKE PRECEDENCE OVER MECHANICAL & ELECTRICAL DRAWINGS.

3. EXIT LIGHTS AND REMOTE INDICATOR LIGHTS LOCATED OVER DOORS SHALL BE CENTERED ON DOOR OPENING UON. EXIT LIGHTS AT CORRIDORSAND PASSAGEWAYS SHALL BE CENTERED ON CORRIDOR OR PASSAGEWAYS UON.

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9. CENTER CEILING GRID BOTH WAYS EXCEPT WHERE OTHERWISE SHOWN.

10. REFERENCE ROOM FINISH SCHEDULE FOR CEILING MATERIALS AND FINISH.

11. AT GRID CEILINGS, CENTER SPRINKLER HEADS, RECESSED LIGHTS , SPEAKERS, FIRE/SMOKE DETECTORS, ETC. ON 2X2 PANELS, UON. AT ALL OTHER CEILINGS, CENTER DEVICES WITHIN ROOM IN STRAIGHT UNIFORM ROWS.

12. COORDINATE ALL CEILING MOUNTED ITEMS WITH STRUCTURAL ELEMENTS.

13. REFERENCE WALLS SECTIONS FOR REQUIREMENTS AT PERIMETER OF CEILINGS AND AT EXTERIOR SOFFITS.

14. NOTE FIRE SPRINKLERS IN LOBBY 100 SHALL BE LOCATED BOTH ABOVE AND BELOW SUSPENDED PLASTIC PANELS. SHOW PROPOSED DETAIL AS PART OF SHOP DRAWING SUBMITTAL ARCH REVIEW AND APPROVAL

KEYNOTES

0.26	LIGHT FIXTURES NORTH OF THE WONDER WALL TO BE PAINTED ONE OF THESE TWO COLORS: PT-15, PT-16
0.27	IN THE OPEN COMPUTING AREA ALL LIGHTS ON OR NORTH OF GRID LINE X TO BE LOCATED BY ARCHITECT AT TIME OF INSTALLATION
0.28	RADIUS CENTER POINT FOR LIGHTING ARRAY @ 201
1.01	ADDITIVE ALTERNATE 4: SOLATUBE
1.09c	
5.33	METAL FABRICATION, LADDER
7.20	ROOF ACCESSORIES, ROOF HATCH
8.01	SOLATUBE
12.12	ROLLER WINDOW SHADES - SURFACE MOUNTED - MANUAL SINGLE RE: A522 PROVIDED BY OWNER INSTALLED BY CONTRACTOR
12.15	ROLLER WINDOW SHADES - SURFACE MOUNTED - POWER SINGLE RE: A522 PROVIDED BY OWNER INSTALLED BY CONTRACTOR

LEGEND -RCP

- SUSPENDED GWB CEILING, SEC 095123
- 2X4 ACT TILE AND GRID, SEC 092900
- EXPOSED STRUCTURE
- PERFORATED MTL DIFFUSER
- SUSPENDED SLOPING ACRYLIC PANELS WITH GAPS B/W PANELS AS SHOWN
- FIRE RATED GWB CEILING
- EXPOSED STRUCTURE
- EXIT SIGN
- FIRE SPRINKLER
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- PENDANT FIXTURE
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- SUSPENDED 4 3/4" LINEAR FIXTURE
- SUSPENDED 2 3/4" LINEAR FIXTURE
- SUSPENDED LINEAR FIXTURE
- SUSPENDED FLORESCENT FIXTURE
- RECESSED LINEAR FIXTURE
- RECESSED CAN LIGHT
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- EXPOSED DECK
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01.12.12

sDOC PROJECT NO: 1020.00
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LEVEL 2 RCP

A-131

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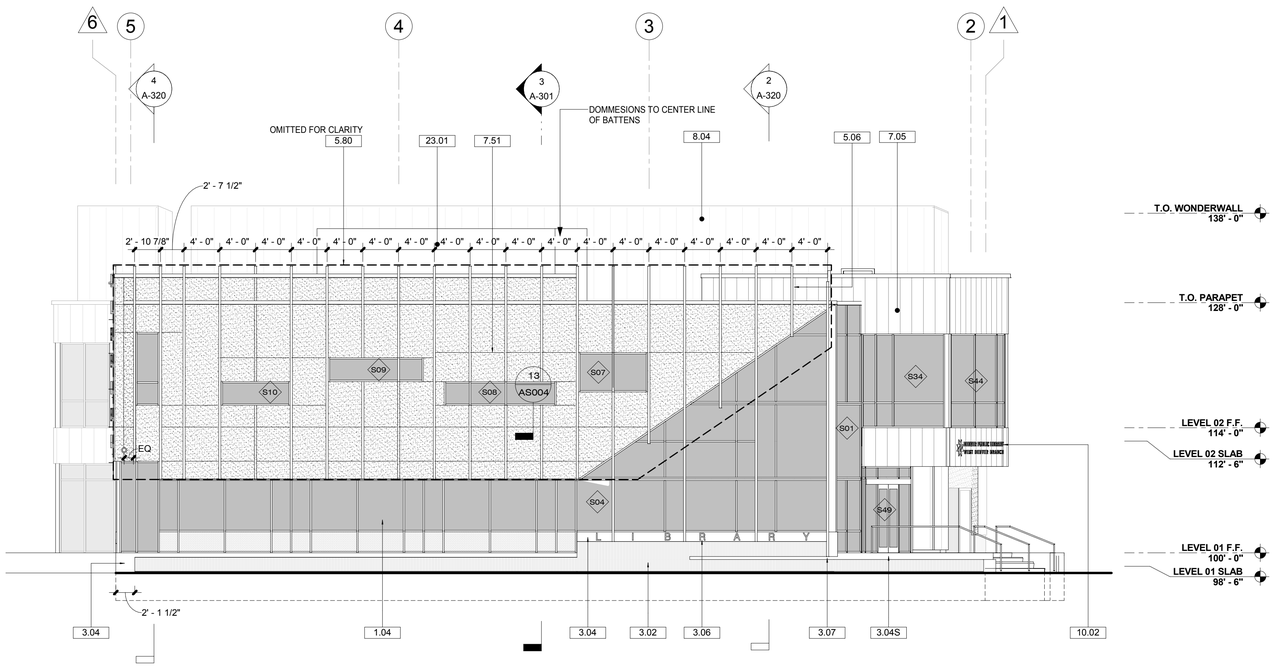
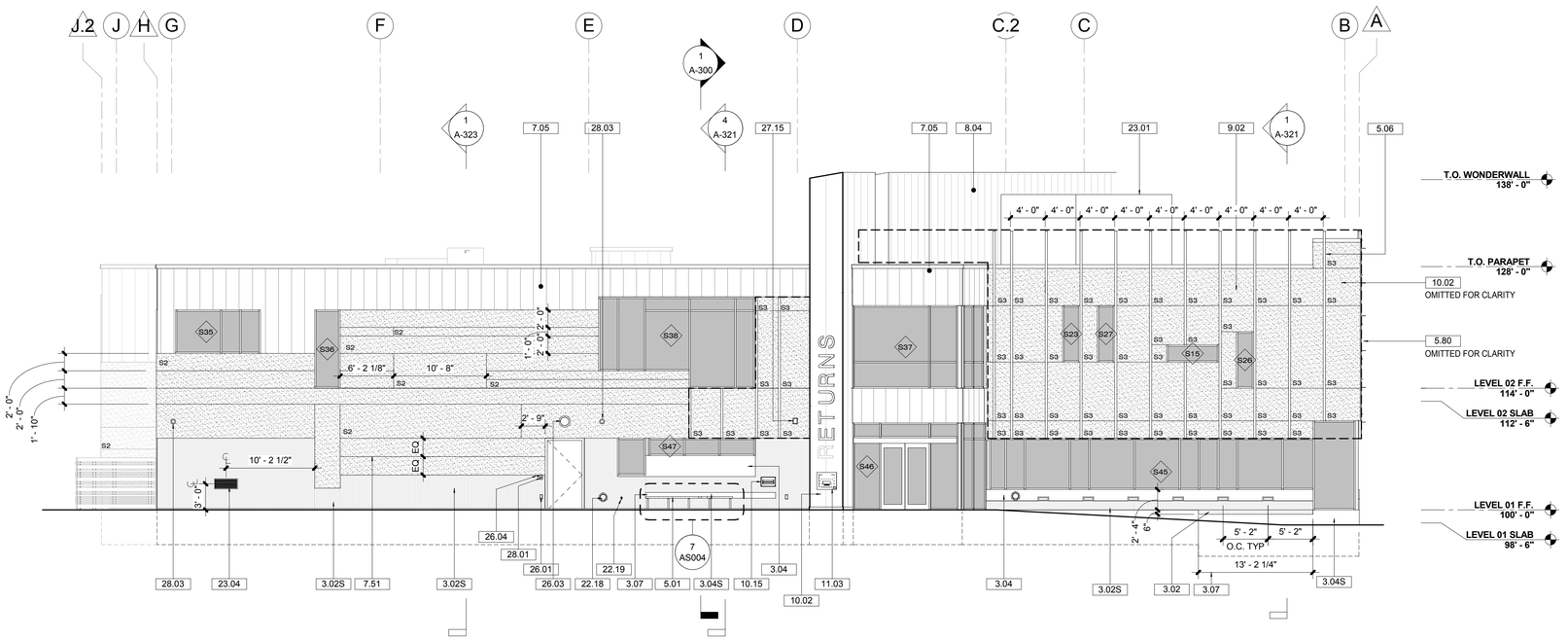


2 NORTH ELEVATION
A-200 1/8" = 1'-0"

ALL STUCCO ON THIS ELEVATION TO BE **S3** / ALL GLAZING ON THIS ELEVATION ADD **ALT 2**



1 EAST ELEVATION
A-200 1/8" = 1'-0"

GENERAL NOTES: ELEVATIONS

1. REFER TO WINDOW SCHEDULE FOR GLAZING TYPES.

2. STOP CONCRETE FORM LINER 2" ABOVE GRADE AND 2" BELOW BOTTOM OF STUCCO, FINISH RE: KEY NOTE 3.04S, U.O.N.

3. REFER TO PROJECT MANUAL FOR SPECIFIC STUCCO FINISHES, COLORS AND TEXTURES.

4. ALL STUCCO TO HAVE GRAFFITI PROOFING UP TO 8'-0" ABOVE GRADE OR TO NEXT AVAILABLE CONTROL JOINT.

5. ALL STUCCO TO BE STUCCO TYPE - **S1**, U.O.N.

LEGEND

- STUCCO
- CORRUGATED CONCRETE
- SMOOTH FINISHED CONCRETE
- STANDING SEAM METAL PANEL
- HORIZONTAL CORRUGATED METAL PANEL
- INSULATED ALUMINUM INFILL PANEL
- GLAZING
- ADD ALT

STUCCO COLOR / FINISH LEGEND

S1	STUCCO TYPE 1
S2	STUCCO TYPE 2
S3	STUCCO TYPE 3

KEYNOTES

1.04	ADDITIVE ALTERNATE 2: HIGHER QUALITY GLAZING
3.02	CAST-IN-PLACE CONCRETE, FORM LINER., ABOVE GRADE
3.02S	CAST-IN-PLACE CONCRETE, FORM LINER, ABOVE GRADE WITH SURFACE APPLIED STAIN
3.04	CAST-IN-PLACE CONCRETE, SLICK FINISH
3.04S	CAST-IN-PLACE CONCRETE, SLICK FINISH WITH SURFACE APPLIED STAIN
3.06	LETTERS RECESSED IN CONCRETE
3.07	2" RECESS IN CONCRETE
5.01	METAL FABRICATION, WALL MOUNTED BENCH SUPPORT WITH WOOD SEAT
5.06	3" x 3" x 1/4" ALUMINUM TUBE, PRE-FINISHED
5.80	BUILDING MOUNTED ALUMINUM PLATE FAÇADE SCREEN, RE: A500
7.05	EXTERIOR METAL CLADDING, TYPE 1
7.51	CONTROL JOINT, TYP
8.04	SINGLE LAYER POLYCARBONATE CURTAIN WALL SYSTEM
9.02	ELASTOMERIC COATINGS, THREE PART CEMENTITIOUS STUCCO, FINISH 2
10.02	BUILDING SIGNAGE, RE: A610 - A614
10.15	THROUGH WALL BOOK RETURN
11.03	EXTERIOR BOOK DROP, N.I.C.
22.18	LAMBS TONG OVER FLOW, CENTERLINE MIN 18" ABOVE FINISHED GRADE
22.19	WALL HYDRANT
23.01	RTU, RE: MECH
23.04	MECHANICAL LOUVER, RE: MECH
26.01	POWER OUTLETS IN WALL, RE: ELEC
26.03	EXTERIOR LIGHT FIXTURE, BUILDING MOUNTED, RE: ELEC
26.04	DOOR BELL, RE: ELEC
27.15	WIRELESS ACCESS POINT, PBO-IBC
28.01	SECURITY: CARD READER
28.03	SECURITY: CAMERAS, PURCHASED BY GC, INSTALLED BY GC'

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BUILDING ELEVATIONS

A-200

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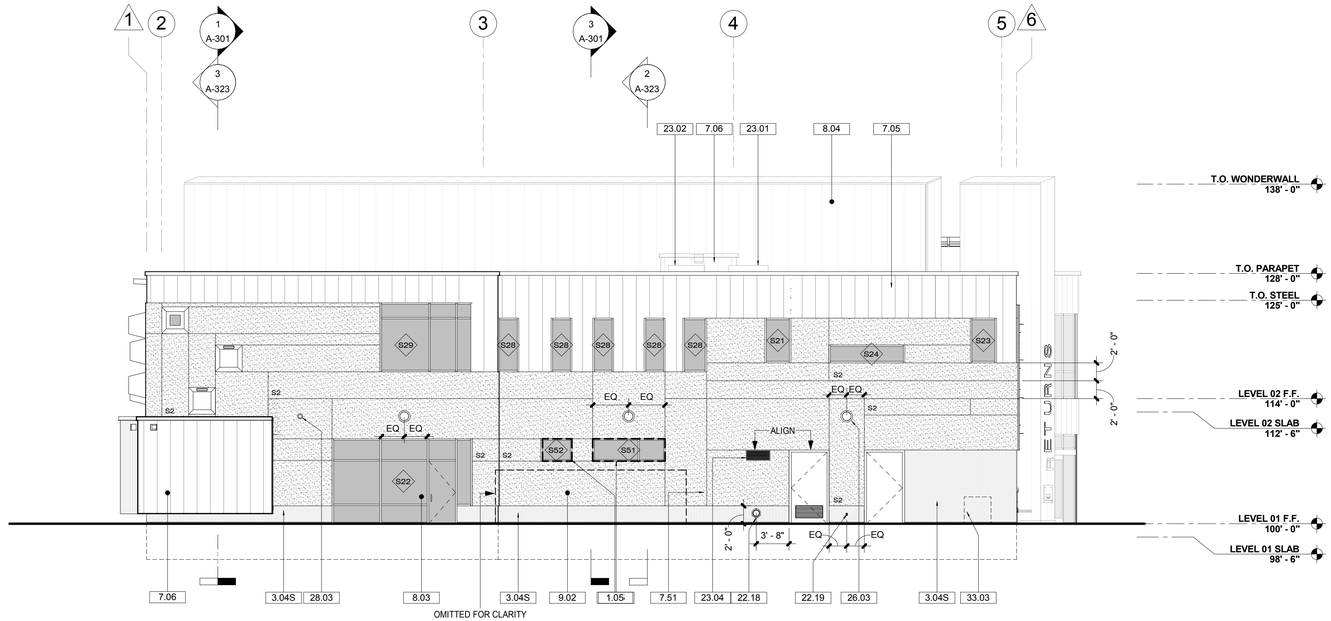
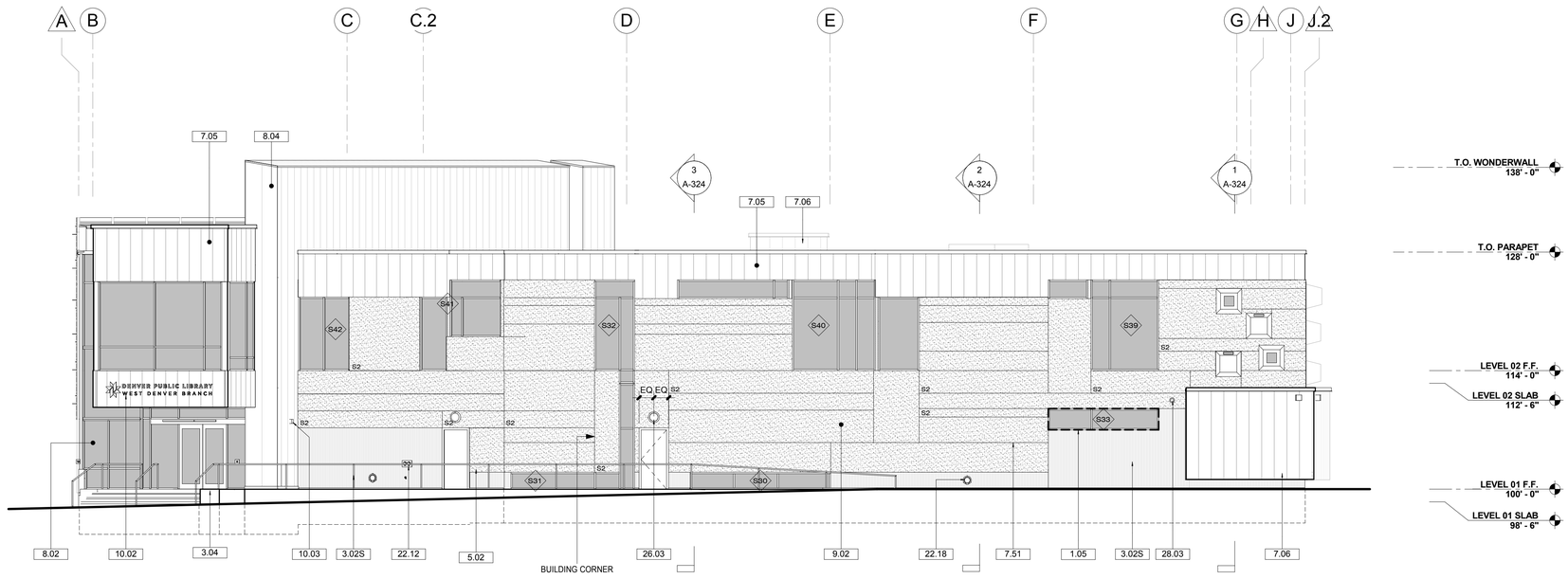


2 SOUTH ELEVATION
A-201 1/8" = 1'-0"



1 WEST ELEVATION
A-201 1/8" = 1'-0"

GENERAL NOTES: ELEVATIONS

1. REFER TO WINDOW SCHEDULE FOR GLAZING TYPES.

2. STOP CONCRETE FORM LINER 2" ABOVE GRADE AND 2" BELOW BOTTOM OF STUCCO, FINISH RE: KEY NOTE 3.04S, U.O.N.

3. REFER TO PROJECT MANUAL FOR SPECIFIC STUCCO FINISHES, COLORS AND TEXTURES.

4. ALL STUCCO TO HAVE GRAFFITI PROOFING UP TO 8'-0" ABOVE GRADE OR TO NEXT AVAILABLE CONTROL JOINT.

5. ALL STUCCO TO BE STUCCO TYPE - **S1**, U.O.N.

LEGEND

	STUCCO
	CORRUGATED CONCRETE
	SMOOTH FINISHED CONCRETE
	STANDING SEAM METAL PANEL
	HORIZONTAL CORRUGATED METAL PANEL
	INSULATED ALUMINUM INFILL PANEL
	GLAZING
– – –	ADD ALT

STUCCO COLOR / FINISH LEGEND

S1	STUCCO TYPE 1
S2	STUCCO TYPE 2
S3	STUCCO TYPE 3

KEYNOTES

1.05	ADDITIVE ALTERNATE 6: WINDOWS IN CHILDREN'S AREA
3.02S	CAST-IN-PLACE CONCRETE, FORM LINER, ABOVE GRADE WITH SURFACE APPLIED STAIN
3.04	CAST-IN-PLACE CONCRETE, SLICK FINISH
3.04S	CAST-IN-PLACE CONCRETE, SLICK FINISH WITH SURFACE APPLIED STAIN
5.02	PIPE AND TUBE RAILINGS, HANDRAIL
7.05	EXTERIOR METAL CLADDING, TYPE 1
7.06	EXTERIOR METAL CLADDING, TYPE 2
7.51	CONTROL JOINT, TYP
8.02	GLAZED ALUMINUM CURTAIN WALL SYSTEM
8.03	ALUMINUM FRAMED ENTRANCES AND STOREFRONT
8.04	SINGLE LAYER POLYCARBONATE CURTAIN WALL SYSTEM
9.02	ELASTOMERIC COATINGS, THREE PART CEMENTITIOUS STUCCO, FINISH 2
10.02	BUILDING SIGNAGE, RE: A610 - A614
10.03	KNOX BOX
22.12	FIRE DEPT CONNECTION, RE: PLMB; LOCATION PENDING
22.18	LAMBS TONG OVER FLOW, CENTERLINE MIN 18" ABOVE FINISHED GRADE
22.19	WALL HYDRANT
23.01	RTU, RE: MECH
23.02	CONDENSER, RE: MECH
23.04	MECHANICAL LOUVER, RE: MECH
26.03	EXTERIOR LIGHT FIXTURE, BUILDING MOUNTED, RE: ELEC
28.03	SECURITY: CAMERAS, PURCHASED BY GC, INSTALLED BY GC"
33.03	GAS METER, SIZE & LOCATION TBD

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PROJECT:
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LIBRARY
1498 NORTH IRVING STREET
DENVER, COLORADO 80204

sDC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02069

ISSUE DATE
01-12-2012

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BUILDING ELEVATIONS

A-201

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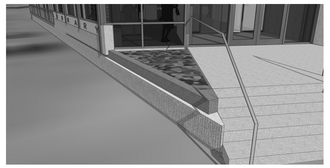
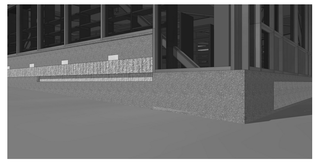
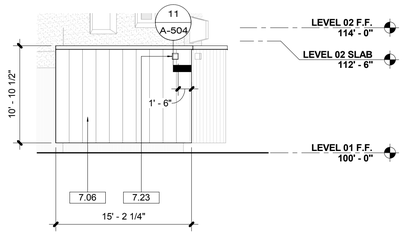


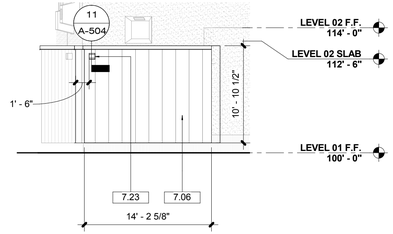
13 A-202 NORTHWEST CORNER RECESS
1/8" = 1'-0"



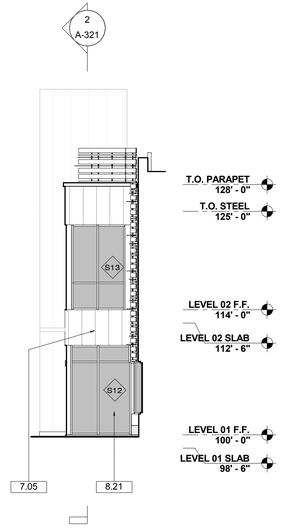
12 A-202 NORTHEAST CORNER RECESS
1/8" = 1'-0"



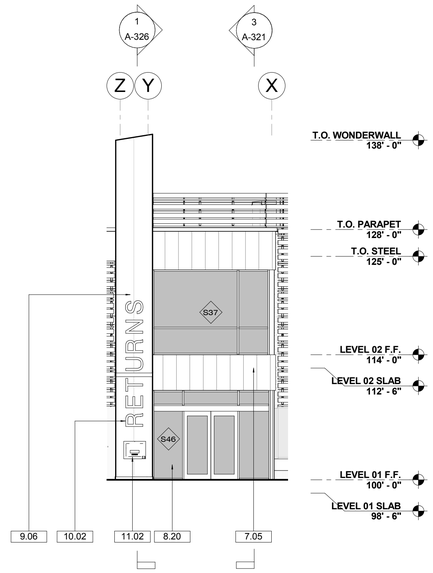
11 A-202 STORYTIME WALL - WEST
1/8" = 1'-0"



10 A-202 STORYTIME WALL - SOUTH
1/8" = 1'-0"



9 A-202 ELEVATION - EAST 4
1/8" = 1'-0"



8 A-202 ELEVATION - EAST ENTRY
1/8" = 1'-0"

GENERAL NOTES: ELEVATIONS

1. REFER TO WINDOW SCHEDULE FOR GLAZING TYPES.

2. STOP CONCRETE FORM LINER 2" ABOVE GRADE AND 2" BELOW BOTTOM OF STUCCO, FINISH RE: KEY NOTE 3.04S, U.O.N.

3. REFER TO PROJECT MANUAL FOR SPECIFIC STUCCO FINISHES, COLORS AND TEXTURES.

4. ALL STUCCO TO HAVE GRAFFITI PROOFING UP TO 8'-0" ABOVE GRADE OR TO NEXT AVAILABLE CONTROL JOINT.

5. ALL STUCCO TO BE STUCCO TYPE - **S1**, U.O.N.

LEGEND

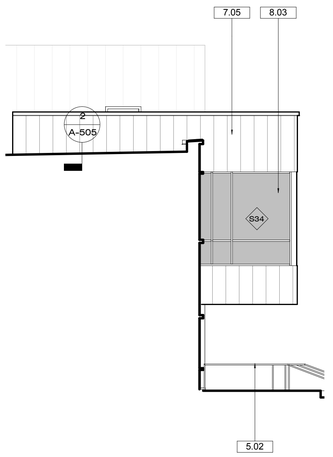
- STUCCO
- CORRUGATED CONCRETE
- SMOOTH FINISHED CONCRETE
- STANDING SEAM METAL PANEL
- HORIZONTAL CORRUGATED METAL PANEL
- INSULATED ALUMINUM INFILL PANEL
- GLAZING
- ADD ALT

STUCCO COLOR / FINISH LEGEND

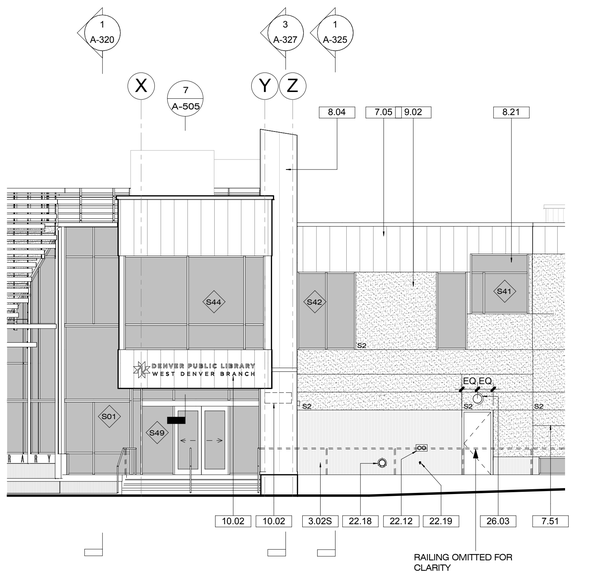
S1	STUCCO TYPE 1
S2	STUCCO TYPE 2
S3	STUCCO TYPE 3

KEYNOTES

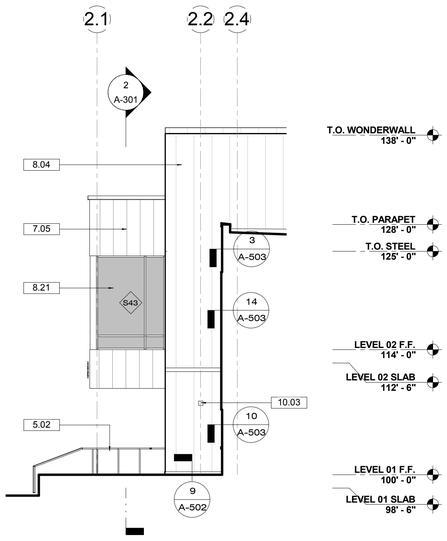
1.11	FUTURE "ALTERNATIVE ENERGY SYSTEM"
3.02S	CAST-IN-PLACE CONCRETE, FORM LINER, ABOVE GRADE WITH SURFACE APPLIED STAIN
3.04	CAST-IN-PLACE CONCRETE, SLICK FINISH
5.01	METAL FABRICATION, WALL MOUNTED BENCH SUPPORT WITH WOOD SEAT
5.02	PIPE AND TUBE RAILINGS, HANDRAIL
5.04	STEEL ANCHOR POINT
7.05	EXTERIOR METAL CLADDING, TYPE 1
7.06	EXTERIOR METAL CLADDING, TYPE 2
7.07	EXTERIOR METAL CLADDING, TYPE 3
7.23	ROOF ACCESSORIES, SCUPPER
7.51	CONTROL JOINT, TYP
8.03	ALUMINUM FRAMED ENTRANCES AND STOREFRONT
8.04	SINGLE LAYER POLYCARBONATE CURTAIN WALL SYSTEM
8.05	DOUBLE LAYER POLYCARBONATE CURTAIN WALL SYSTEM
8.20	ALUMINUM FRAMED ENTRANCES AND STOREFRONT, ENTRANCE DOORS
8.21	ALUMINUM FRAMED ENTRANCES AND STOREFRONT, WINDOW WALLS
8.22	ALUMINUM FRAMED ENTRANCES AND STOREFRONT, RIBBON WALLS
8.23	ALUMINUM FRAMED ENTRANCES AND STOREFRONT, PUNCHED OPENINGS
8.26	ALUMINUM FRAMED SKYLIGHT
9.02	ELASTOMERIC COATINGS, THREE PART CEMENTITIOUS STUCCO, FINISH 2
9.06	MULTIWALL POLYCARBONATE GLAZING SHEETS AND SYSTEMS, REFER TO SECTION 088400
9.13	GWB, COLOR RE: FINISH SCHEDULE, PROVIDE BLOCKING AS REQUIRED FOR SYSTEMS FURNITURE
10.02	BUILDING SIGNAGE, RE: A610 - A614
10.03	KNOX BOX
10.64	INDUSTRIAL HOSE & REEL
11.02	AUTOMATED MATERIALS HANDLING UNIT, PURCHASED BY DPL, INSTALLED BY TECH LOGIC
22.12	FIRE DEPT CONNECTION, RE: PLMB; LOCATION PENDING
22.18	LAMBS TONG OVER FLOW, CENTERLINE MIN 18" ABOVE FINISHED GRADE
22.19	WALL HYDRANT
26.03	EXTERIOR LIGHT FIXTURE, BUILDING MOUNTED, RE: ELEC
28.01	SECURITY: CARD READER



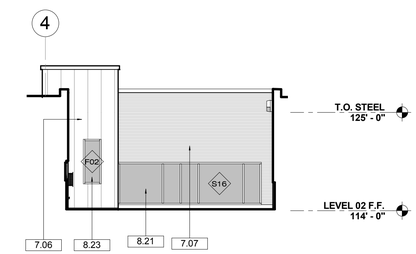
7 A-202 ELEVATION - NORTH SIDE NW ENTRANCE
1/8" = 1'-0"



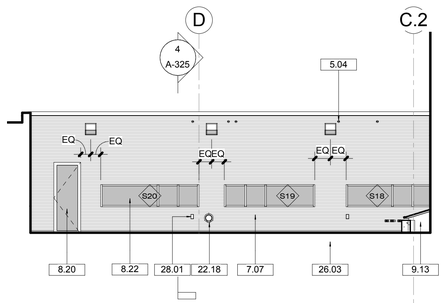
6 A-202 NW CORNER ELEVATION
1/8" = 1'-0"



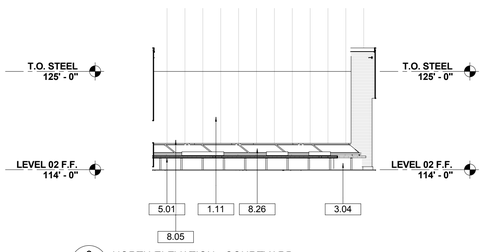
5 A-202 ELEVATION - SOUTH SIDE NW ENTRANCE
1/8" = 1'-0"



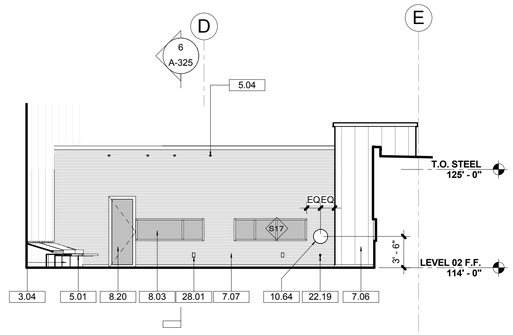
4 A-202 SOUTH ELEVATION - COURTYARD
1/8" = 1'-0"



3 A-202 WEST ELEVATION - COURTYARD
1/8" = 1'-0"



2 A-202 NORTH ELEVATION - COURTYARD
1/8" = 1'-0"



1 A-202 EAST ELEVATION - COURTYARD
1/8" = 1'-0"

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BUILDING ELEVATIONS

A-202

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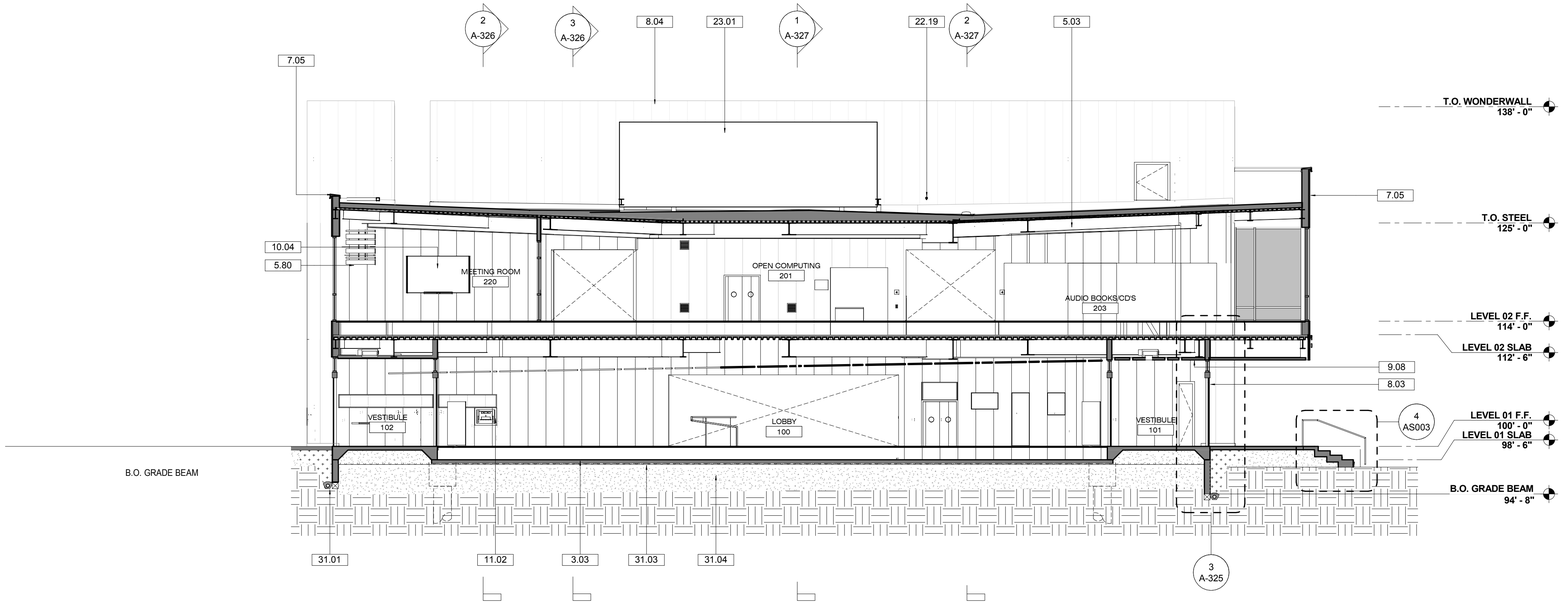
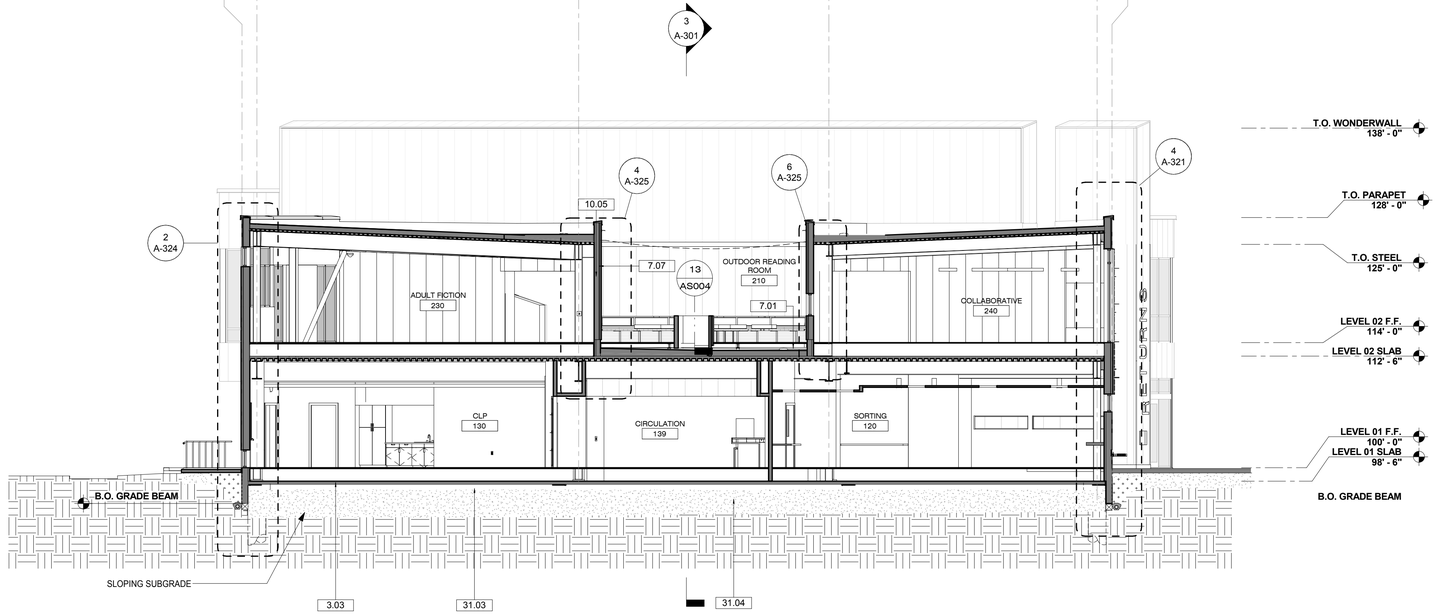


2 A-300 BUILDING SECTION EAST - WEST PARALLEL TO WONDER WALL
1/8" = 1'-0"



1 A-300 BUILDING SECTION EAST - WEST (2)
1/8" = 1'-0"

GENERAL NOTES - SECTIONS

1. REFER TO STRUCTURAL FOR FOUNDATION INFORMATION

KEYNOTES

3.03	CAST-IN-PLACE CONCRETE, S.O.G, RE: STRL
5.03	EXPOSED STRUCTURAL STEEL, RE: STRL
5.80	BUILDING MOUNTED ALUMINUM PLATE FAÇADE SCREEN, RE: A500
7.01	ROOF DRAIN, RE: PLMB
7.05	EXTERIOR METAL CLADDING, TYPE 1
7.07	EXTERIOR METAL CLADDING, TYPE 3
8.03	ALUMINUM FRAMED ENTRANCES AND STOREFRONT
8.04	SINGLE LAYER POLYCARBONATE CURTAIN WALL SYSTEM
9.08	SUSPENDED, SLOPED ACRYLIC CEILING
10.04	VISUAL DISPLAY SURFACES, BOARD 1, PURCHASED BY DPL, INSTALLED BY DPL
10.05	AWNING, FABRIC SUNSHADE CANOPY
11.02	AUTOMATED MATERIALS HANDLING UNIT, PURCHASED BY DPL, INSTALLED BY TECH LOGIC
22.19	WALL HYDRANT
23.01	RTU, RE: MECH
31.01	SUB-GRADE DRAINAGE SYSTEM, RE: CIVIL
31.03	VAPOR VENTILATION SYSTEM, RE: ENV
31.04	STRL FILL, RE: FOUNDATION PLAN + SPECS FOR CLARIFICATION

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BUILDING SECTIONS

A-300

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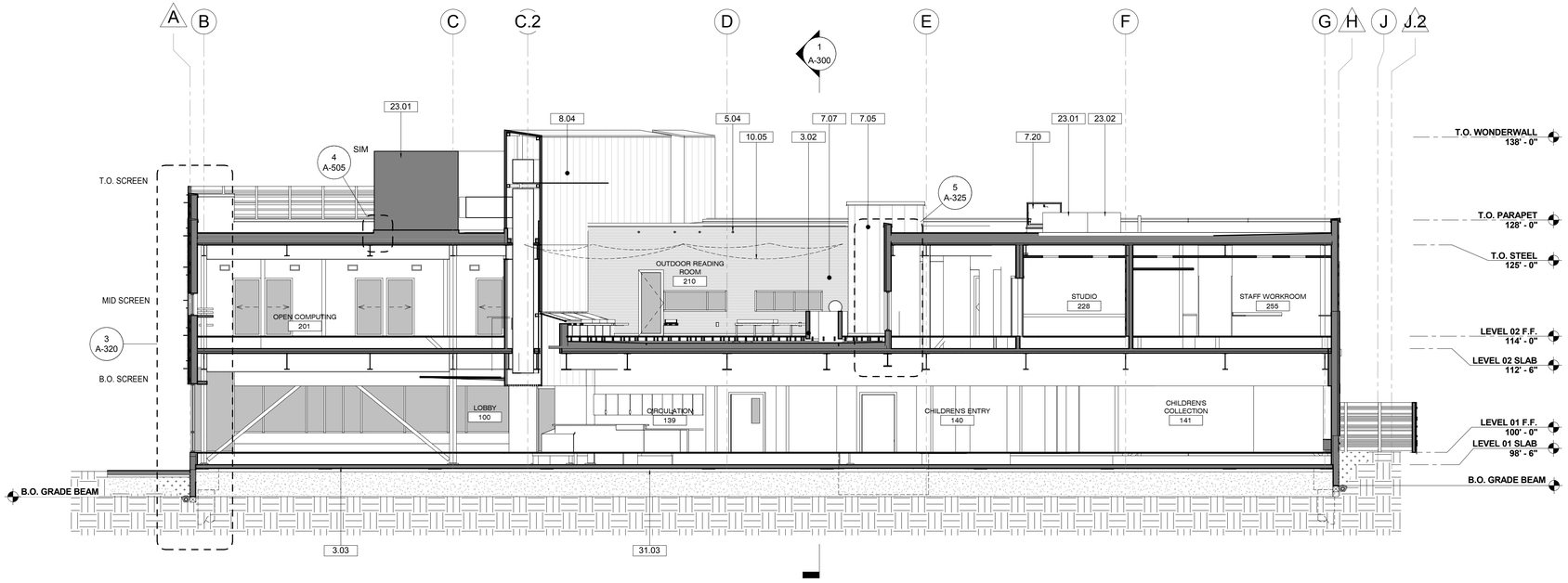
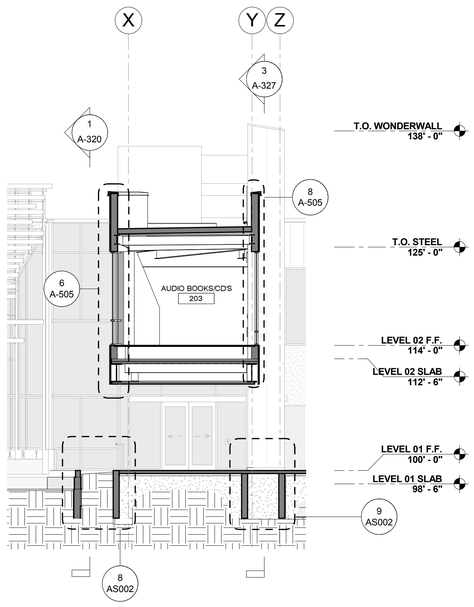
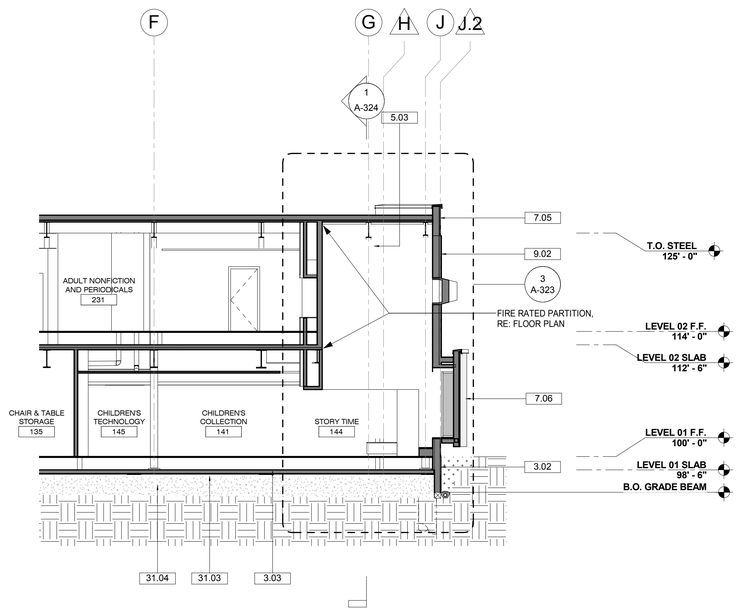


3 A-301 BUILDING SECTION - NORTH / SOUTH
1/8" = 1'-0"



2 A-301 PERCH SECTION
1/8" = 1'-0"



1 A-301 BUILDING SECTION - STORY TIME TOWER
1/8" = 1'-0"

GENERAL NOTES - SECTIONS

1. REFER TO STRUCTURAL FOR FOUNDATION INFORMATION

KEYNOTES

3.02	CAST-IN-PLACE CONCRETE, FORM LINER., ABOVE GRADE
3.03	CAST-IN-PLACE CONCRETE, S.O.G, RE: STRL
5.03	EXPOSED STRUCTURAL STEEL, RE: STRL
5.04	STEEL ANCHOR POINT
7.05	EXTERIOR METAL CLADDING, TYPE 1
7.06	EXTERIOR METAL CLADDING, TYPE 2
7.07	EXTERIOR METAL CLADDING, TYPE 3
7.20	ROOF ACCESSORIES, ROOF HATCH
8.04	SINGLE LAYER POLYCARBONATE CURTAIN WALL SYSTEM
9.02	ELASTOMERIC COATINGS, THREE PART CEMENTITIOUS STUCCO, FINISH 2
9.08	SUSPENDED, SLOPED ACRYLIC CEILING
10.05	AWNING, FABRIC SUNSHADE CANOPY
23.01	RTU, RE: MECH
23.02	CONDENSER, RE: MECH
31.03	VAPOR VENTILATION SYSTEM, RE: ENV
31.04	STRL FILL, RE: FOUNDATION PLAN + SPECS FOR CLARIFICATION

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BUILDING SECTIONS

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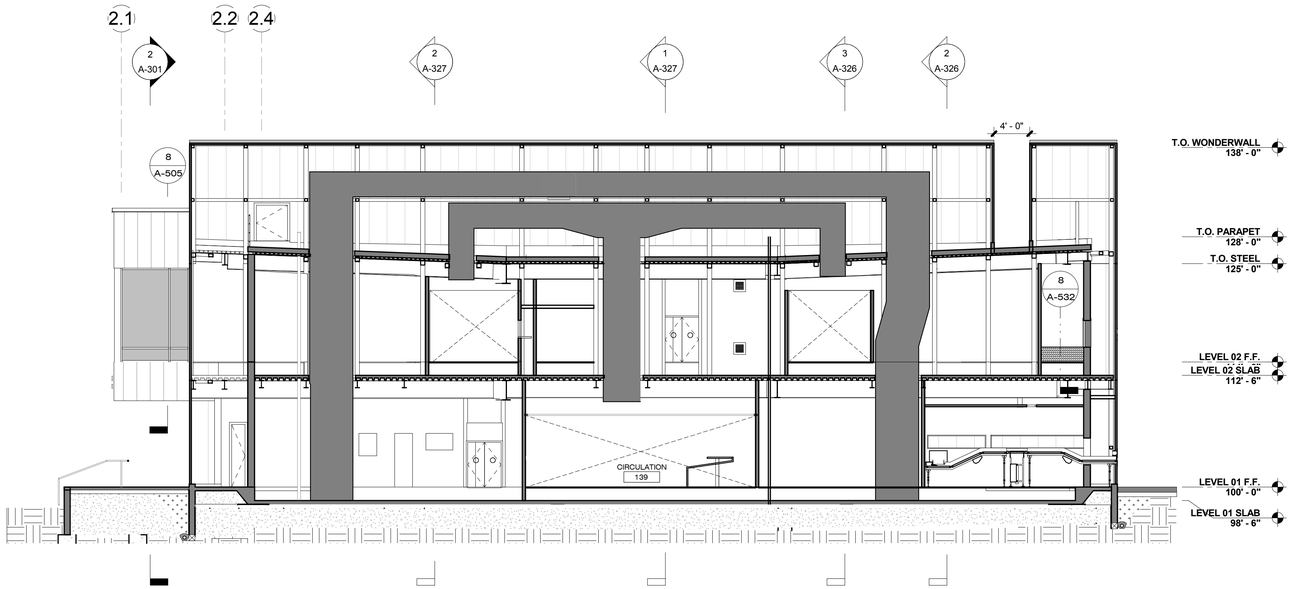
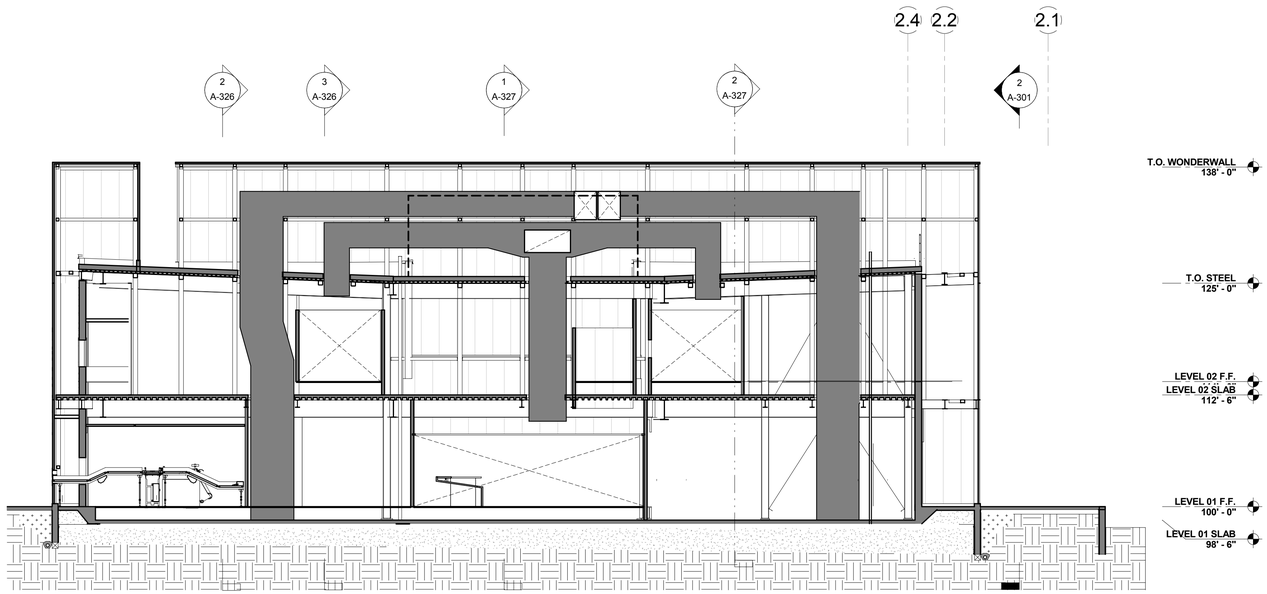


2 A-302 WONDER WALL - SOUTH
1/8" = 1'-0"



1 A-302 WONDER WALL - NORTH
1/8" = 1'-0"

GENERAL NOTES - SECTIONS

1. REFER TO STRUCTURAL FOR FOUNDATION INFORMATION
2. VIEWS CUT PARALLELTO WONDER WALL

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sDC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02089

ISSUE DATE
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BUILDING SECTIONS

A-302

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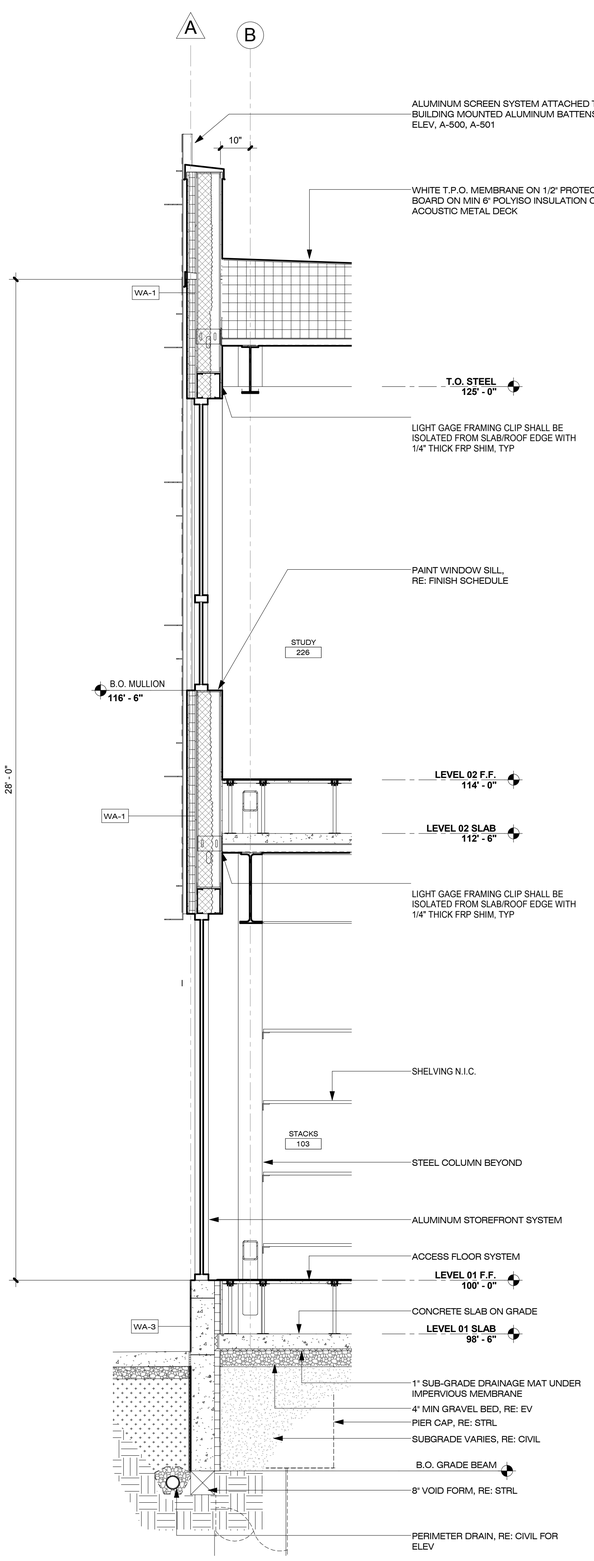
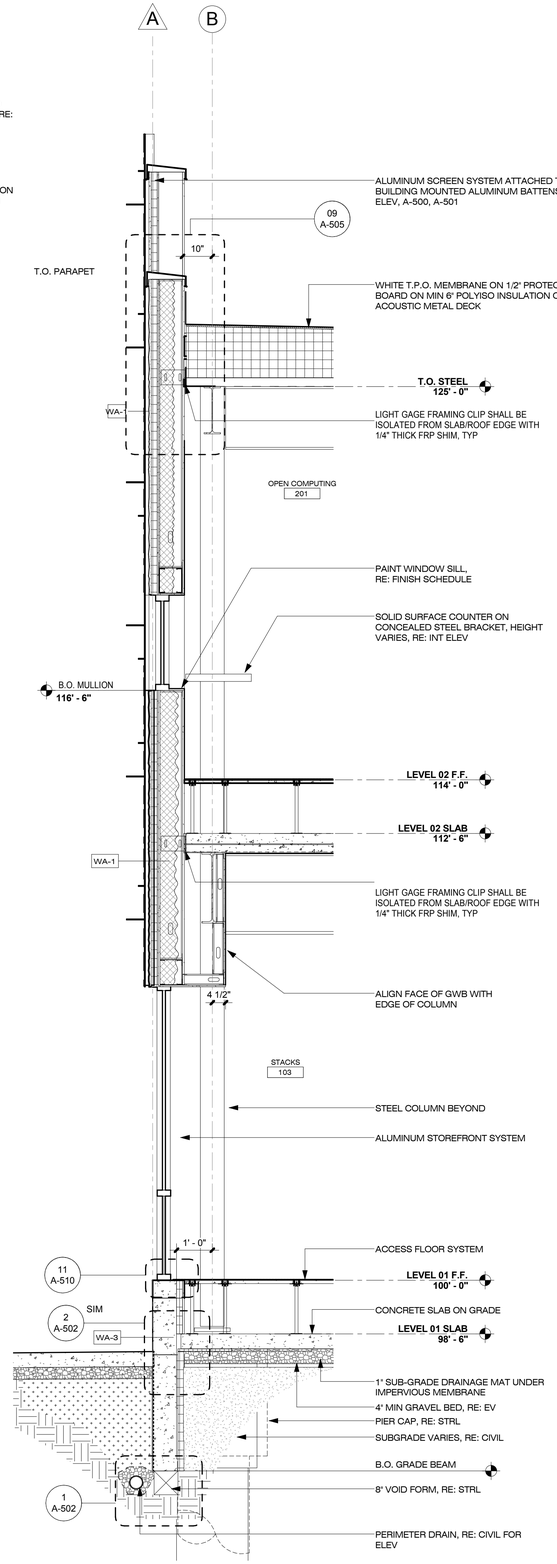
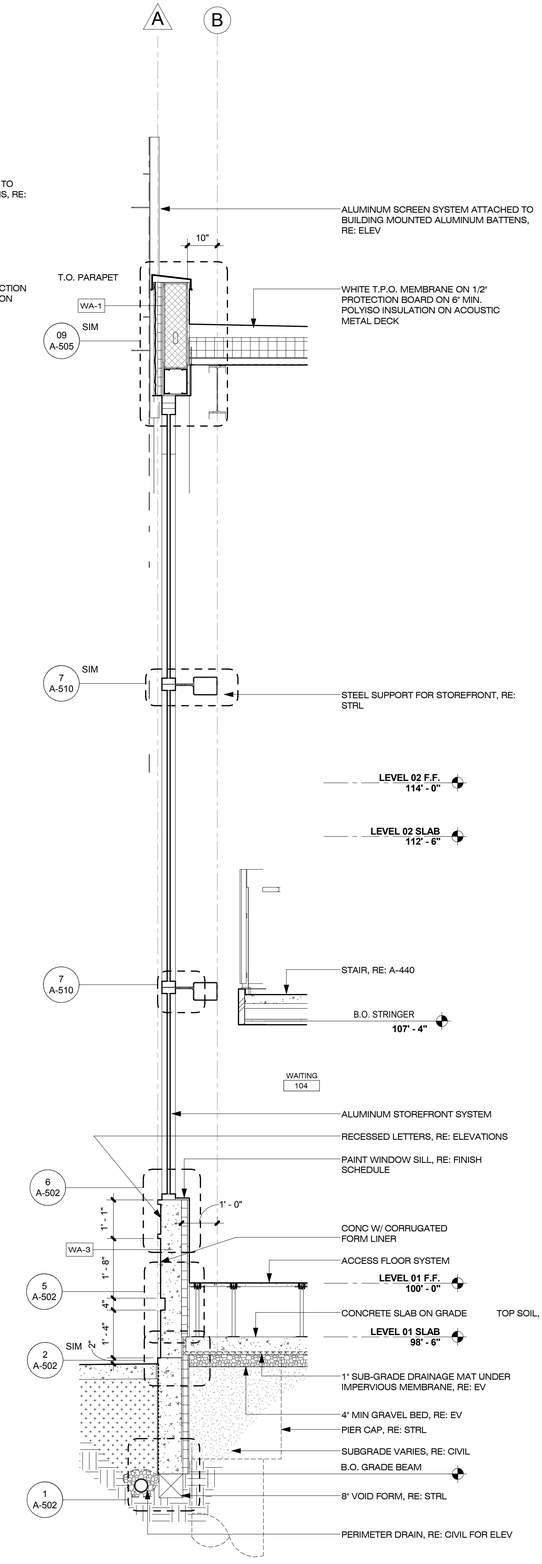


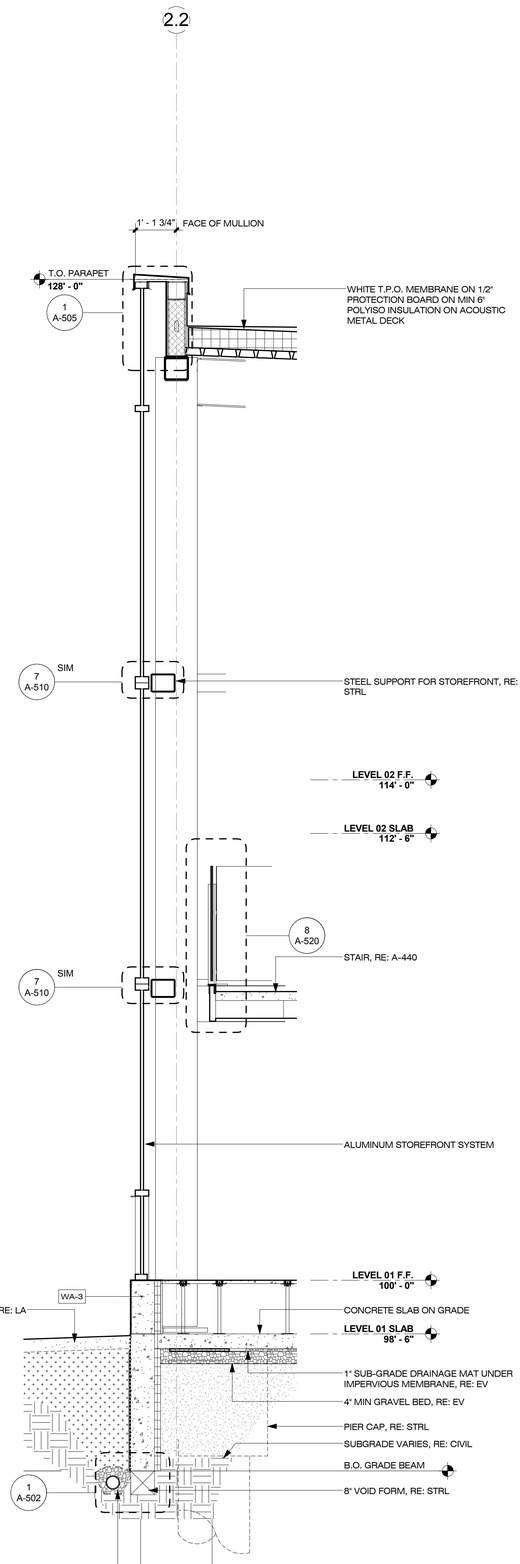
4 A-320 WALL SECTION - NORTH 3
1/2" = 1'-0"



3 A-320 WALL SECTION - NORTH
1/2" = 1'-0"



2 A-320 WALL SECTION @ MAIN STAIR 2
1/2" = 1'-0"



1 A-320 SECTION -
1/2" = 1'-0"

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WALL SECTIONS

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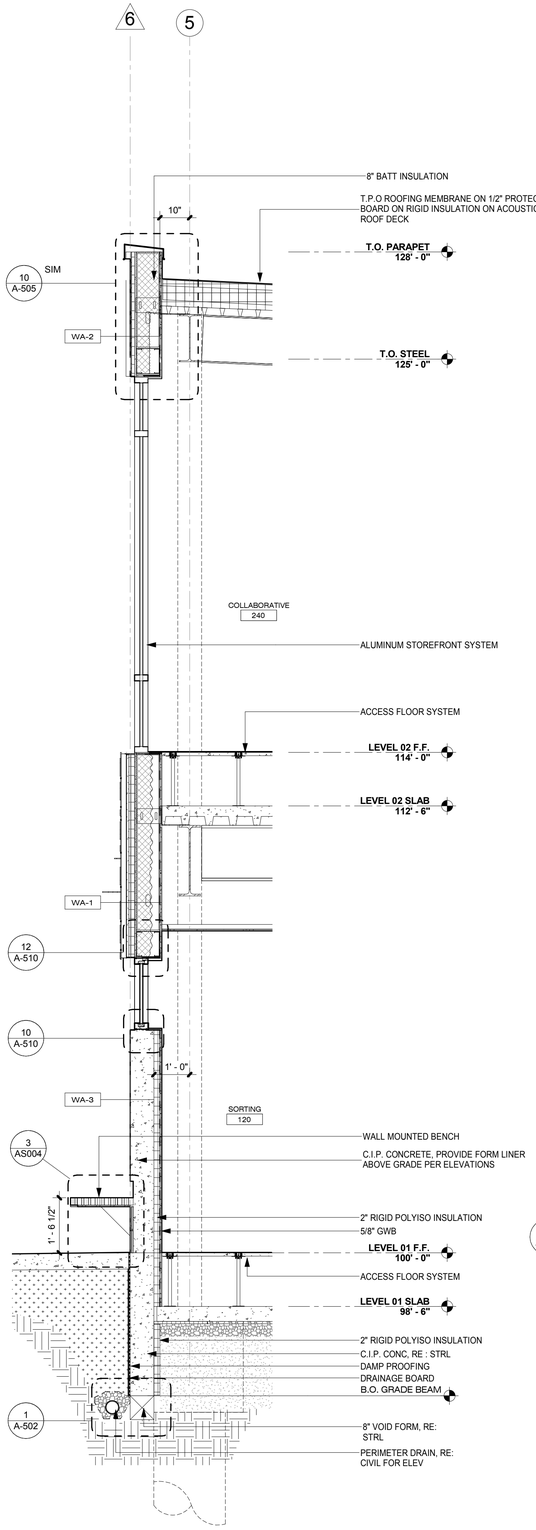
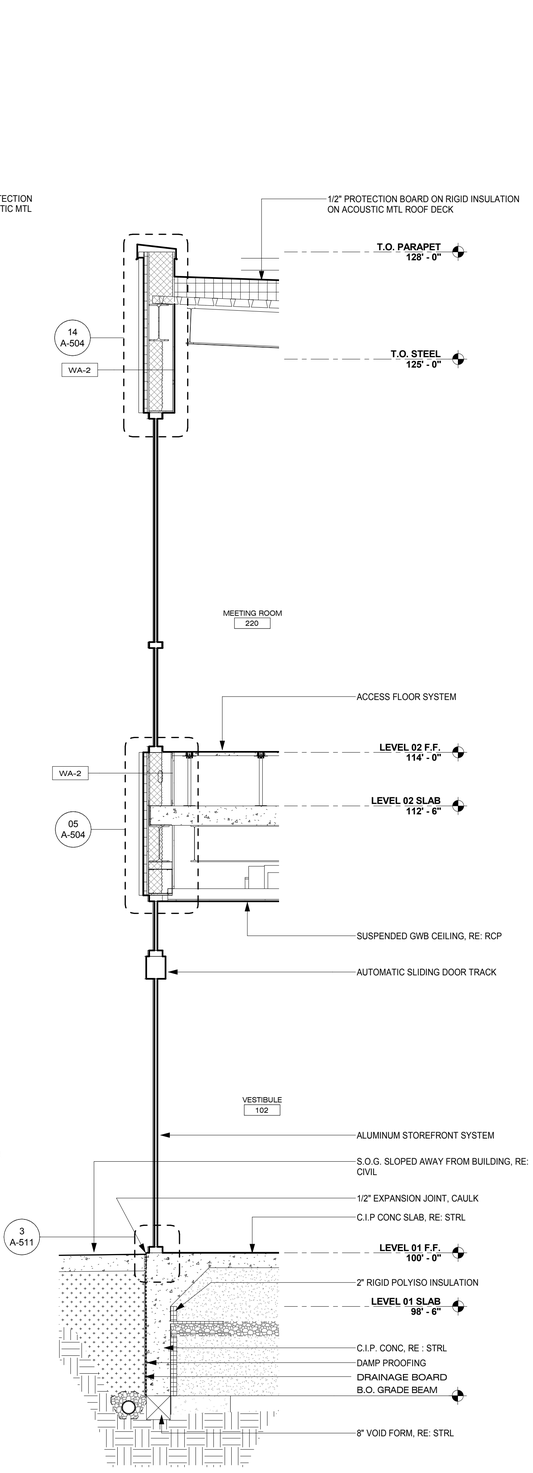
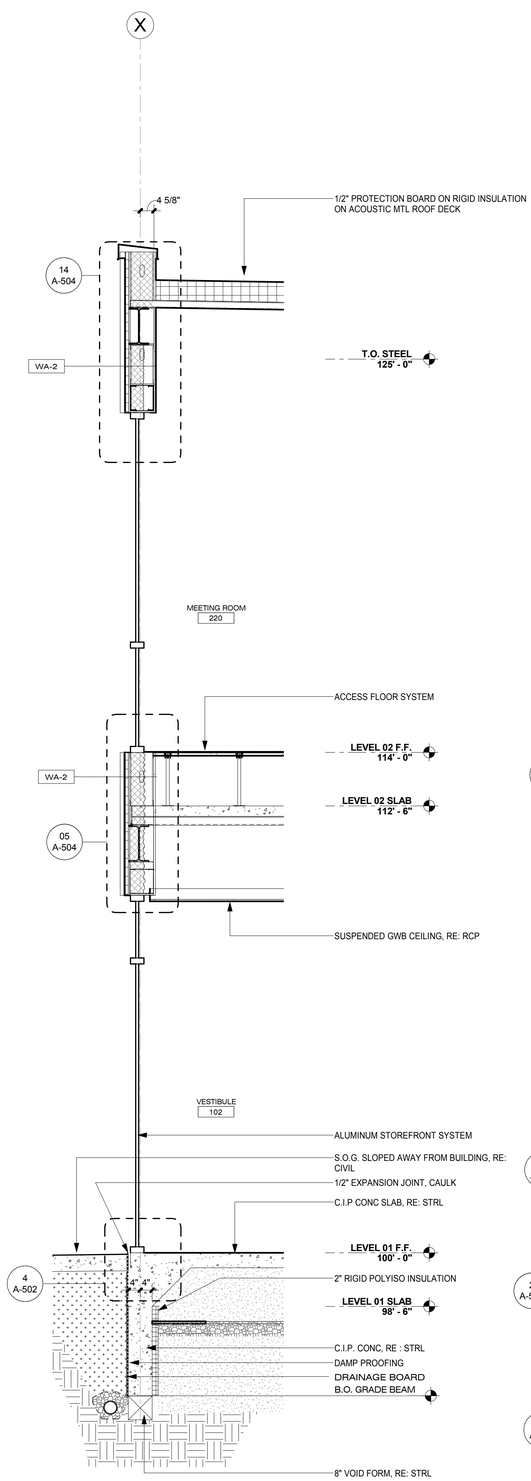


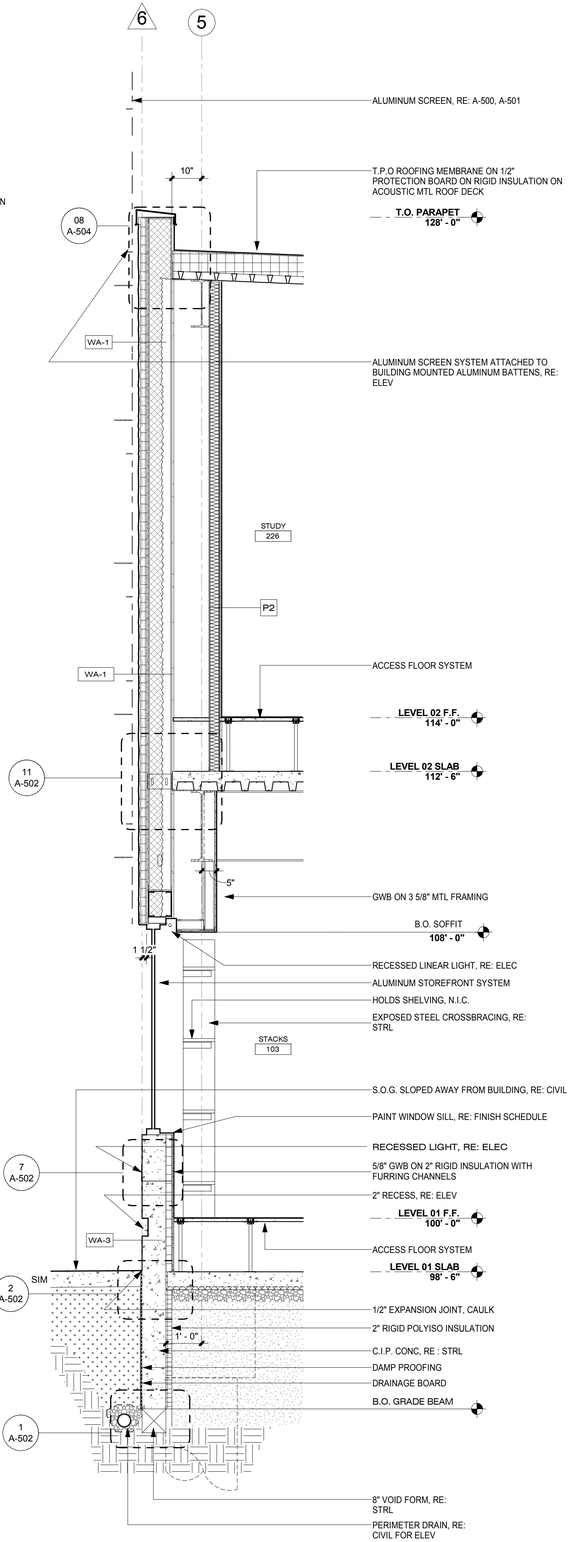
4 WALL SECTION - EAST
A-321 1/2" = 1'-0"



3 WALL SECTION - EAST ENTRY 2
A-321 1/2" = 1'-0"



2 WALL SECTION - EAST ENTRY.
A-321 1/2" = 1'-0"



1 WALL SECTION - EAST 2
A-321 1/2" = 1'-0"

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WALL SECTIONS

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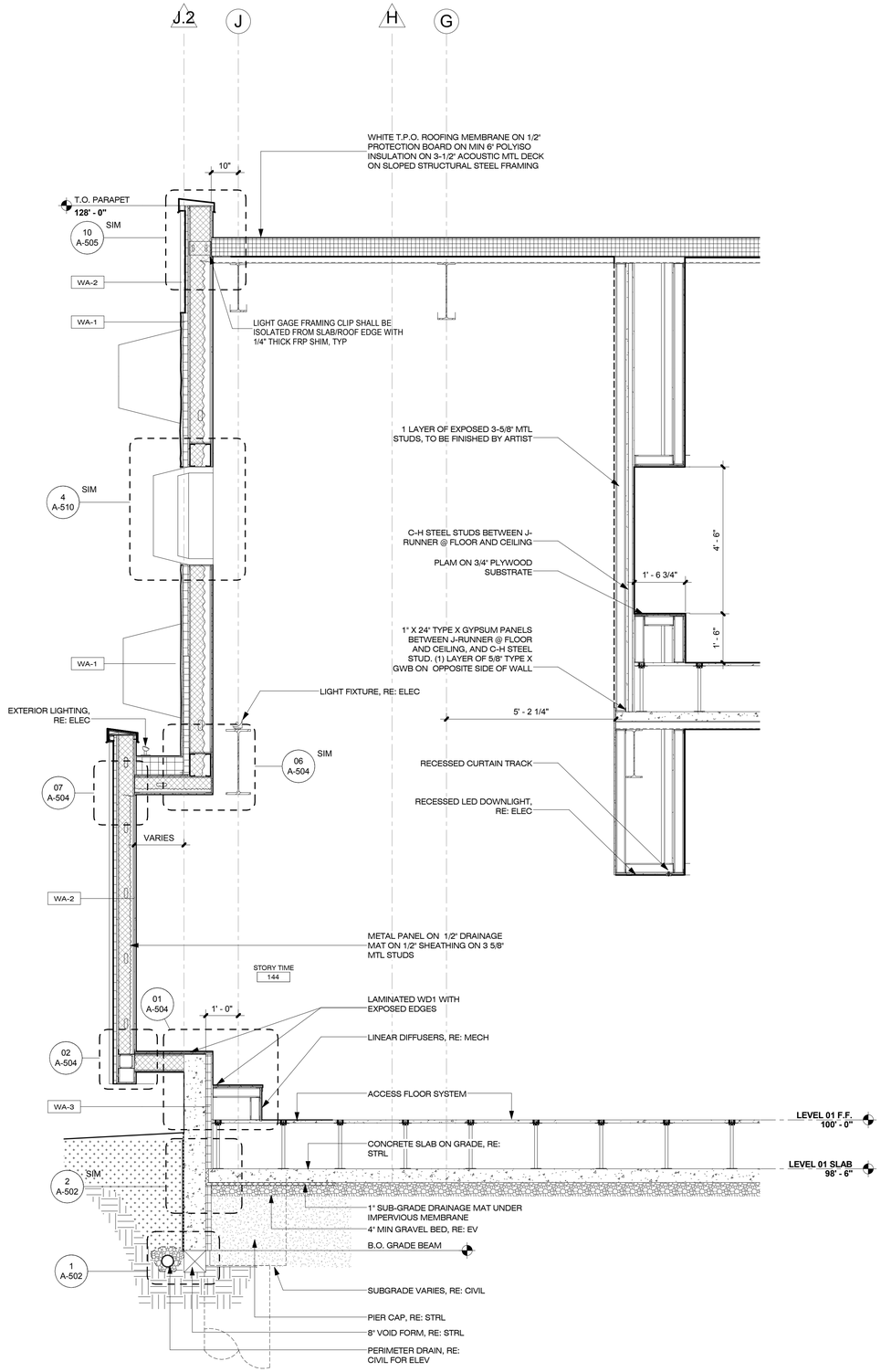
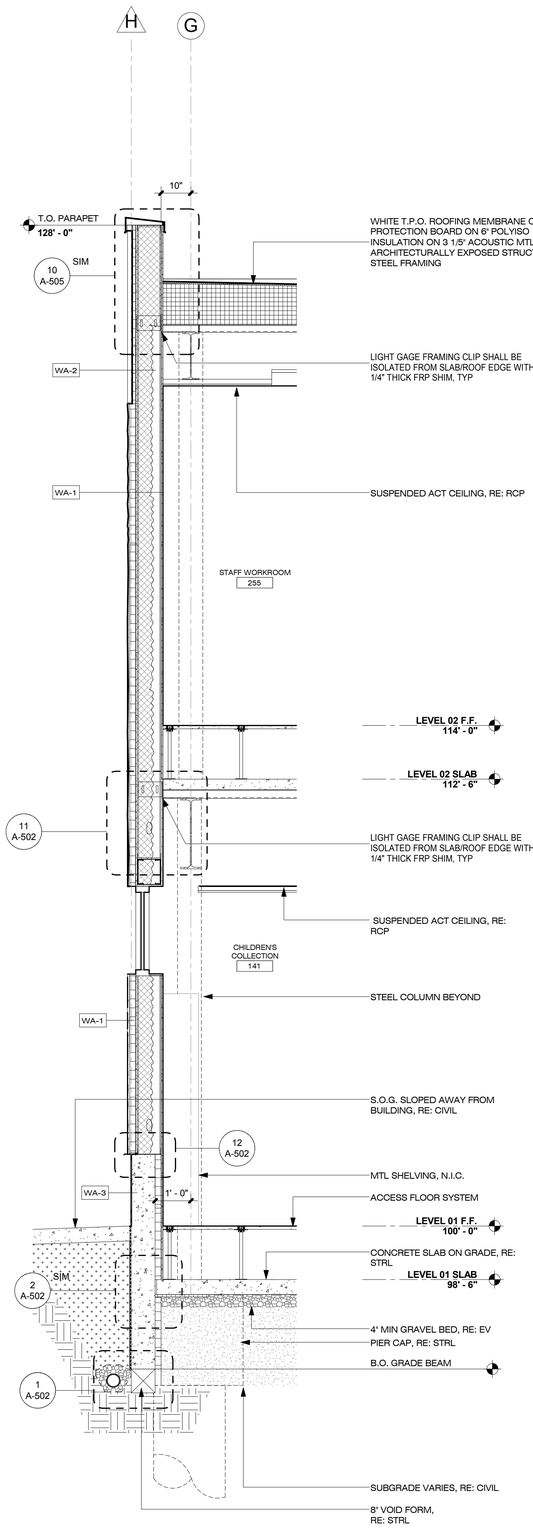


3 / A-323 WALL SECTION - SOUTH 3
1/2" = 1'-0"



2 / A-323 WALL SECTION - SOUTH
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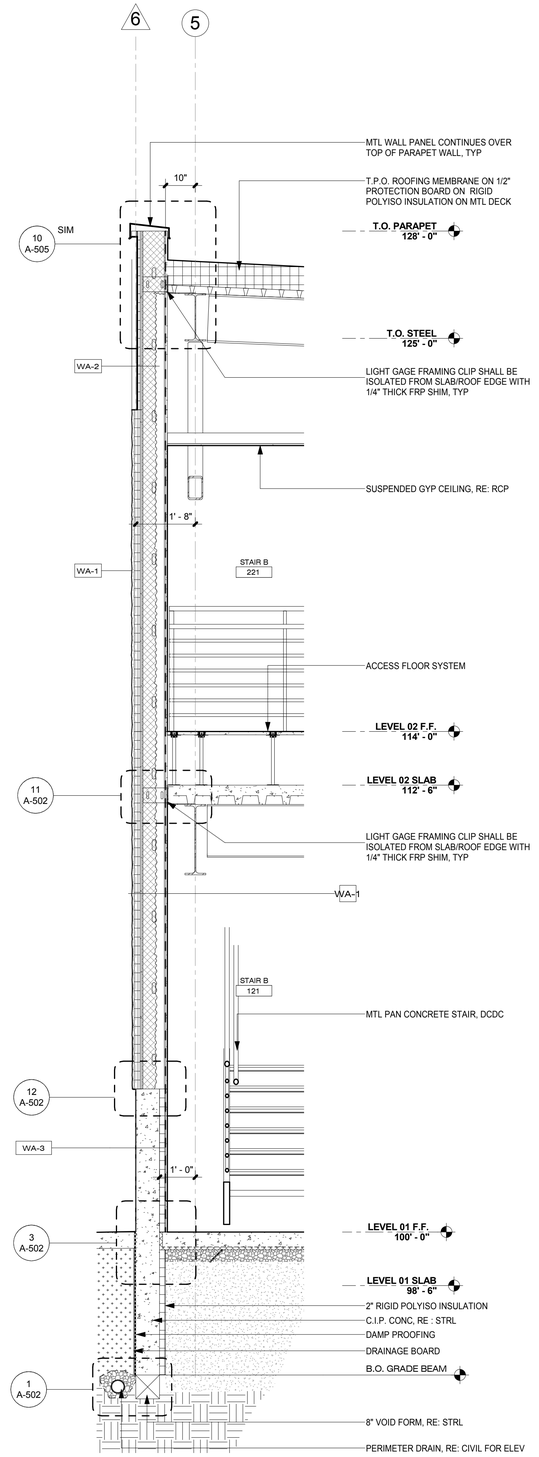

1 / A-323 WALL SECTION @ EXIT STAIR
1/2" = 1'-0"

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WALL SECTIONS

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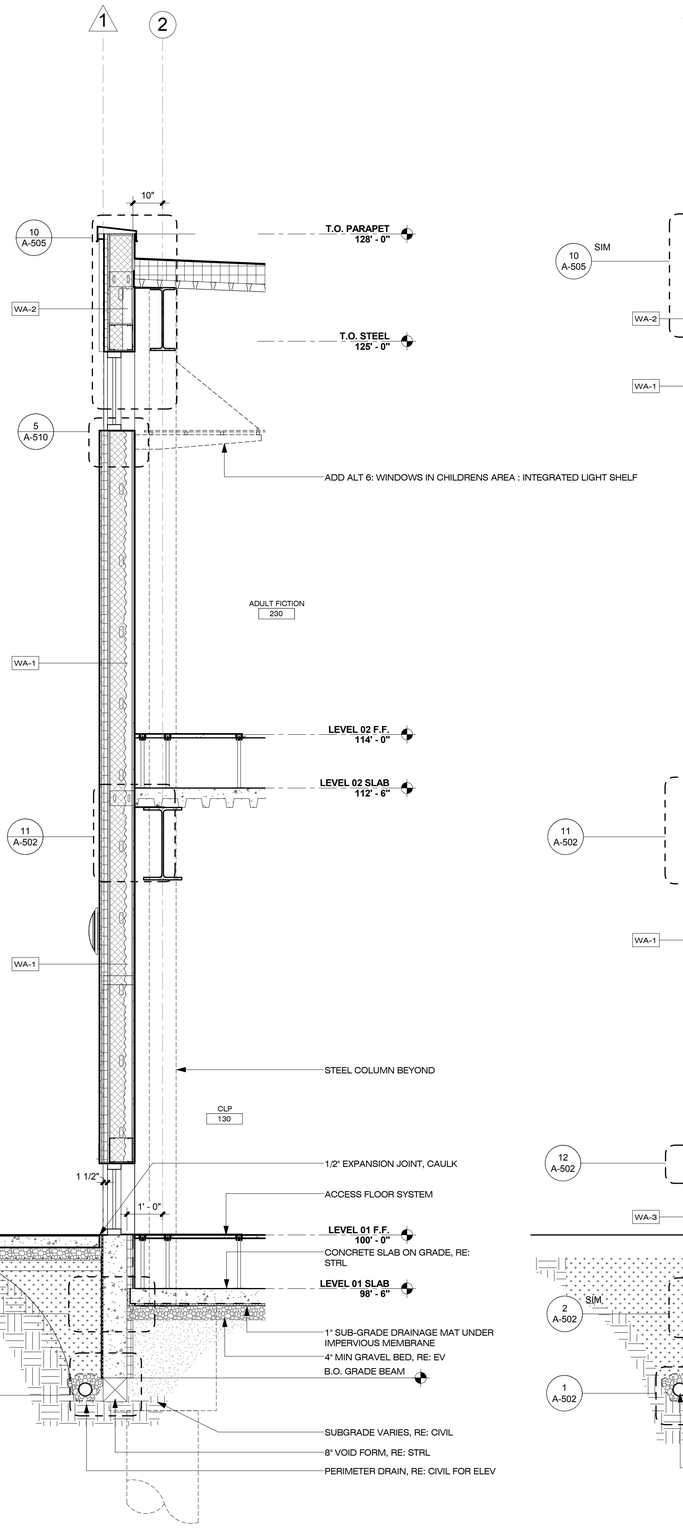
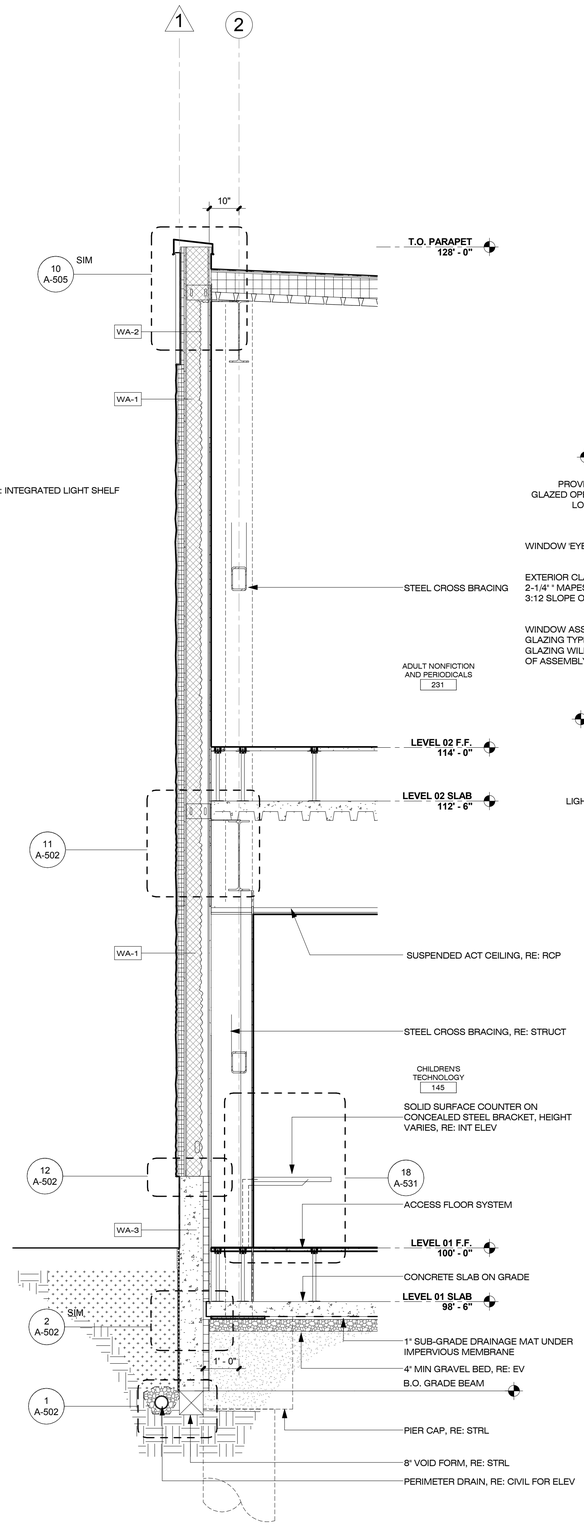


3 A-324 WALL SECTION WEST - 2
1/2" = 1'-0"



2 A-324 WALL SECTION WEST - 1
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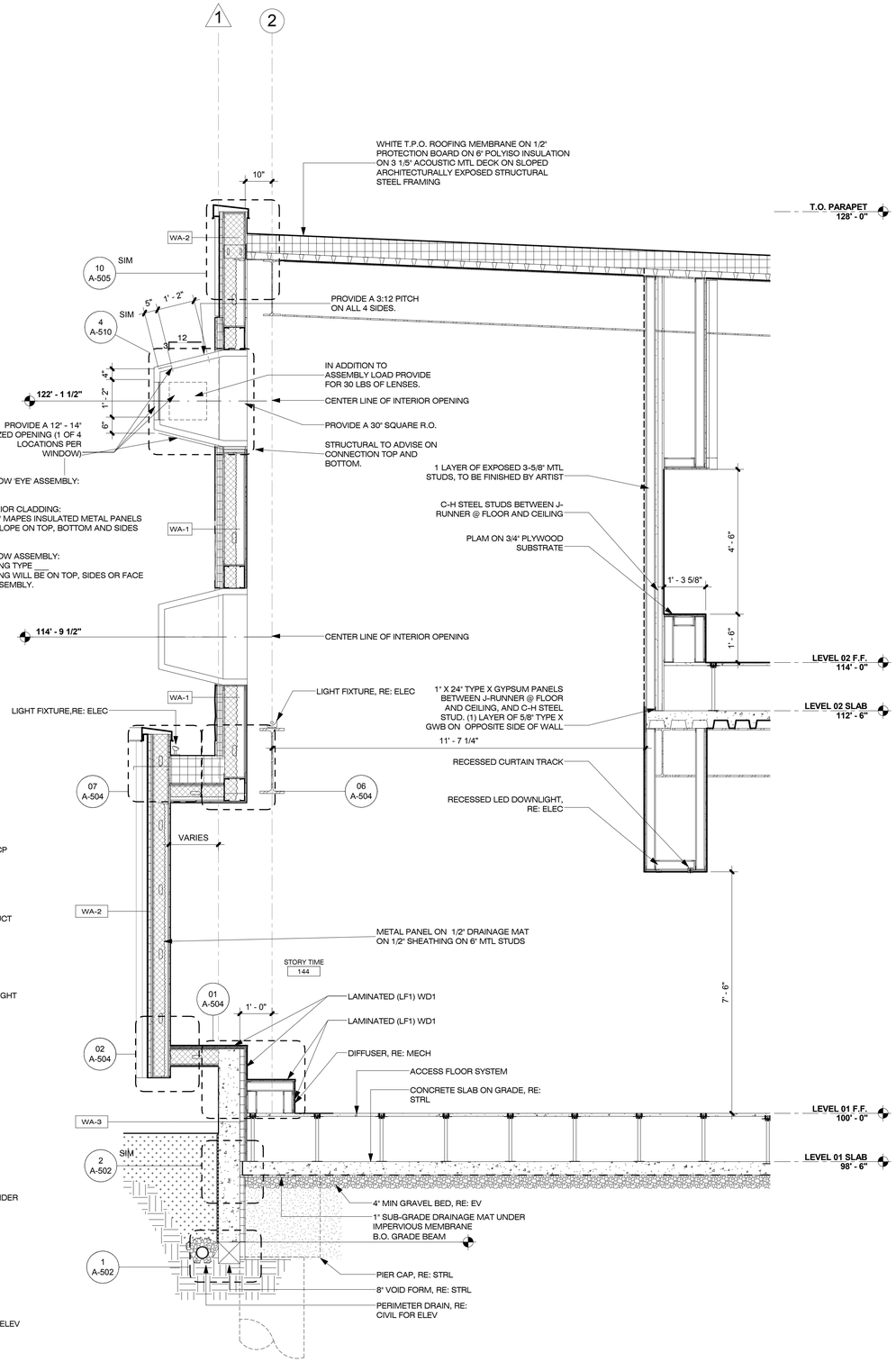

1 A-324 WALL SECTION - WEST 2
1/2" = 1'-0"

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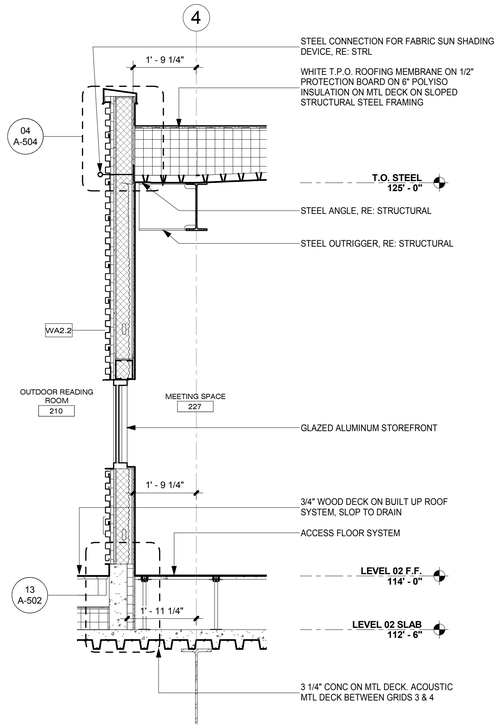
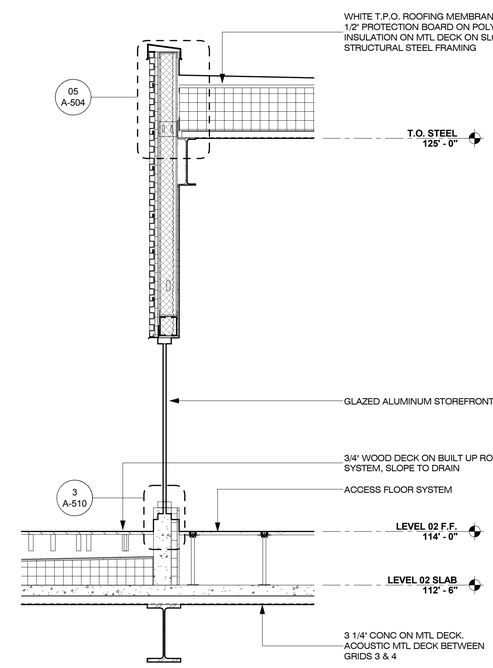
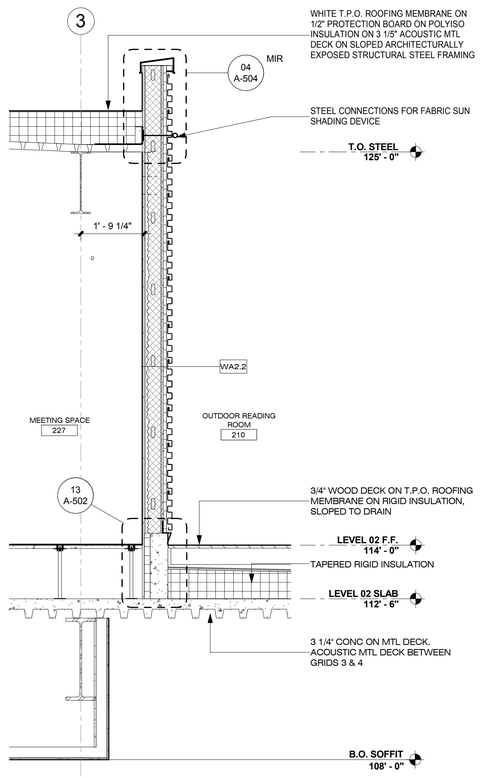


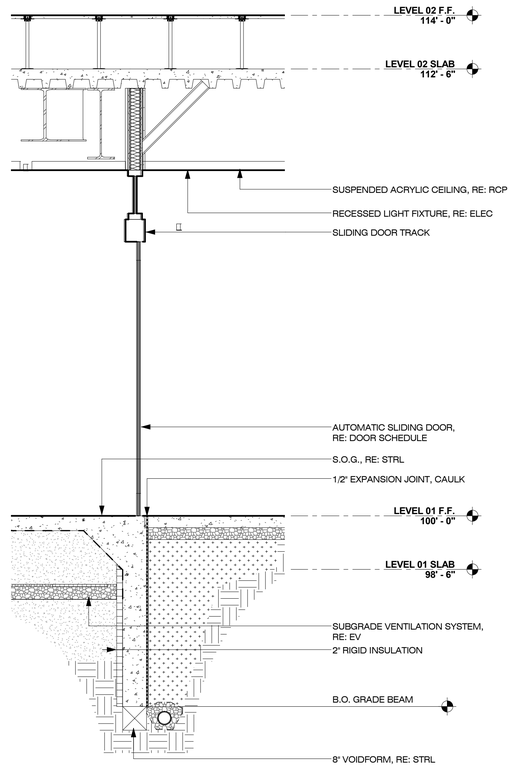
6 A-325 WALL SECTION - COURTYARD EAST
1/2" = 1'-0"



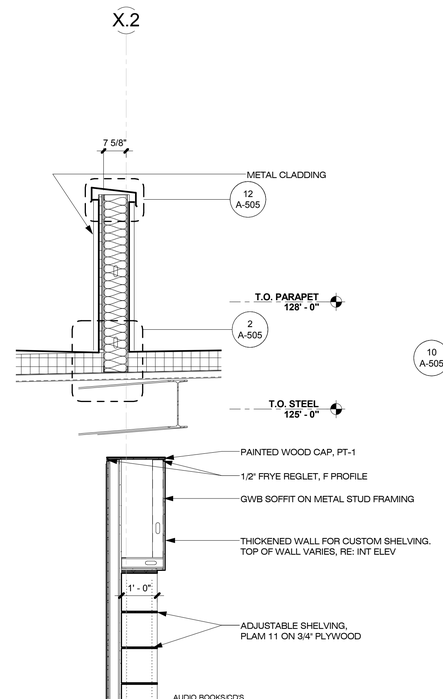
5 A-325 WALL SECTION - COURTYARD SOUTH
1/2" = 1'-0"



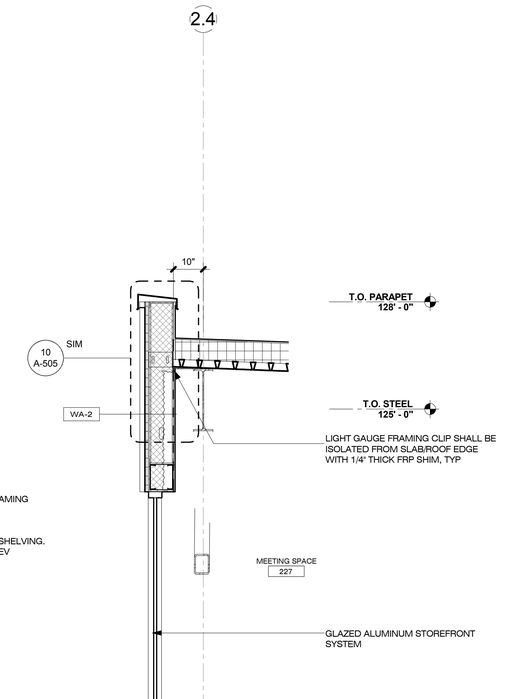
4 A-325 WALL SECTION - COURTYARD WEST
1/2" = 1'-0"



3 A-325 WALL SECTION @ VESTIBULE
1/2" = 1'-0"



2 A-325 SECTION GLASS WALL AT MAIN STAIR
1/2" = 1'-0"



1 A-325 WALL SECTION WEST - 3
1/2" = 1'-0"

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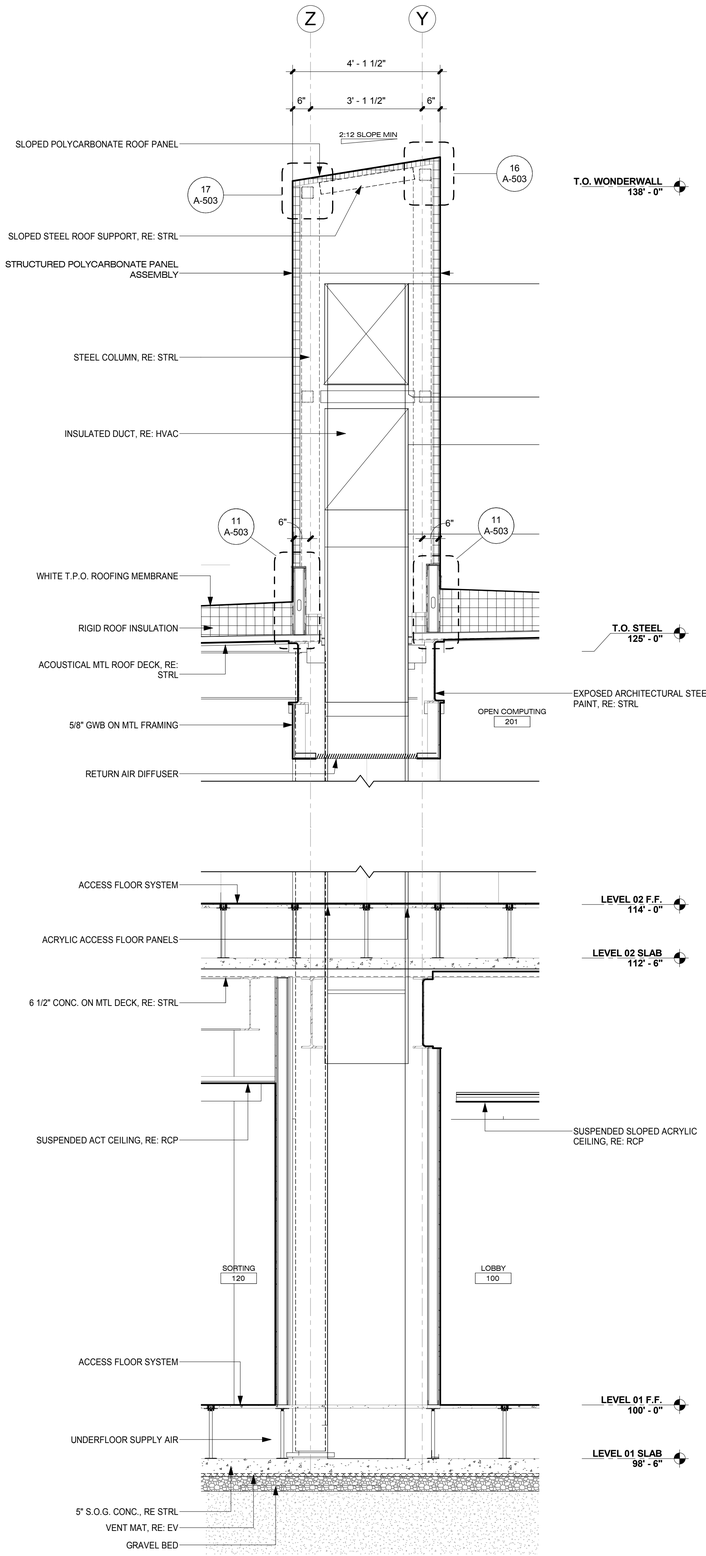
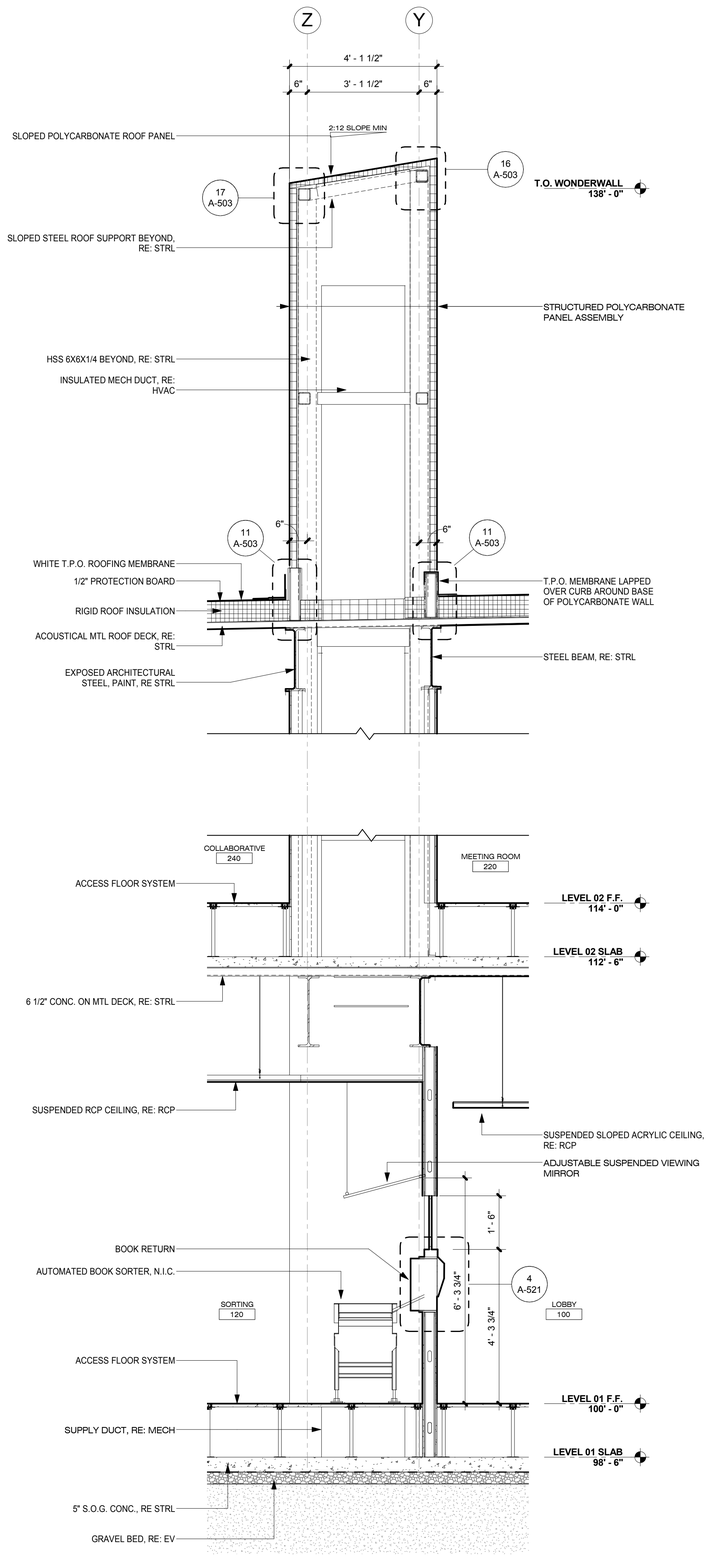
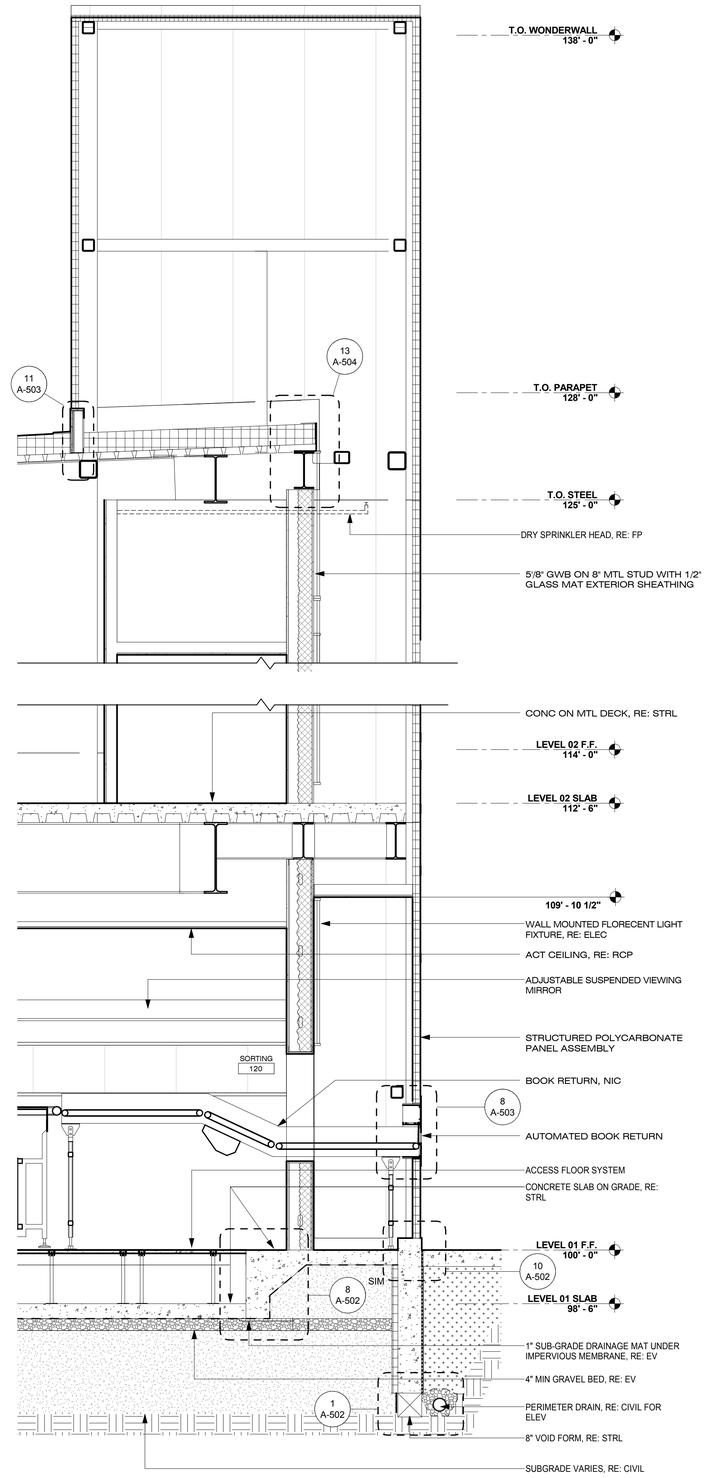


3 A-326 WONDERWALL SECTION - 3
1/2" = 1'-0"



2 A-326 WONDERWALL SECTION - 2
1/2" = 1'-0"



1 A-326 WALL SECTION - WONDER WALL
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PROJECT:
WEST DENVER BRANCH LIBRARY
1498 NORTH IRVING STREET
DENVER, COLORADO 80204

sDC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02089

ISSUE DATE
01-12-2012

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WALL SECTIONS

A-326

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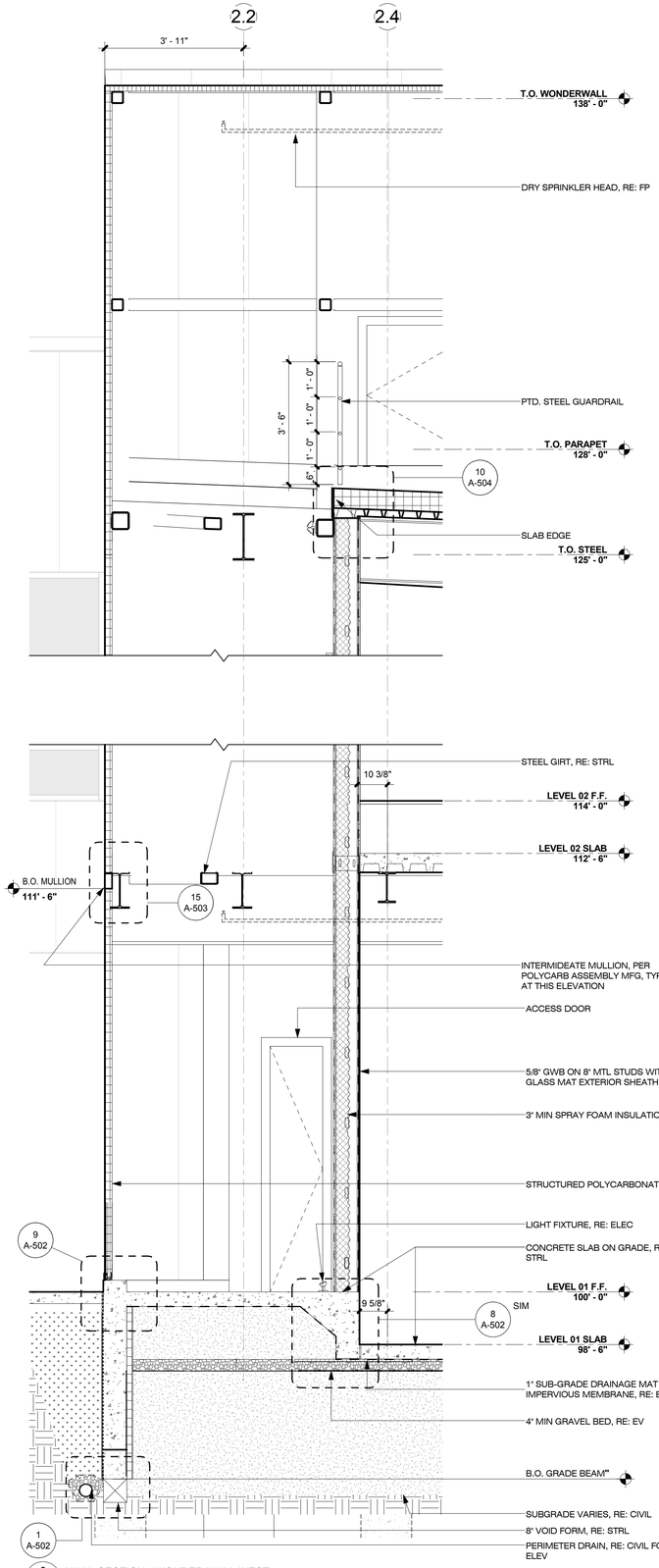
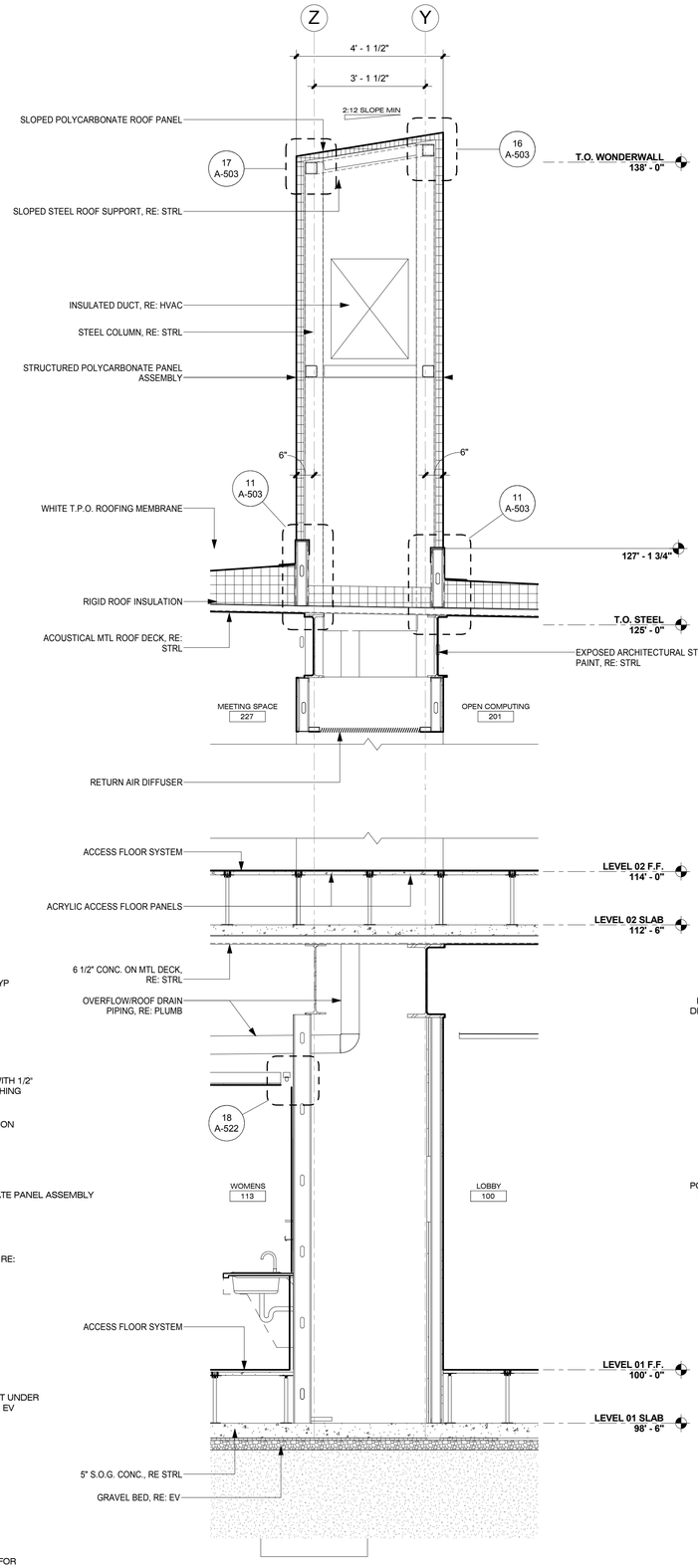
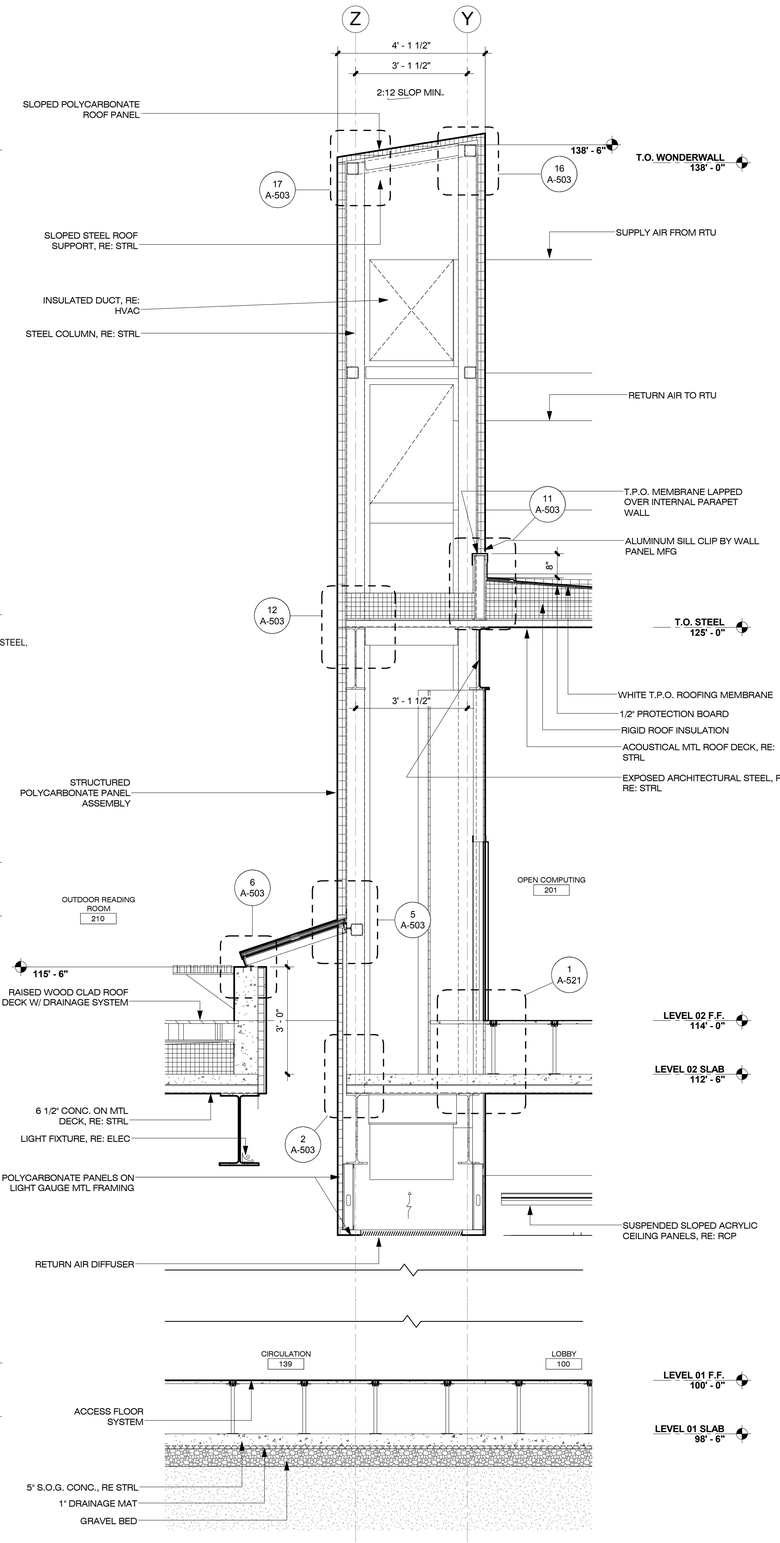


3 / A-327 WALL SECTION - WONDER WALL WEST
1/2" = 1'-0"



2 / A-327 WONDERWALL SECTION - 5
1/2" = 1'-0"



1 / A-327 WONDERWALL SECTION - 4
1/2" = 1'-0"

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WALL SECTIONS

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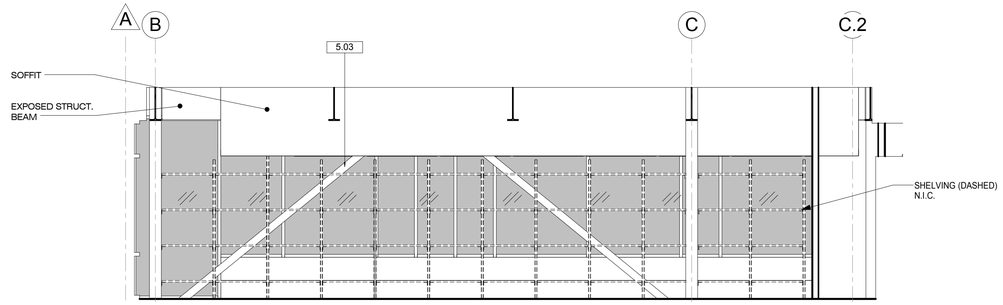
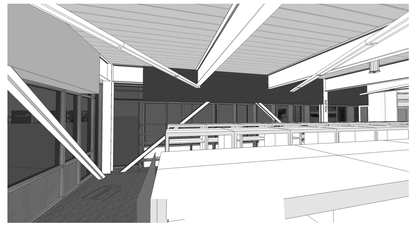


9 A-400 HOLDS 103 - EAST 1/4" = 1'-0"



8 A-400 HOLDS 1/16" = 1'-0"

GENERAL NOTES - INTERIOR ELEVATIONS

1. ALL FURNITURE AND SHELVING SHOWN AS DASHED ARE N.I.C. SHOWN FOR COORDINATION ONLY.

2. REFER TO FINISH SCHEDULE FOR WALL FINISH MATERIAL, COLOR, AND BASE MATERIAL.

3. ALL WALLS PT1 UNLESS OTHERWISE NOTED.

4. ALL BASE RB1 UNLESS OTHERWISE NOTED.

5. ALL WALL SURFACES SHOWN TO BE GWB U.O.N.

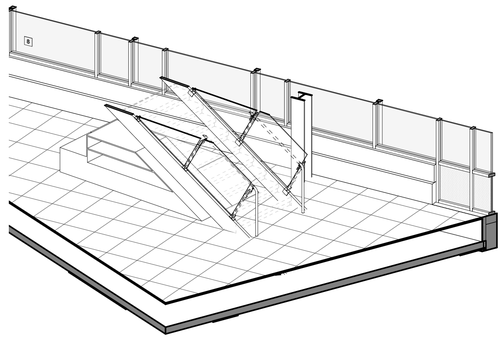
6. REFER TO A-610 - A-615 FOR GRAPHICS.

7. PROVIDE BLOCKING AT ALL WALLS WITH SHELVING AND MILLWORK. COORDINATE SHELVING N.I.C.

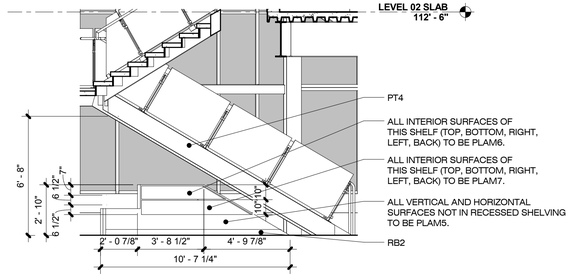
8. REFER TO GRAPHICS SHEETS (A-600+) AND SPECIFICATIONS FOR ADDITIONAL INFORMATION.

KEYNOTES

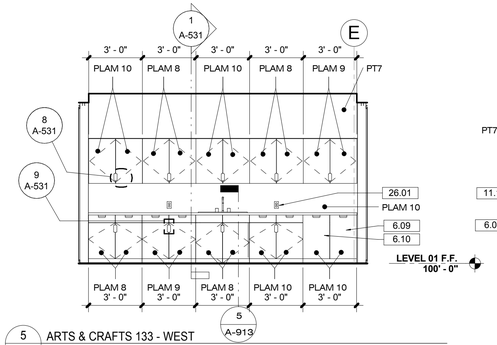
5.03	EXPOSED STRUCTURAL STEEL, RE: STRL
6.09	INTERIOR ARCHITECTURAL WOODWORK, BUILT-IN RECYCLING, PULL-OUT ROLLERS
6.10	INTERIOR ARCHITECTURAL WOODWORK, BUILT-IN TRASH, PULL-OUT ROLLERS
8.27	SECTIONAL DOOR
9.12	BASE FINISH, RE: FINISH SCHEDULE
10.50	FIRE EXTINGUISHER CABINETS
10.53	DRINKING FOUNTAIN
11.11	RESIDENTIAL APPLIANCES, FULL SIZE REFRIGERATOR, PURCHASED BY GC, INSTALLED BY GC
11.60	PRINTER, PURCHASED BY DPL, INSTALLED BY DPL
11.92	VENDING MACHINES - LEASED BY DPL, INSTALLED BY VENDOR, N.I.C.
26.01	POWER OUTLETS IN WALL, RE: ELEC



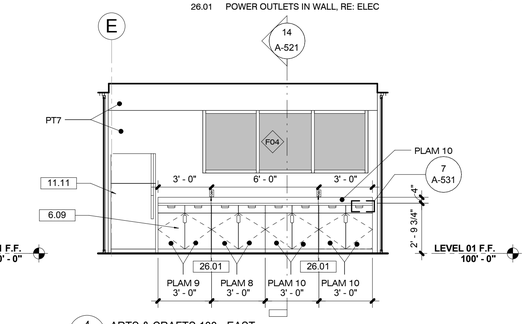
7 A-400 WINDOW BAR



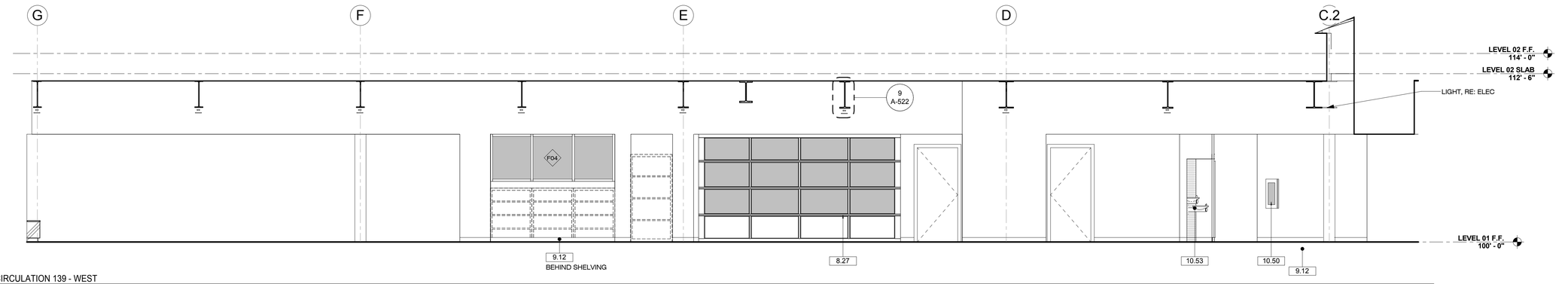
6 A-400 INT ELEVATION KIOSK 1/4" = 1'-0"



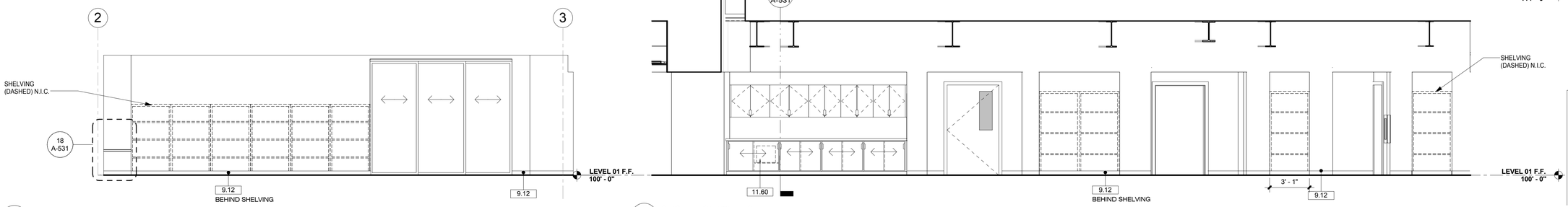
5 A-400 ARTS & CRAFTS 133 - WEST 1/4" = 1'-0"



4 A-400 ARTS & CRAFTS 133 - EAST 1/4" = 1'-0"



3 A-400 CIRCULATION 139 - WEST 1/4" = 1'-0"



2 A-400 CHILDRENS TECHNOLOGY 145 - NORTH 1/4" = 1'-0"

1 A-400 CIRCULATION 139 - EAST 1/4" = 1'-0"

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INTERIOR ELEVATIONS

A-400

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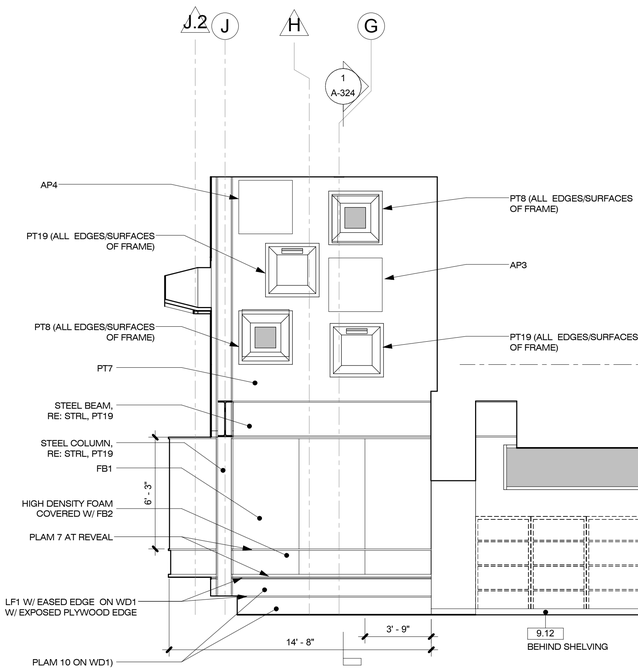
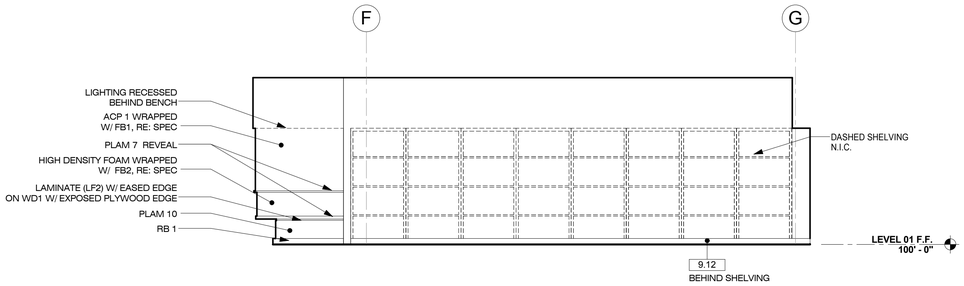
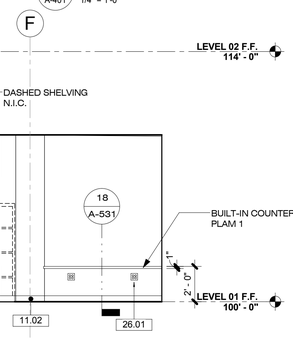
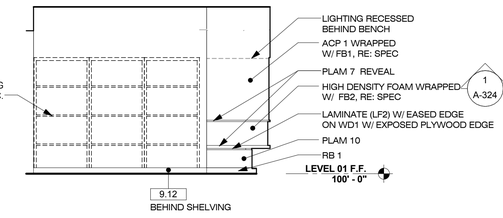


6 A-401 STORYTIME 144 - WEST - SECTION
1/4" = 1'-0"

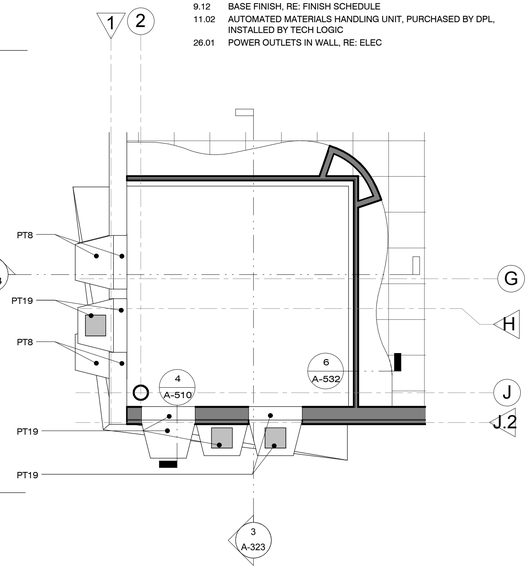


7 A-401 CHILDREN'S AREA - EAST
1/4" = 1'-0"

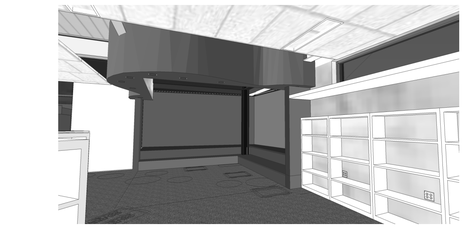




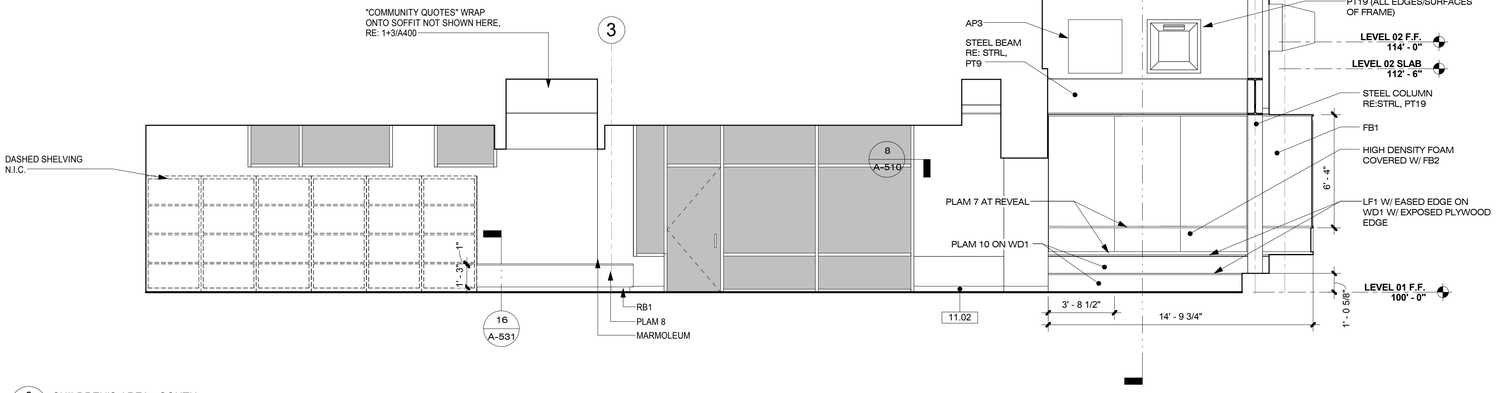
5 A-401 CHILDREN'S AREA - NORTH
1/4" = 1'-0"



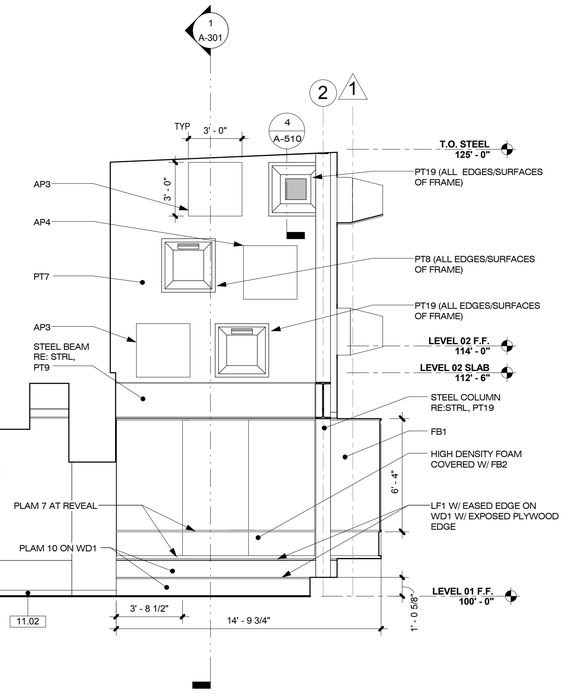
4 A-401 STORYTIME 144 LEVEL 2 - ENLARGED RCP
1/4" = 1'-0"

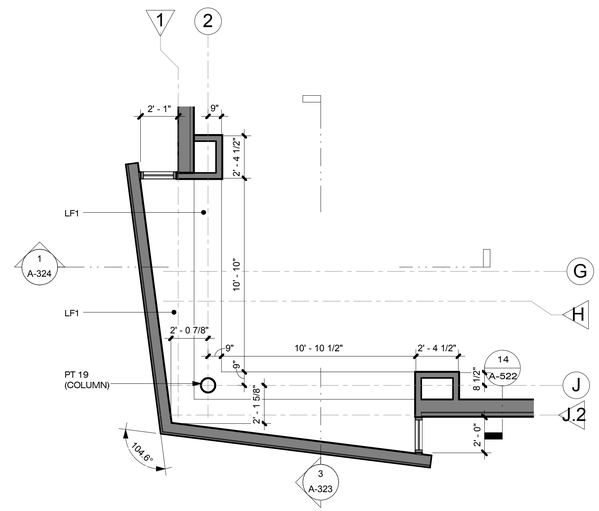


3 A-401 STORY TIME
1/16" = 1'-0"



2 A-401 CHILDREN'S AREA - SOUTH
1/4" = 1'-0"





1 A-401 STORYTIME 144 LEVEL 1 - ENLARGED FLOOR PLAN
1/4" = 1'-0"

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KEYNOTES

9.12	BASE FINISH, RE: FINISH SCHEDULE
11.02	AUTOMATED MATERIALS HANDLING UNIT, PURCHASED BY DPL, INSTALLED BY TECH LOGIC
26.01	POWER OUTLETS IN WALL, RE: ELEC

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INTERIOR ELEVATIONS

A-401

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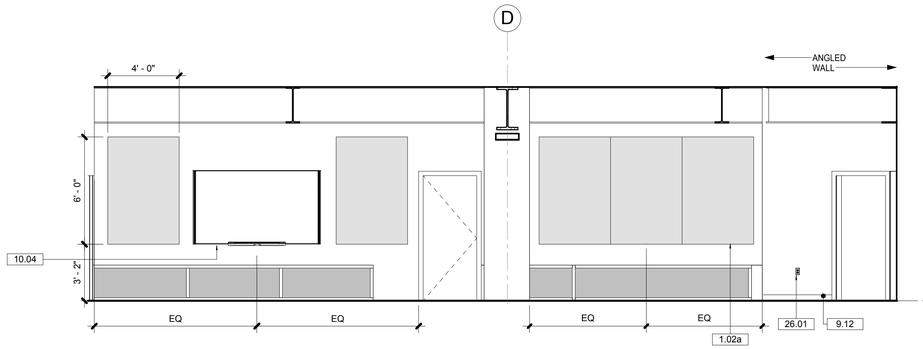
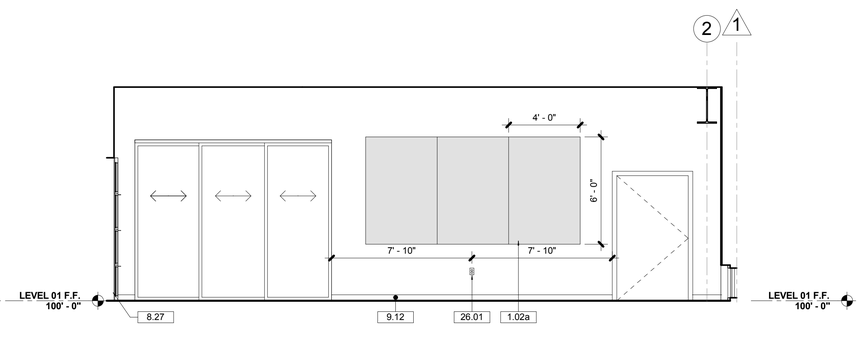
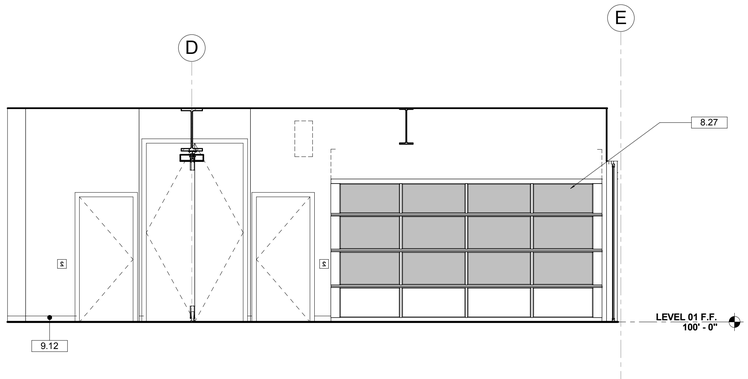


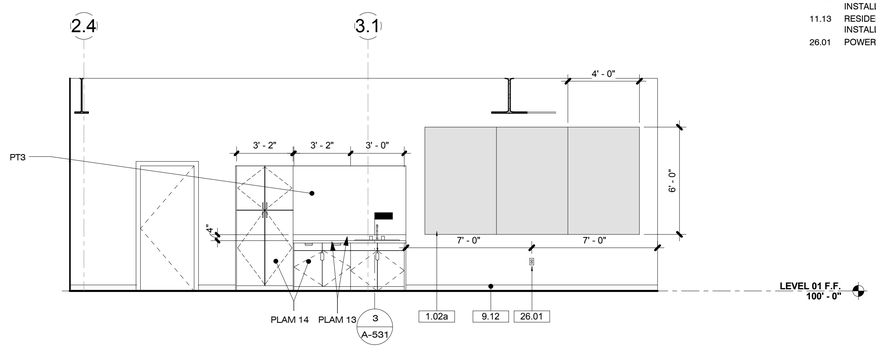
11 A-402 CLP 130 - WEST
1/4" = 1'-0"



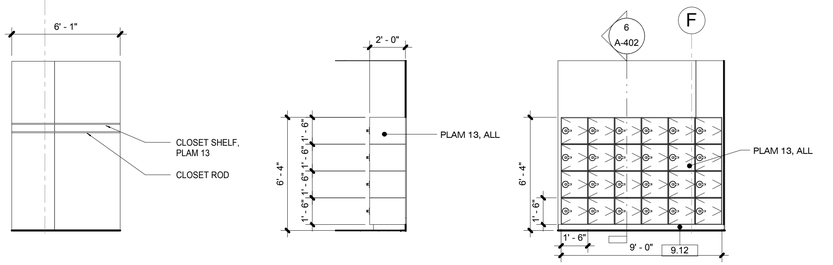
10 A-402 CLP 130 - SOUTH
1/4" = 1'-0"



9 A-402 CLP 130 - EAST
1/4" = 1'-0"



8 A-402 CLP 130 - NORTH
1/4" = 1'-0"

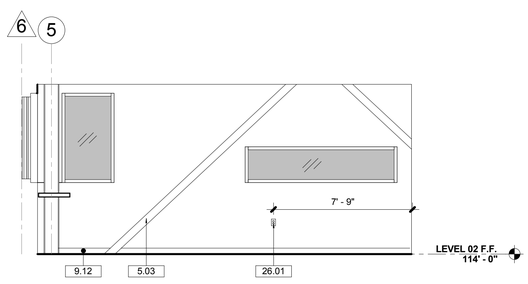


7 A-402 STAFF LOCKERS 251 - WEST
1/4" = 1'-0"

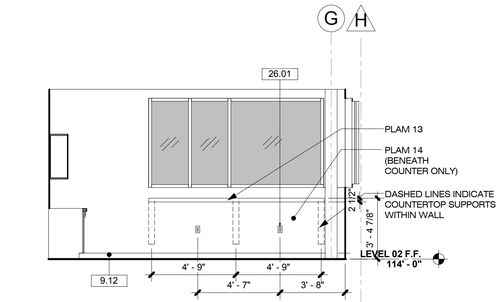
6 A-402 DTL STAFF LOCKERS 251
1/4" = 1'-0"

5 A-402 STAFF LOCKERS 251 - EAST
1/4" = 1'-0"

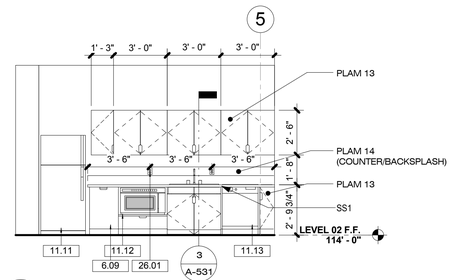
4 A-402 STAFF LOUNGE 253 - WEST
1/4" = 1'-0"



3 A-402 STAFF LOUNGE 253 - SOUTH
1/4" = 1'-0"



2 A-402 STAFF LOUNGE 253 - EAST
1/4" = 1'-0"



1 A-402 STAFF LOUNGE 253 - NORTH
1/4" = 1'-0"

GENERAL NOTES - INTERIOR ELEVATIONS

1. ALL FURNITURE AND SHELVING SHOWN AS DASHED ARE N.I.C. SHOWN FOR COORDINATION ONLY.

2. REFER TO FINISH SCHEDULE FOR WALL FINISH MATERIAL, COLOR, AND BASE MATERIAL.

3. ALL WALLS PT1 UNLESS OTHERWISE NOTED.

4. ALL BASE RB1 UNLESS OTHERWISE NOTED.

5. ALL WALL SURFACES SHOWN TO BE GWB U.O.N.

6. REFER TO A-610 - A-615 FOR GRAPHICS.

7. PROVIDE BLOCKING AT ALL WALLS WITH SHELVING AND MILLWORK. COORDINATE SHELVING N.I.C.

8. REFER TO GRAPHICS SHEETS (A-600+) AND SPECIFICATIONS FOR ADDITIONAL INFORMATION.

KEYNOTES

1.02a	ADDITIVE ALTERNATE 7: ACOUSTICAL TREATMENTS IN THE STUDIO (50% FABRIC WRAPPED PANELS)
5.03	EXPOSED STRUCTURAL STEEL, RE: STRL
6.03	INTERIOR ARCHITECTURAL WOODWORK, BUILT-IN CASEWORK
6.09	INTERIOR ARCHITECTURAL WOODWORK, BUILT-IN RECYCLING, PULL-OUT ROLLERS
8.27	SECTIONAL DOOR
9.12	BASE FINISH, RE: FINISH SCHEDULE
10.04	VISUAL DISPLAY SURFACES, BOARD 1, PURCHASED BY DPL, INSTALLED BY DPL
11.11	RESIDENTIAL APPLIANCES, FULL SIZE REFRIGERATOR, PURCHASED BY GC, INSTALLED BY GC
11.12	RESIDENTIAL APPLIANCES, MICROWAVE, PURCHASED BY GC, INSTALLED BY GC
11.13	RESIDENTIAL APPLIANCES, DISHWASHER, PURCHASED BY GC, INSTALLED BY GC
26.01	POWER OUTLETS IN WALL, RE: ELEC

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PROJECT: WEST DENVER BRANCH LIBRARY
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sDC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02069

ISSUE DATE
01-12-2012

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INTERIOR ELEVATIONS

A-402

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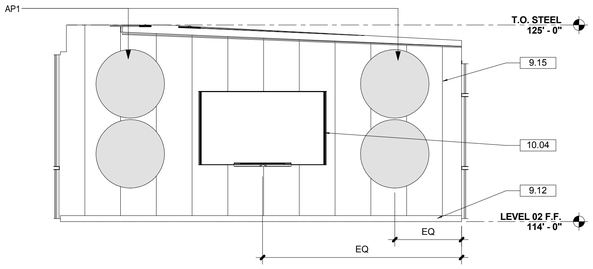
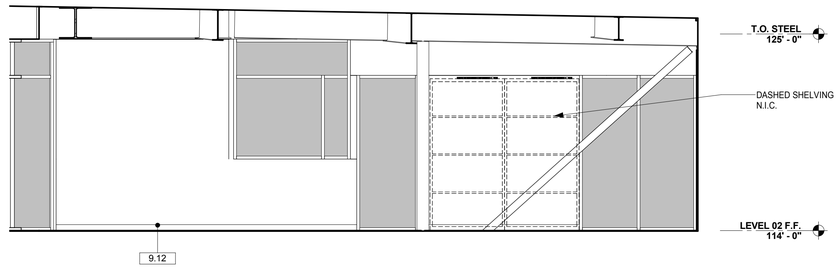
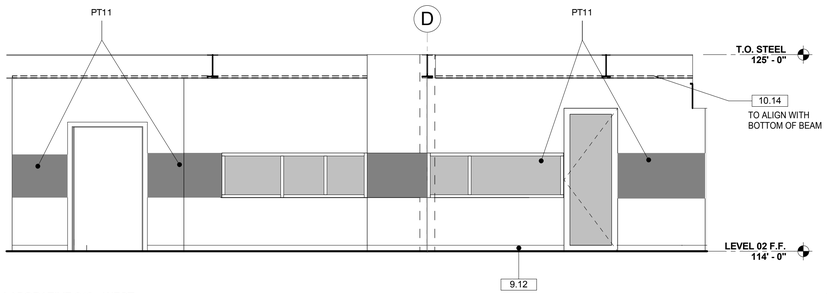
1/13/2012 2:56:37 AM



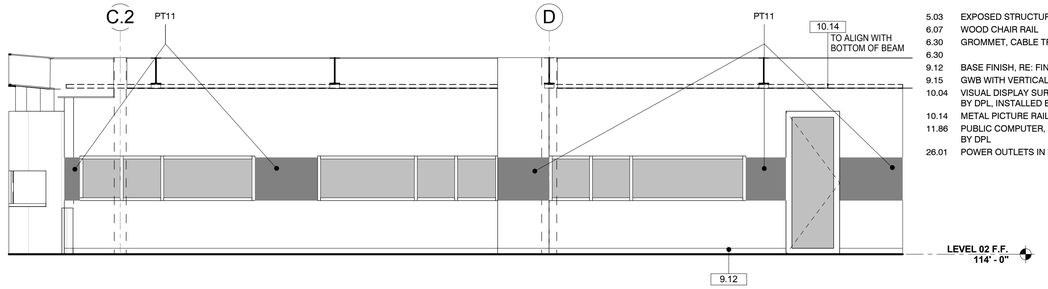
10 A-403 MEETING ROOM 220 - SOUTH
1/4" = 1'-0"



9 A-403 LEVEL 2 MEETING SPACE
1/4" = 1'-0"



8 A-403 COLLABORATIVE 240 - WEST
1/4" = 1'-0"



7 A-403 ADULT FICTION 230 - EAST
1/4" = 1'-0"

GENERAL NOTES - INTERIOR ELEVATIONS

1. ALL FURNITURE AND SHELVING SHOWN AS DASHED ARE N.I.C. SHOWN FOR COORDINATION ONLY.

2. REFER TO FINISH SCHEDULE FOR WALL FINISH MATERIAL, COLOR, AND BASE MATERIAL.

3. ALL WALLS PT1 UNLESS OTHERWISE NOTED.

4. ALL BASE RB1 UNLESS OTHERWISE NOTED.

5. ALL WALL SURFACES SHOWN TO BE GWB U.O.N.

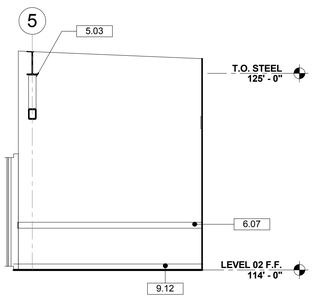
6. REFER TO A-610 - A-615 FOR GRAPHICS.

7. PROVIDE BLOCKING AT ALL WALLS WITH SHELVING AND MILLWORK. COORDINATE SHELVING N.I.C.

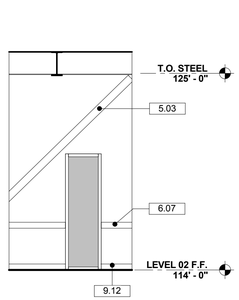
8. REFER TO GRAPHICS SHEETS (A-600+) AND SPECIFICATIONS FOR ADDITIONAL INFORMATION.

KEYNOTES

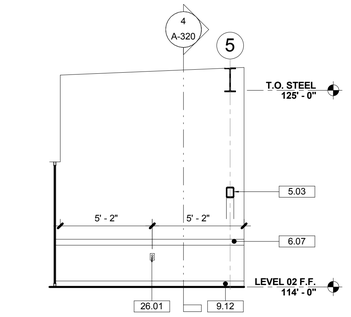
5.03	EXPOSED STRUCTURAL STEEL, RE: STRL
6.07	WOOD CHAIR RAIL
6.30	GROMMET, CABLE TRAY BELOW
6.30	
9.12	BASE FINISH, RE: FINISH SCHEDULE
9.15	GWB WITH VERTICAL CONTROL JOINT 2'-0" O.C.
10.04	VISUAL DISPLAY SURFACES, BOARD 1, PURCHASED BY DPL, INSTALLED BY DPL
10.14	METAL PICTURE RAIL
11.86	PUBLIC COMPUTER, PURCHASED BY DPL, INSTALLED BY DPL
26.01	POWER OUTLETS IN WALL, RE: ELEC



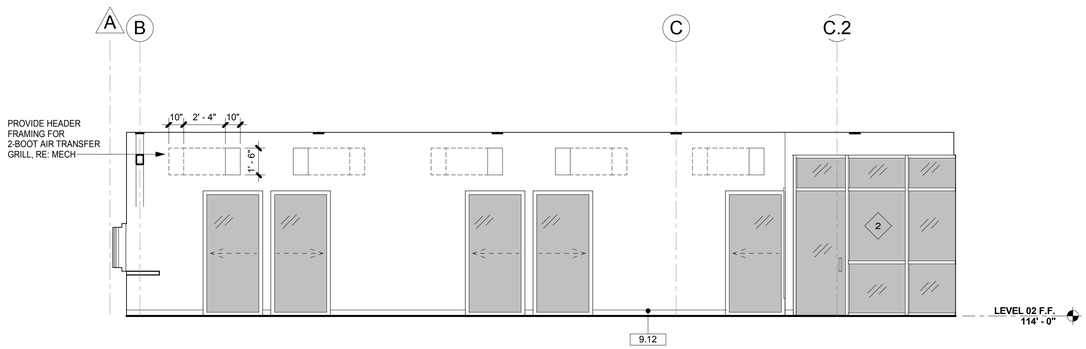
6 A-403 TYP STUDY 222-226 - SOUTH
1/4" = 1'-0"



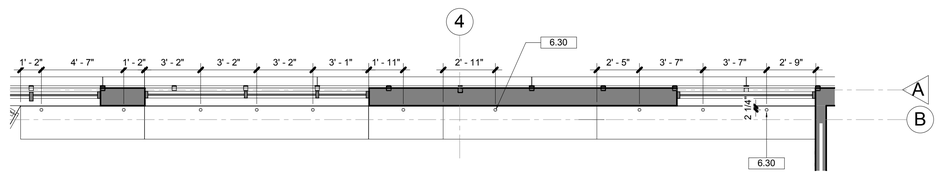
5 A-403 TYP STUDY 222-226 - EAST
1/4" = 1'-0"



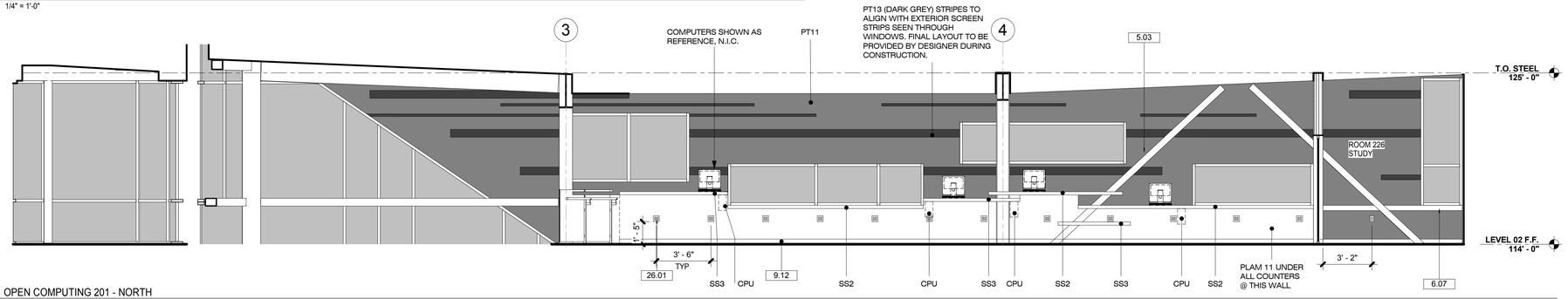
4 A-403 TYP STUDY 222-226 - NORTH
1/4" = 1'-0"



3 A-403 OPEN COMPUTING 201 - EAST
1/4" = 1'-0"



2 A-403 ENLARGED PLAN - OPEN COMPUTING COUNTERTOP
1/4" = 1'-0"



1 A-403 OPEN COMPUTING 201 - NORTH
1/4" = 1'-0"

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sDC PROJECT NO: 1020.00
COOD PROJECT NO: CE 02089

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INTERIOR ELEVATIONS

A-403

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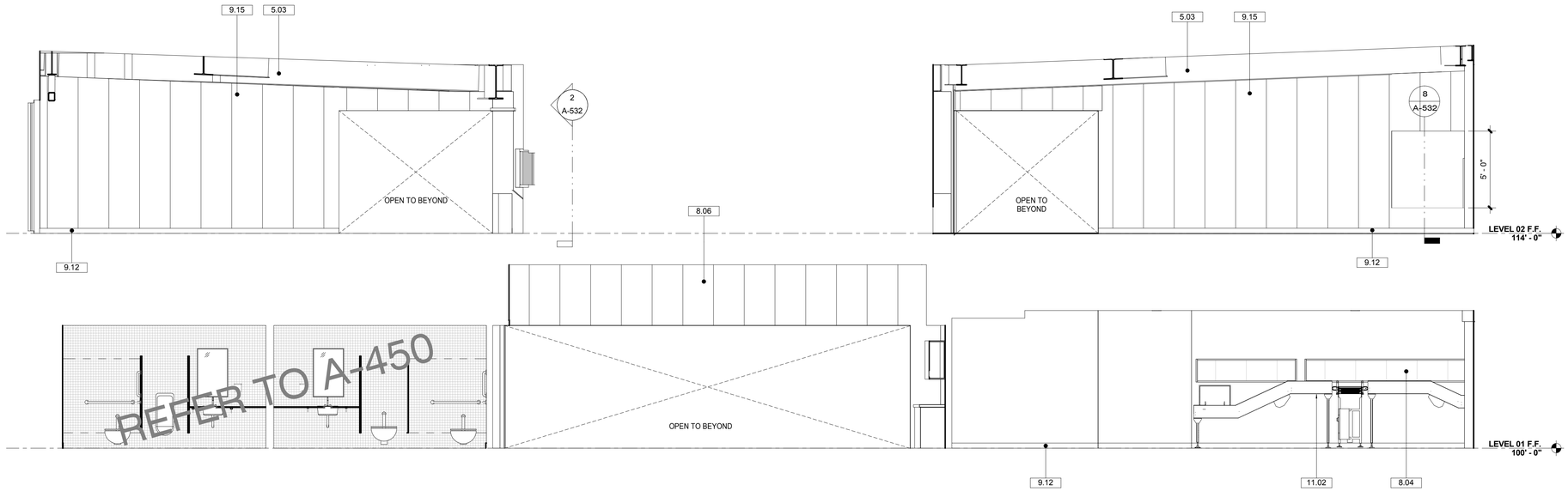
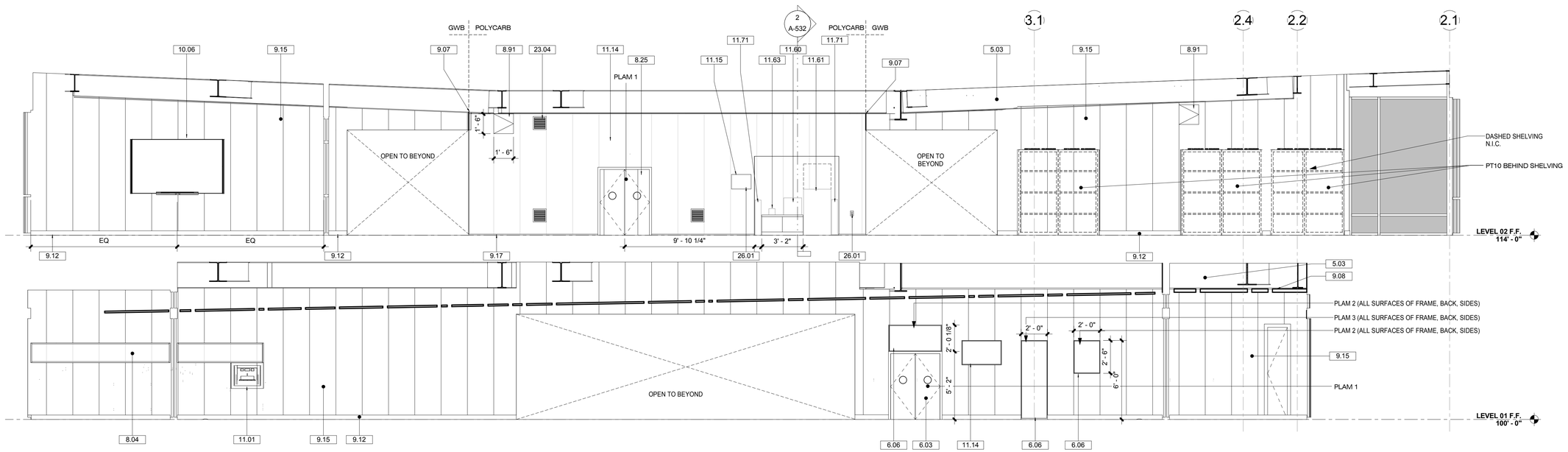


2 A-404 INT ELEV - WONDER WALL - SOUTH
1/4" = 1'-0"



1 A-404 INT ELEV - WONDER WALL - NORTH
1/4" = 1'-0"

GENERAL NOTES - INTERIOR ELEVATIONS

1. ALL FURNITURE AND SHELVING SHOWN AS DASHED ARE N.I.C. SHOWN FOR COORDINATION ONLY.

2. REFER TO FINISH SCHEDULE FOR WALL FINISH MATERIAL, COLOR, AND BASE MATERIAL.

3. ALL WALLS PT1 UNLESS OTHERWISE NOTED.

4. ALL BASE RB1 UNLESS OTHERWISE NOTED.

5. ALL WALL SURFACES SHOWN TO BE GWB U.O.N.

6. REFER TO A-610 - A-615 FOR GRAPHICS.

7. PROVIDE BLOCKING AT ALL WALLS WITH SHELVING AND MILLWORK. COORDINATE SHELVING N.I.C.

8. REFER TO GRAPHICS SHEETS (A-600+) AND SPECIFICATIONS FOR ADDITIONAL INFORMATION.

KEYNOTES

0.04	GWB, PT.
5.03	EXPOSED STRUCTURAL STEEL, RE: STRL
6.03	INTERIOR ARCHITECTURAL WOODWORK, BUILT-IN CASEWORK
6.06	INTERIOR ARCHITECTURAL WOODWORK, BUILT-IN DISPLAY CASE
8.04	SINGLE LAYER POLYCARBONATE CURTAIN WALL SYSTEM
8.06	SINGLE LAYER POLYCARBONATE ON LIGHT GAUGE MTL FRAMING
8.25	ALUMINUM FRAMED POLYCARBONATE DOORS WITH GROMMETED OPENINGS FOR TRASH
8.91	ACCESS DOOR
9.07	EXTRUDED ALUMINUM REGLET "F" REVEAL
9.08	SUSPENDED, SLOPED ACRYLIC CEILING
9.12	BASE FINISH, RE: FINISH SCHEDULE
9.15	GWB WITH VERTICAL CONTROL JOINT 2'-0" O.C.
9.17	ALUMINUM ANGLE 1"TALL x 1/2" DEEP, CONTINUOUS AROUND CORNERS UNDER POLYCARBONATE PANEL
10.06	VISUAL DISPLAY SURFACES, BOARD 2
11.01	INTERIOR BOOK DROP
11.02	AUTOMATED MATERIALS HANDLING UNIT, PURCHASED BY DPL, INSTALLED BY TECH LOGIC
11.14	LCD DISPLAY, RE: AV/IT, PROVIDE WALL BLOCKING, PURCHASED BY DPL, INSTALLED BY GC
11.15	LCD TOUCH SCREEN WALL MOUNT - PURCHASED BY DPL, INSTALLED BY DPL, BACKING PROVIDED BY GC
11.40	EQUIPMENT, OWNER PROVIDED AND INSTALLED
11.60	PRINTER, PURCHASED BY DPL, INSTALLED BY DPL
11.61	COPIER - LEASED BY DPL
11.63	RECEIPT PRINTER, PURCHASED BY DPL, INSTALLED BY DPL
11.71	ENVISIONWARE COIN AND BILL ACCEPTOR, PURCHASED BY DPL, INSTALLED BY DPL
23.04	MECHANICAL LOUVER, RE: MECH
26.01	POWER OUTLETS IN WALL, RE: ELEC

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01.12.12

sDC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02089

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INTERIOR ELEVATIONS
WONDER WALL

A-404

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GENERAL NOTES - INTERIOR ELEVATIONS

1. ALL FURNITURE AND SHELVING SHOWN AS DASHED ARE N.I.C. SHOWN FOR COORDINATION ONLY.

2. REFER TO FINISH SCHEDULE FOR WALL FINISH MATERIAL, COLOR, AND BASE MATERIAL.

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4. ALL BASE RB1 UNLESS OTHERWISE NOTED.

5. ALL WALL SURFACES SHOWN TO BE GWB U.O.N.

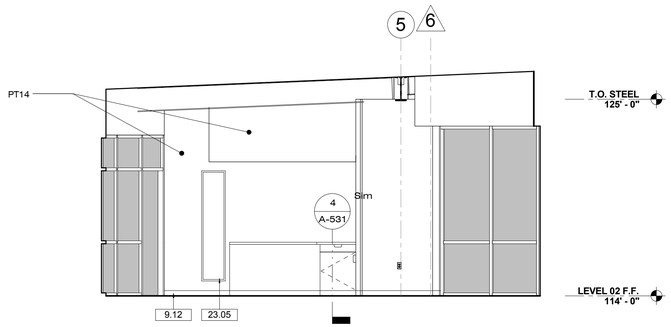
6. REFER TO A-610 - A-615 FOR GRAPHICS.

7. PROVIDE BLOCKING AT ALL WALLS WITH SHELVING AND MILLWORK. COORDINATE SHELVING N.I.C.

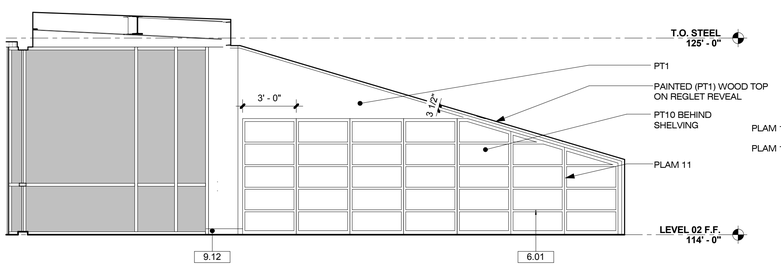
8. REFER TO GRAPHICS SHEETS (A-600+) AND SPECIFICATIONS FOR ADDITIONAL INFORMATION.

KEYNOTES

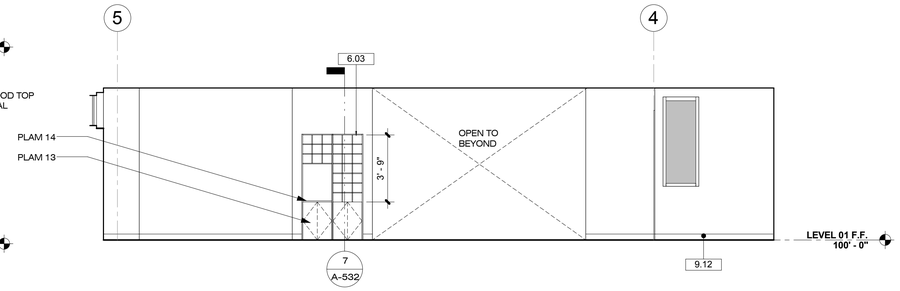
6.01	INTERIOR ARCHITECTURAL WOODWORK, BUILT-IN SHELVES
6.03	INTERIOR ARCHITECTURAL WOODWORK, BUILT-IN CASEWORK
8.04	SINGLE LAYER POLYCARBONATE CURTAIN WALL SYSTEM
9.12	BASE FINISH, RE: FINISH SCHEDULE
10.15	THROUGH WALL BOOK RETURN
11.02	AUTOMATED MATERIALS HANDLING UNIT, PURCHASED BY DPL, INSTALLED BY TECH LOGIC
11.60	PRINTER, PURCHASED BY DPL, INSTALLED BY DPL
23.05	AIR TRANSFER GRILLE, RE: MECH



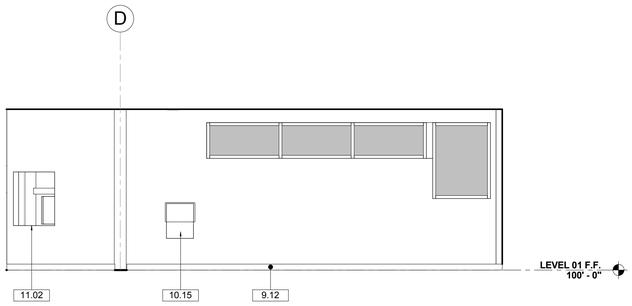
5 A-405 INT ELEVATION MEETING ROOM SOUTH
1/4" = 1'-0"



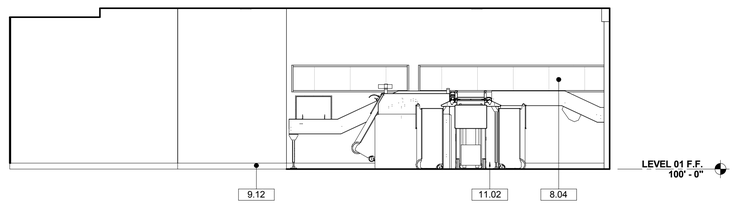
4 A-405 INT ELEVATION BUILT IN BOOK SHELVES
1/4" = 1'-0"



3 A-405 INT ELEVATION SORTING SOUTH
1/4" = 1'-0"



2 A-405 INT ELEVATION SORTING EAST
1/4" = 1'-0"



1 A-405 INT ELEVATION SORTING NORTH
1/4" = 1'-0"

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INTERIOR ELEVATIONS

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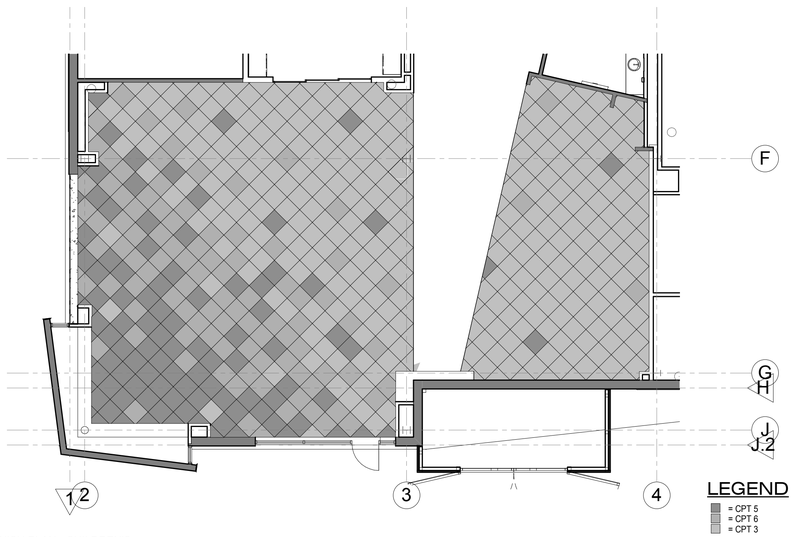
1 A-410 ENLARGED FINISH PLAN - ENTRY
1/8" = 1'-0"



2 A-410 ENLARGED FINISH PLAN - CHILDREN'S
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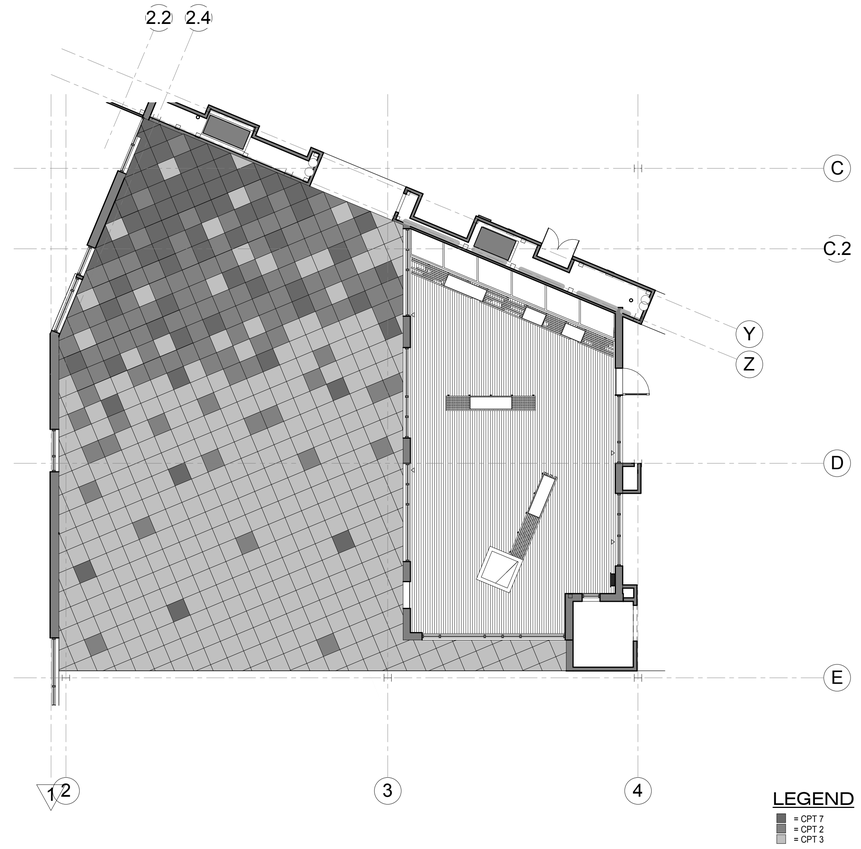

3 A-410 ENLARGED FINISH PLAN - TEAM
1/8" = 1'-0"

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ENLARGED FINISH PLANS

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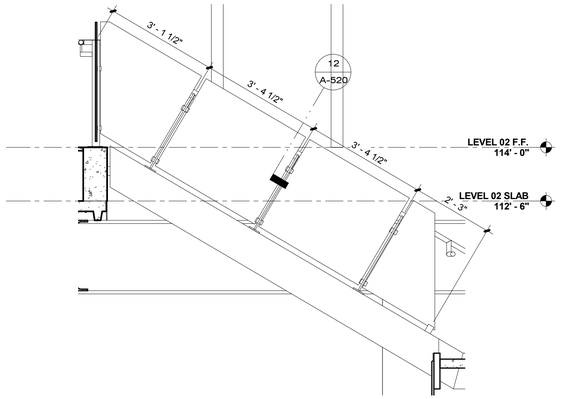
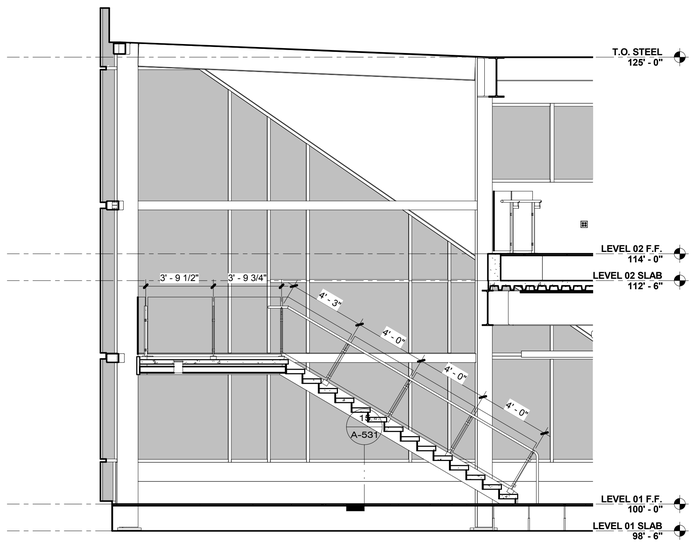
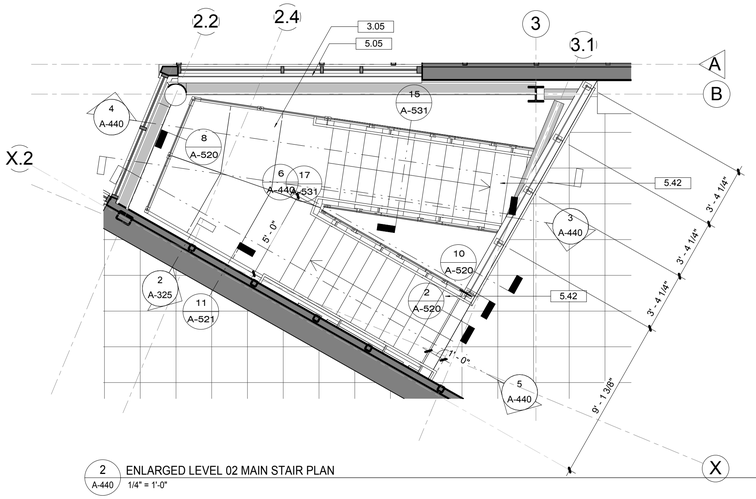


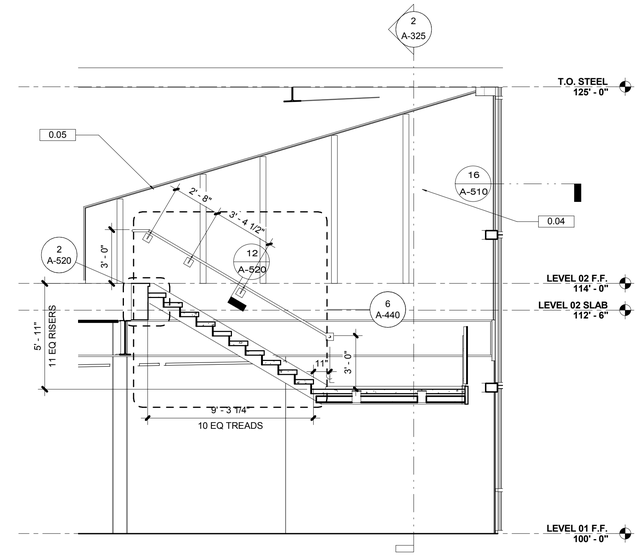
6 A-440 SECTION - MAIN STAIR UPPER FLIGHT
1/2" = 1'-0"



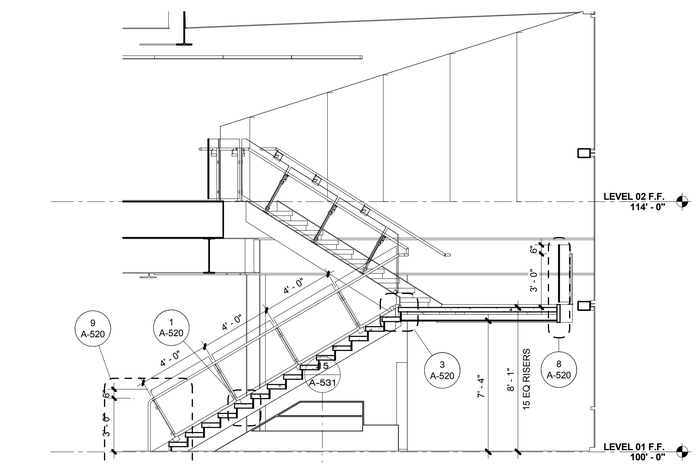
4 A-440 SECTION - MAIN STAIR - LOWER FLIGHT NORTH
1/4" = 1'-0"



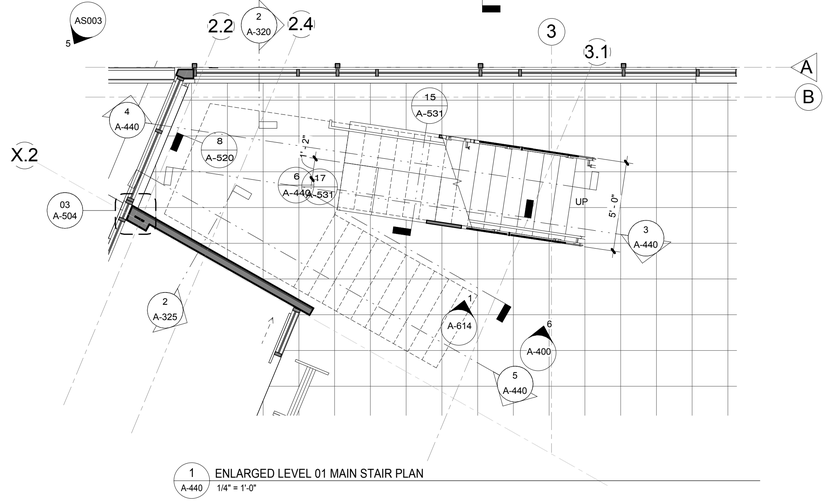
2 A-440 ENLARGED LEVEL 02 MAIN STAIR PLAN
1/4" = 1'-0"



5 A-440 SECTION - MAIN STAIR - UPPER FLIGHT
1/4" = 1'-0"



3 A-440 SECTION - MAIN STAIR - LOWER FLIGHT
1/4" = 1'-0"



1 A-440 ENLARGED LEVEL 01 MAIN STAIR PLAN
1/4" = 1'-0"

KEYNOTES

0.04	GWB, PT.
0.05	POPLAR WALL CAP, PT., FRY REGLET REVEAL BENEATH
3.05	CONCRETE, PRE-CAST PANELS
5.05	METAL, STEEL BRACKET
5.42	METAL STAIRS, PRE MANUFACTURED CONCRETE PAN, RE: SPEC

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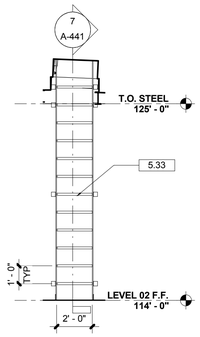
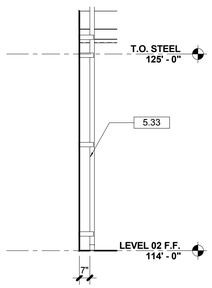
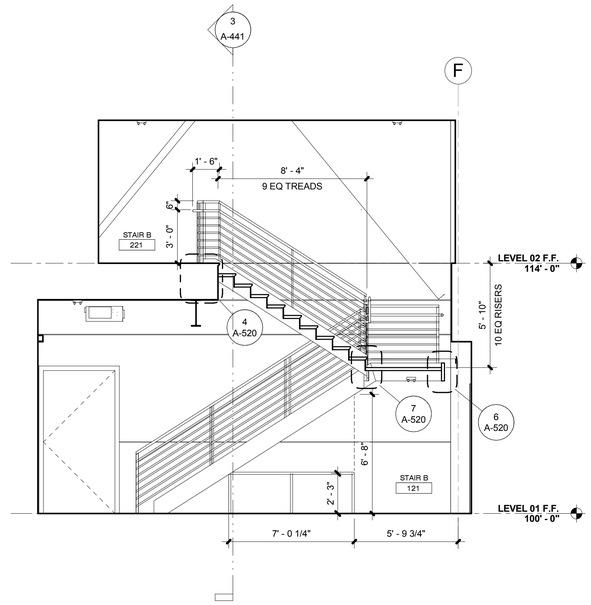


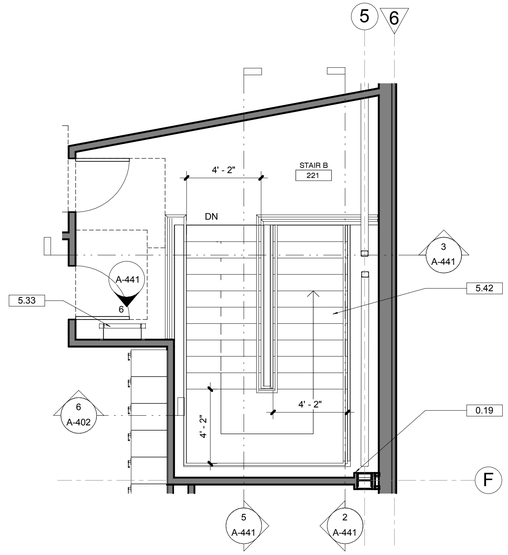
6 A-441 ELEV - DTL HATCH ACCESS LADDER
1/4" = 1'-0"



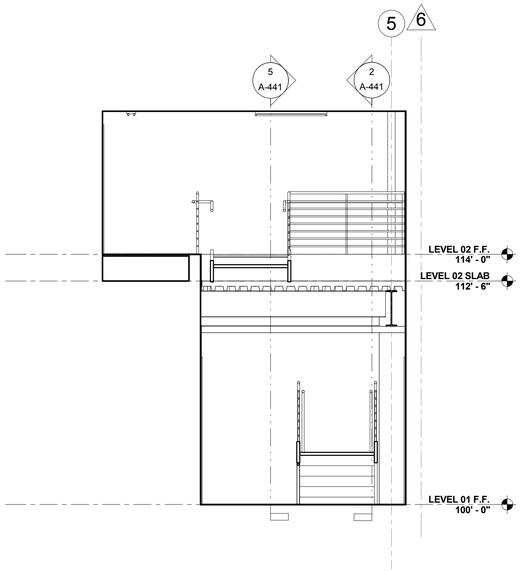
7 A-441 SEC - DTL - ACCESS LADDER
1/4" = 1'-0"



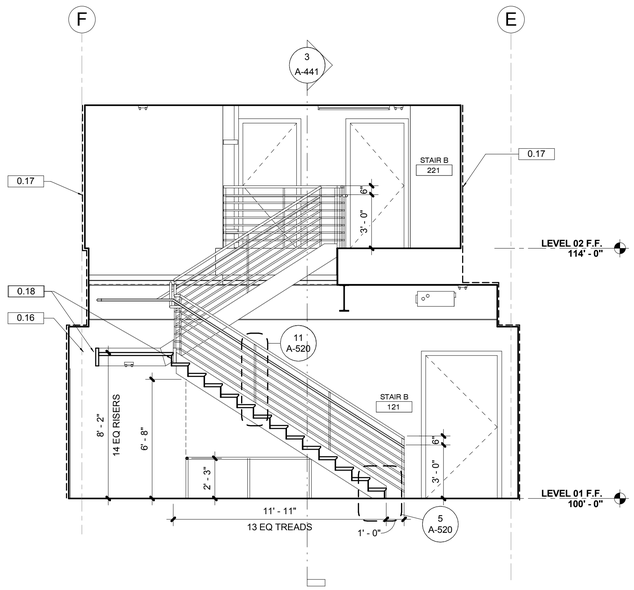
5 A-441 SECTION - STAIR B UPPER FLIGHT
1/4" = 1'-0"



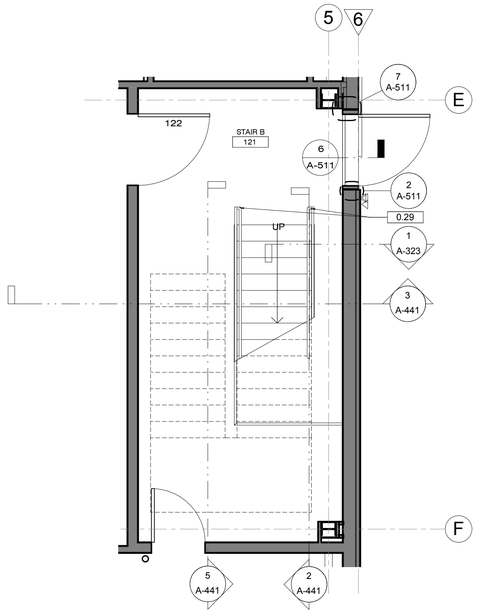
4 A-441 ENLARGED LEVEL 02 STAIR B PLAN
1/4" = 1'-0"



3 A-441 SECTION - STAIR B NORTH
1/4" = 1'-0"



2 A-441 SECTION - STAIR B LOWER FLIGHT
1/4" = 1'-0"



1 A-441 ENLARGED LEVEL 01 STAIR B PLAN
1/4" = 1'-0"

KEYNOTES

0.16	STRINGER EXTENSION BYND
0.17	CONT. FIRE RATING
0.18	CHANNEL RE: 6/S402
0.19	NOTE: UNINTERRUPTED FIRE RATING AROUND COL., TYP.
0.29	RETURN HANDRAIL BACK TO POST
5.33	METAL FABRICATION, LADDER
5.42	METAL STAIRS, PRE MANUFACTURED CONCRETE PAN, RE: SPEC

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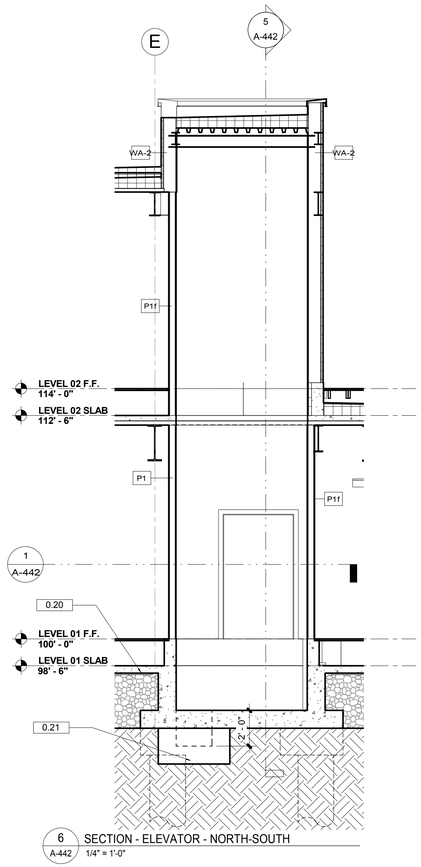
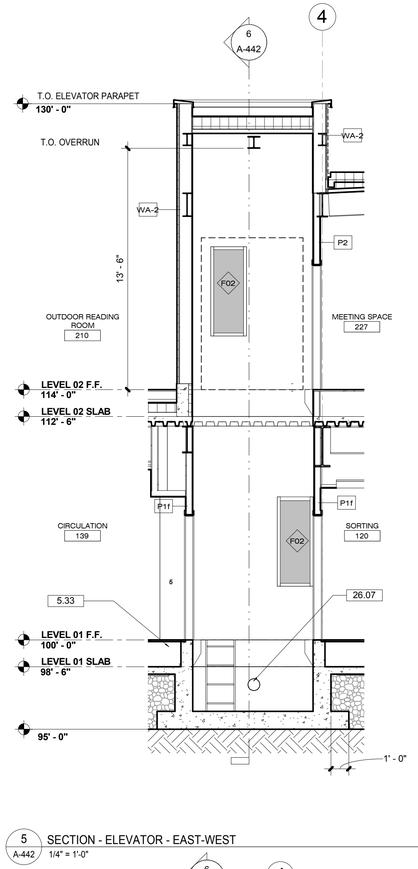


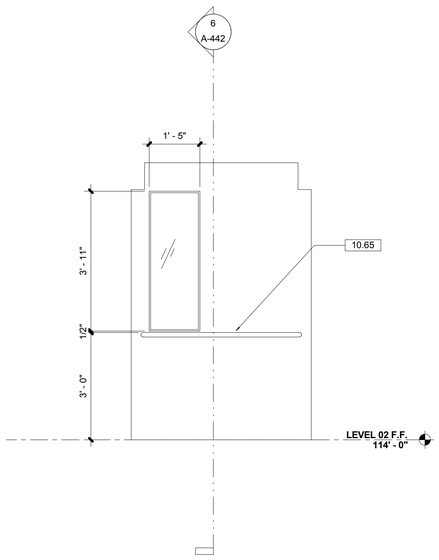
6 A-442 SECTION - ELEVATOR - NORTH-SOUTH
1/4" = 1'-0"



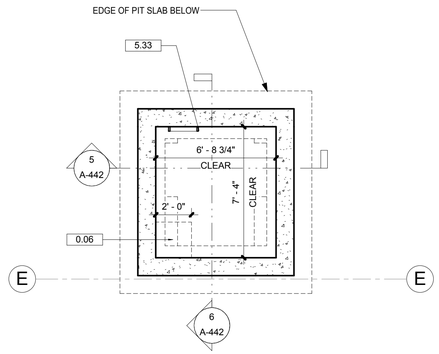
5 A-442 SECTION - ELEVATOR - EAST-WEST
1/4" = 1'-0"

KEYNOTES

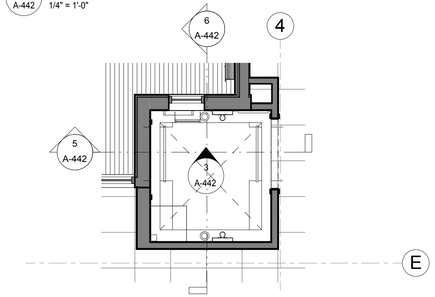
0.06	ELEVATOR SUMP PIT
0.20	IMPERVIOUS MEMBRANE CONT. DOWN & AROUND ELEV PIT WALLS ENKAVENT MAT SHALL BE ARRANGED TO MISS PIT WALLS
0.21	WRAP VAPOR BARRIER ONTO SWAMP PIT WALLS & FLOOR BEYOND
5.33	METAL FABRICATION, LADDER
10.65	ELEVATOR CAB HANDRAIL, RETURN TO WALL AT BOTH ENDS
26.07	ELECTRICAL LIGHTING: ELEVATOR PIT LIGHT



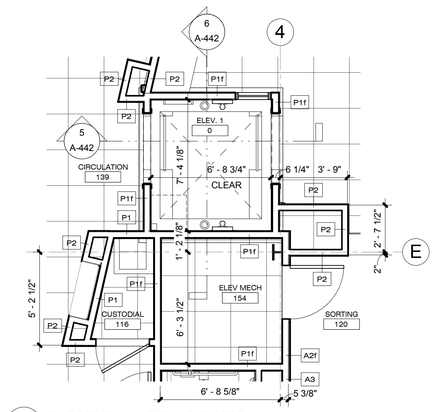
3 A-442 INT ELEVATION - CAB NORTH
1/2" = 1'-0"



2 A-442 ENLARGED PLAN - ELEVATOR PIT
1/4" = 1'-0"



4 A-442 ENLARGED PLAN - LEVEL 2 ELEVATOR
1/4" = 1'-0"



1 A-442 ELARGED PLAN - LEVEL 1 ELEVATOR
1/4" = 1'-0"

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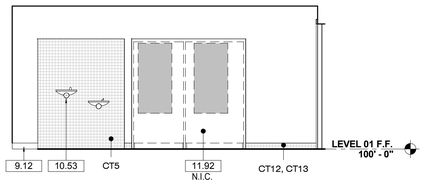
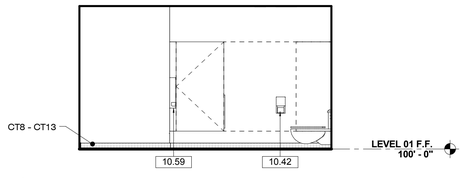
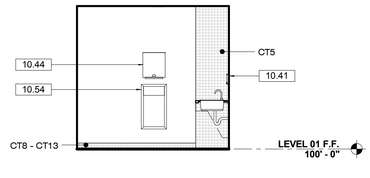


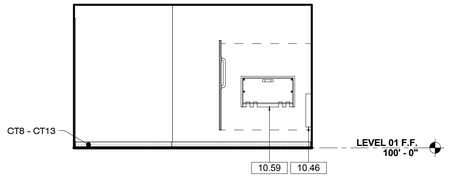
10 A-450 DRINKING FOUNTAIN - SOUTH
1/4" = 1'-0"



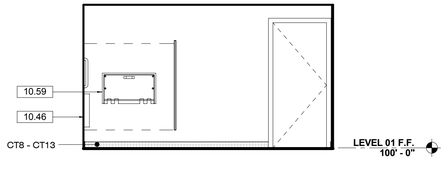
9 A-450 ENLARGED ELEVATION LEVEL 01 MENS RR WEST
1/4" = 1'-0"



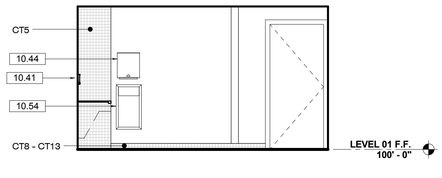
8 A-450 ENLARGED ELEVATION LEVEL 01 WOMENS RR WEST
1/4" = 1'-0"



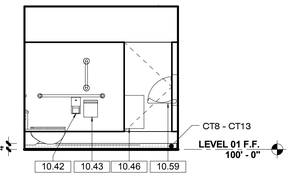
7 A-450 ENLARGED ELEVATION LEVEL 01 MENS RR SOUTH
1/4" = 1'-0"



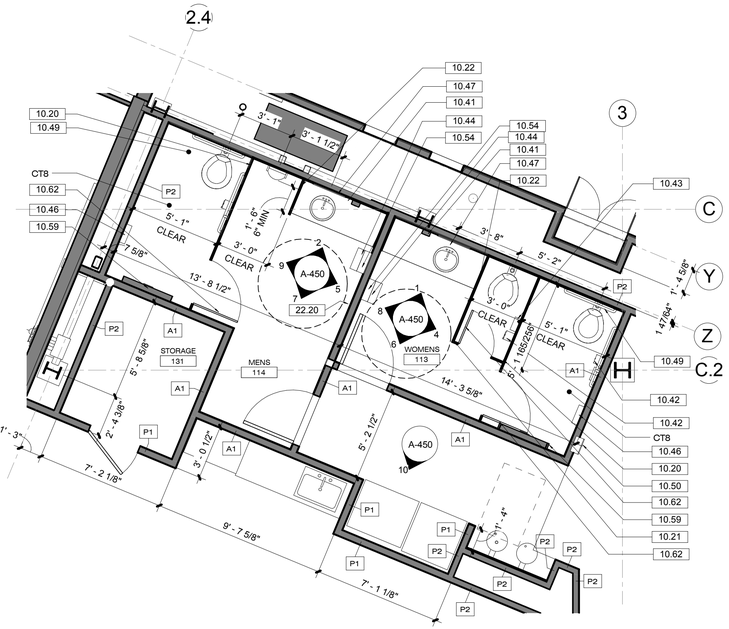
6 A-450 ENLARGED ELEVATION LEVEL 01 WOMENS RR SOUTH
1/4" = 1'-0"



5 A-450 ENLARGED ELEVATION LEVEL 01 MENS RR EAST
1/4" = 1'-0"



4 A-450 ENLARGED ELEVATION LEVEL 01 WOMENS RR EAST
1/4" = 1'-0"



3 A-450 ENLARGED LEVEL 01 RESTROOM PLAN
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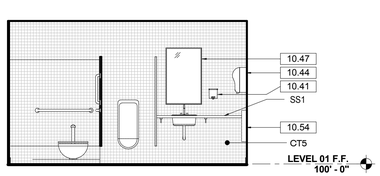
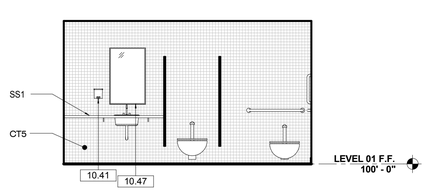


2 A-450 ENLARGED ELEVATION LEVEL 01 MENS RR NORTH
1/4" = 1'-0"



1 A-450 ENLARGED ELEVATION LEVEL 01 WOMENS RR NORTH
1/4" = 1'-0"

GENERAL NOTES - RESTROOMS

1. DIMENSIONS SHOWN AT PLUMBING FIXTURES ARE TO CENTER OF FIXTURE.

2. TOILET ACCESSORIES SHALL BE MOUNTED AT "BARRIER FREE" HEIGHT PER MANUFACTURER'S GUIDELINES AND ADA GUIDELINES.

3. FLOOR TILE EXTENDS CONTINUOUS UNDER ALL VANITIES, TILE BASE IS CONTINUOUS AT ALL WALLS UNLESS OTHERWISE NOTED.

4. TILE IS DRAWN ONLY TO CLARIFY INTENT OF TILE WORK, AND IS NOT INTENDED TO SHOW ACTUAL JOINT LOCATIONS. TILE LAYOUT SHALL BE PER FOLLOWING RULES: CENTER FLOOR TILE PATTERN BOTH WAYS FROM CENTER OF MAIN PART OF ROOM WITH NO PERIMETER TILES LESS THAN 1/2 OF A TILE WIDTH AT MAIN PART OF ROOM. ALIGN ALL BASE AND WALL TILE JOINTS WITH JOINTS AT FLOOR TILE.

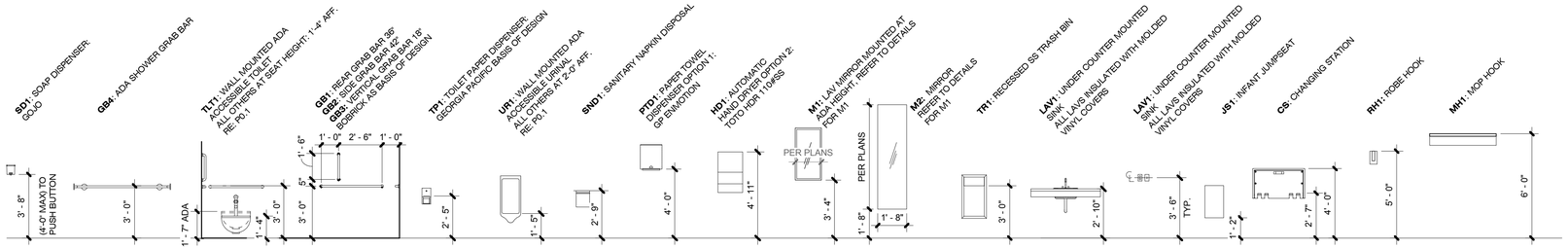
5. REFER TO FINISH SCHEDULE AND PLANS FOR FINSIHES.

6. PROVIDE UNDER LAVATORY GUARDS AT ALL EXPOSED SINK PIPES.

7. BASE TILE TE BE THE SAME AS COLOR AS THE ADJACENT FLOOR TILE.

KEYNOTES

9.12	BASE FINISH, RE: FINISH SCHEDULE
10.20	TOILET COMPARTMENTS, TOILET ENCLOSURE LAYOUT AS INDICATED ON DRAWING
10.21	TOILET COMPARTMENTS
10.22	TOILET COMPARTMENTS
10.41	SD1: SOAP DISPENSER
10.42	TP1: TOILET PAPER DISPENSER
10.43	SND1: SANITARY NAPKIN DISPOSAL
10.44	PTD1: PAPER TOWEL DISPENSER
10.46	JS1: INFANT JUMPSEAT
10.47	M1: MIRROR
10.49	GB1, GB2, GB3:
10.50	FIRE EXTINGUISHER CABINETS
10.53	DRINKING FOUNTAIN
10.54	TR1: SEMI-RECESSED TRASH RECEPTACLE
10.59	CS: CHANGING STATION
10.62	RH1: ROBE HOOK
11.92	VENDING MACHINES - LEASED BY DPL, INSTALLED BY VENDOR, N.I.C.
22.20	FLOOR DRAIN, RE: PLMB



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01-12-2012

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RESTROOMS

A-450

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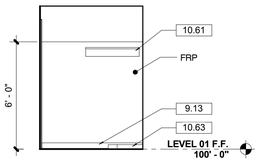
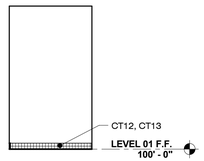
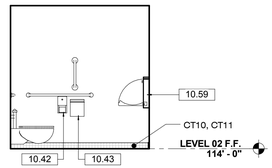


19 A-451 INT - ELEV - CUSTODIAL WEST
1/4" = 1'-0"



18 A-451 ENLARGED ELEVATION LEVEL 01 FAMILY RR WEST
1/4" = 1'-0"



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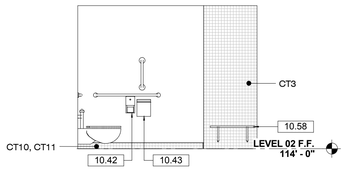
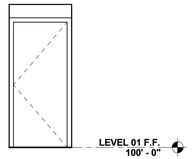
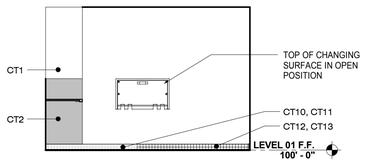
1/4" = 1'-0"



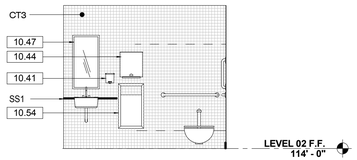
16 A-451 ENLARGED ELEVATION LEVEL 02 STAFF RR WEST
1/4" = 1'-0"



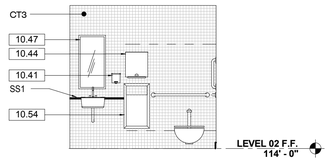
15 A-451 INT - ELEV - CUSTODIAL SOUTH
1/4" = 1'-0"



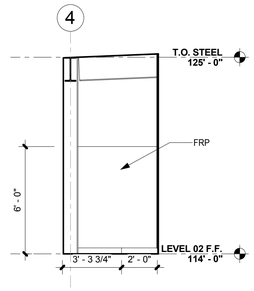
14 A-451 ENLARGED ELEVATION LEVEL 01 RR SOUTH
1/4" = 1'-0"



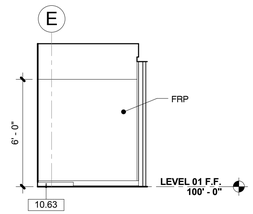
13 A-451 ENLARGED ELEVATION LEVEL 02 RR SOUTH
1/4" = 1'-0"



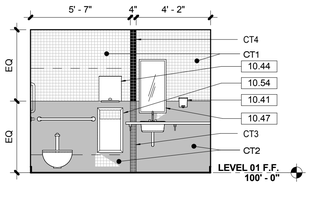
12 A-451 ENLARGED ELEVATION LEVEL 02 STAFF RR SOUTH
1/4" = 1'-0"



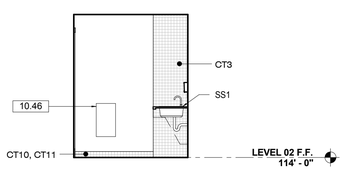
20 A-451 ELEVATION - NORTH JANITOR
1/4" = 1'-0"



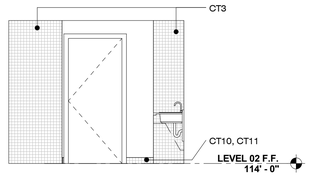
11 A-451 INT - ELEV - CUSTODIAL EAST
1/4" = 1'-0"



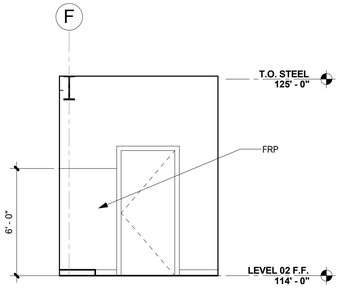
10 A-451 ENLARGED ELEVATION LEVEL 01 RR EAST
1/4" = 1'-0"



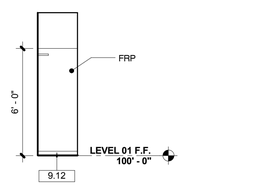
9 A-451 ENLARGED ELEVATION LEVEL 02 RR EAST
1/4" = 1'-0"



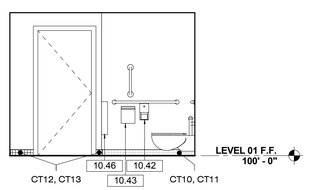
8 A-451 ENLARGED ELEVATION LEVEL 02 STAFF RR EAST
1/4" = 1'-0"



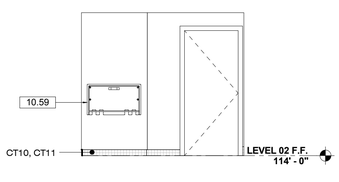
21 A-451 ELEVATION - EAST JANITOR
1/4" = 1'-0"



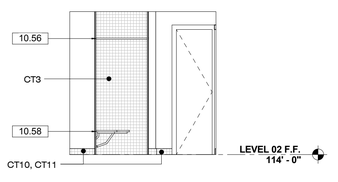
7 A-451 INT - ELEV - CUSTODIAL NORTH
1/4" = 1'-0"



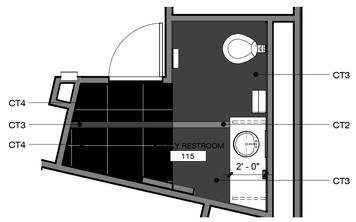
6 A-451 ENLARGED ELEVATION LEVEL 01 FAMILY RR NORTH
1/4" = 1'-0"



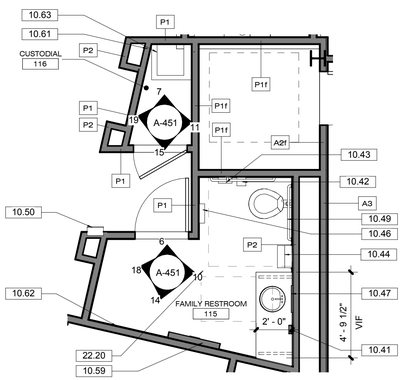
5 A-451 ENLARGED ELEVATION LEVEL 02 RR NORTH
1/4" = 1'-0"



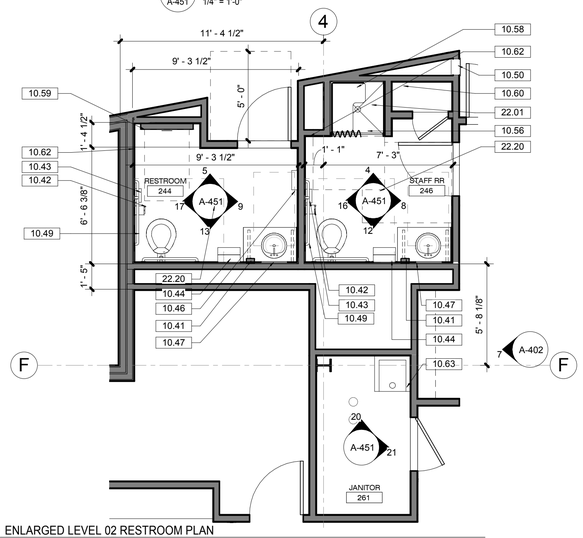
4 A-451 ENLARGED ELEVATION LEVEL 02 STAFF RR NORTH
1/4" = 1'-0"



3 A-451 ENLARGED LEVEL 01 FAMILY RESTROOM - FINISHES
1/4" = 1'-0"



2 A-451 ENLARGED LEVEL 01 FAMILY RESTROOM
1/4" = 1'-0"



1 A-451 ENLARGED LEVEL 02 RESTROOM PLAN
1/4" = 1'-0"

RESTROOMS

A-451

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GENERAL NOTES - RESTROOMS

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2. TOILET ACCESSORIES SHALL BE MOUNTED AT "BARRIER FREE" HEIGHT PER MANUFACTURER'S GUIDELINES AND ADA GUIDELINES.

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4. TILE IS DRAWN ONLY TO CLARIFY INTENT OF TILE WORK, AND IS NOT INTENDED TO SHOW ACTUAL JOINT LOCATIONS. TILE LAYOUT SHALL BE PER FOLLOWING RULES: CENTER FLOOR TILE PATTERN BOTH WAYS FROM CENTER OF MAIN PART OF ROOM WITH NO PERIMETER TILES LESS THAN 1/2 OF A TILE WIDTH AT MAIN PART OF ROOM. ALIGN ALL BASE AND WALL TILE JOINTS WITH JOINTS AT FLOOR TILE.

5. REFER TO FINISH SCHEDULE AND PLANS FOR FINSIHES.

6. PROVIDE UNDER LAVATORY GUARDS AT ALL EXPOSED SINK PIPES.

7. BASE TILE TE BE THE SAME AS COLOR AS THE ADJACENT FLOOR TILE.

KEYNOTES

9.12	BASE FINISH. RE: FINISH SCHEDULE
9.13	GWB. COLOR RE: FINISH SCHEDULE, PROVIDE BLOCKING AS REQUIRED FOR SYSTEMS FURNITURE
10.41	SD1: SOAP DISPENSER
10.42	TP1: TOILET PAPER DISPENSER
10.43	SND1: SANITARY NAPKIN DISPOSAL
10.44	PTD1: PAPER TOWEL DISPENSER
10.46	JS1: INFANT JUMPSEAT
10.47	M1: MIRROR
10.49	GB1, GB2, GB3:
10.50	FIRE EXTINGUISHER CABINETS
10.54	TR1: SEMI-RECESSED TRASH RECEPTACLE
10.56	SCR1, SC1, SCH1: SHOWER ROD, CURTAIN, CURTAIN HOOKS
10.58	BATHROOM ACCESSORIES - ADA SHOWER TRANSFER SEAT
10.59	CS: CHANGING STATION
10.60	METAL STORAGE SHELVING
10.61	MH1: METAL SHELF AND MOP HOOKS
10.62	RH1: ROBE HOOK
10.63	MOP SINK
22.01	ADA TRANSFER SHOWER PAN
22.20	FLOOR DRAIN, RE: PLMB

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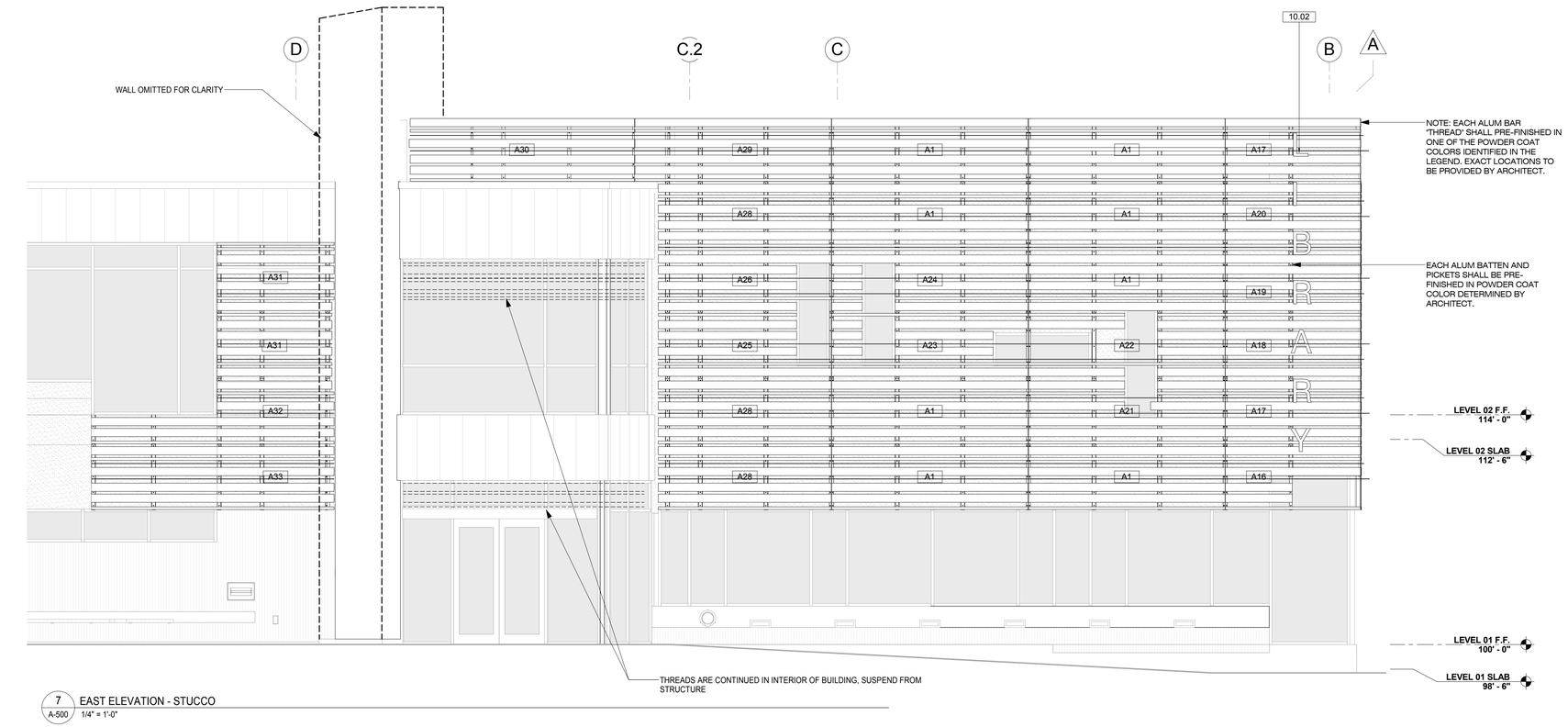
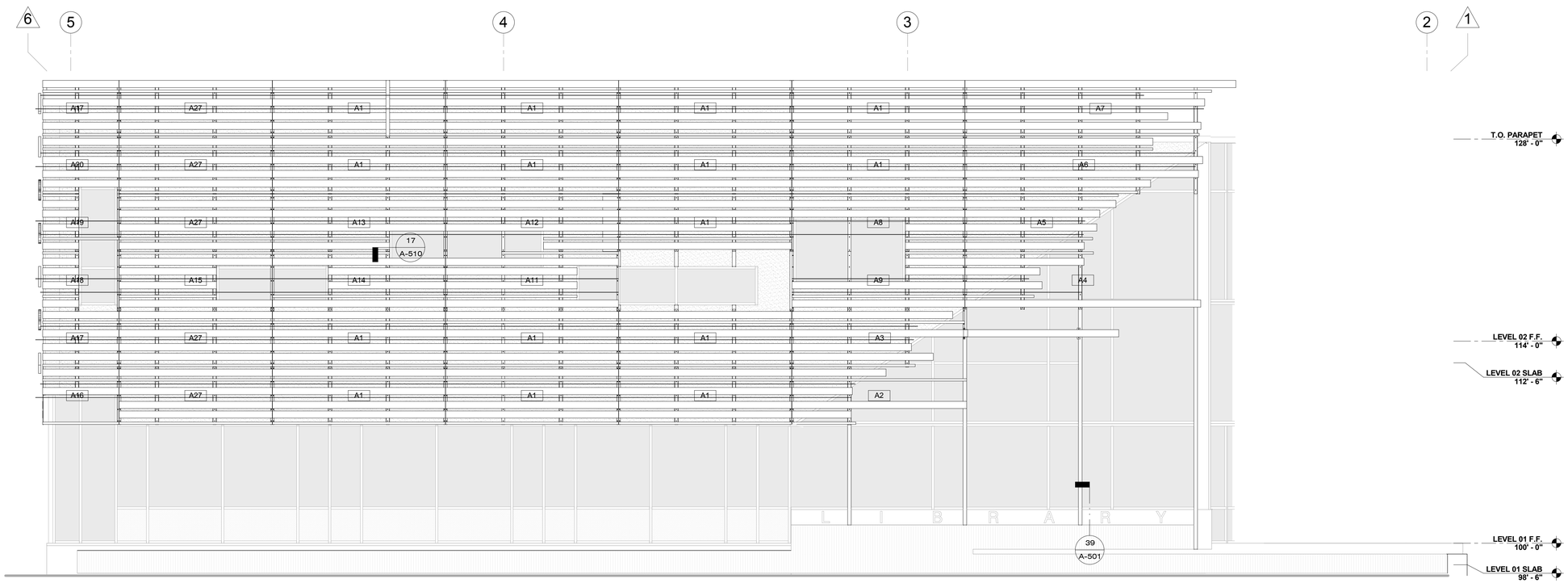


7 EAST ELEVATION - STUCCO
A-500 1/4" = 1'-0"



8 NORTH ELEVATION - STUCCO
A-500 1/4" = 1'-0"

GENERAL NOTES: FACADE SCREEN

1. ALL PANELS ARE BASED ON PANEL A1. REFER TO A-501 FOR SPECIFIC PANEL ELEVATIONS.

LEGEND: PAINT COLORS

1 - RAL 1019
2 - RAL 1016
3 - RAL 8003
4 - JOLLIPOP BRASS
5 - RAL 1012
6 - RAL 1020
7 - RAL 2001

KEYNOTES

7.05	EXTERIOR METAL CLADDING, TYPE 1
10.02	BUILDING SIGNAGE, RE: A610 - A614

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sDC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02089

ISSUE DATE 01-12-2012
PHASE 100% CD

SCREEN ELEVATIONS

A-500

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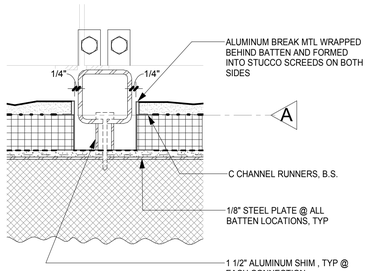
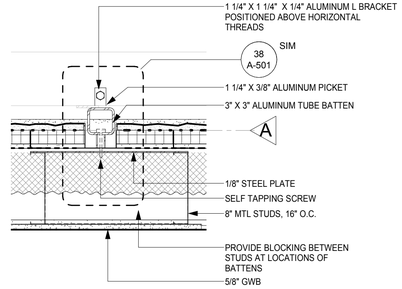
1/13/2012 12:36:51 PM



38 A-501 PLAN DTL - TYP BATTEN
3" = 1'-0"



37 A-501 PLAN DTL - MTL SCREEN BATTEN 2
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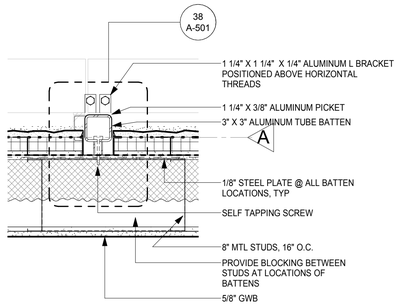

36 A-501 PLAN DTL - MTL SCREEN BATTEN
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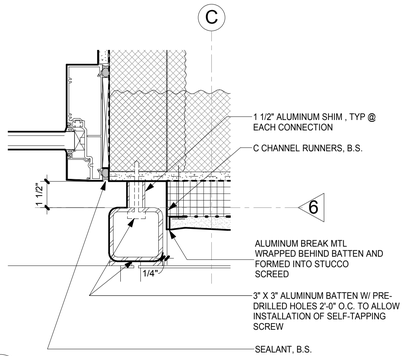

35 A-501 PLAN DTL - ENLARGED BATTEN @ MULLION
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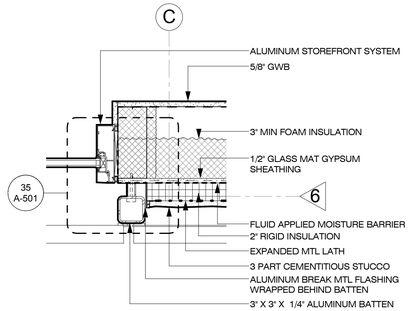

34 A-501 PLAN DTL - BATTEN @ MULLION
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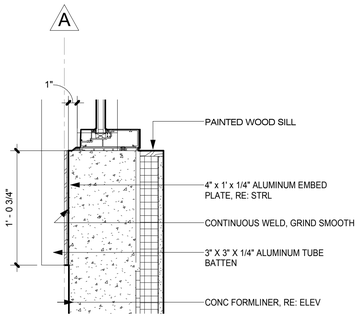


39 A-501 SECTION DTL - BATTEN @ EMBED PLATE, TYP
1 1/2" = 1'-0"

33 A-501 ALUMINUM PANEL - A33
1/4" = 1'-0"

32 A-501 ALUMINUM PANEL - A32
1/4" = 1'-0"

31 A-501 ALUMINUM PANEL - A31
1/4" = 1'-0"

30 A-501 ALUMINUM PANEL - A30
1/4" = 1'-0"

29 A-501 ALUMINUM PANEL - A29
1/4" = 1'-0"

28 A-501 ALUMINUM PANEL - A28
1/4" = 1'-0"

27 A-501 ALUMINUM PANEL - A27
1/4" = 1'-0"

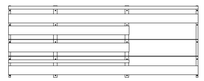
26 A-501 ALUMINUM PANEL - A26
1/4" = 1'-0"

25 A-501 ALUMINUM PANEL - A25
1/4" = 1'-0"

24 A-501 ALUMINUM PANEL - A24
1/4" = 1'-0"

23 A-501 ALUMINUM PANEL - A23
1/4" = 1'-0"

22 A-501 ALUMINUM PANEL - A22
1/4" = 1'-0"



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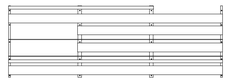

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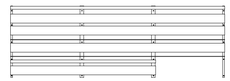

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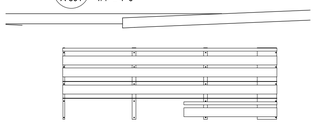

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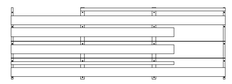

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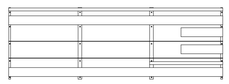

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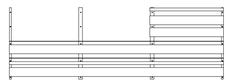

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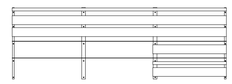
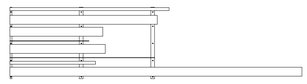


14 A-501 ALUMINUM PANEL - A14
1/4" = 1'-0"

13 A-501 ALUMINUM PANEL - A13
1/4" = 1'-0"

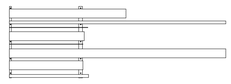
12 A-501 ALUMINUM PANEL - A12
1/4" = 1'-0"

11 A-501 ALUMINUM PANEL - A11
1/4" = 1'-0"



10 A-501 ALUMINUM PANEL - A10
1/4" = 1'-0"

9 A-501 ALUMINUM PANEL - A9
1/4" = 1'-0"



8 A-501 ALUMINUM PANEL - A8
1/4" = 1'-0"

7 A-501 ALUMINUM PANEL - A7
1/4" = 1'-0"

6 A-501 ALUMINUM PANEL - A6
1/4" = 1'-0"

5 A-501 ALUMINUM PANEL - A5
1/4" = 1'-0"

4 A-501 ALUMINUM PANEL - A4
1/4" = 1'-0"

3 A-501 ALUMINUM PANEL - A3
1/4" = 1'-0"

2 A-501 ALUMINUM PANEL - A2
1/4" = 1'-0"

1 A-501 TYP ALUMINUM PANEL - A1
1/4" = 1'-0"

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sDC PROJECT NO: 1020.00
COOD PROJECT NO: CE 02069

ISSUE DATE
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SCREEN DETAILS

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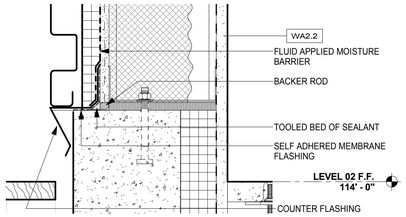
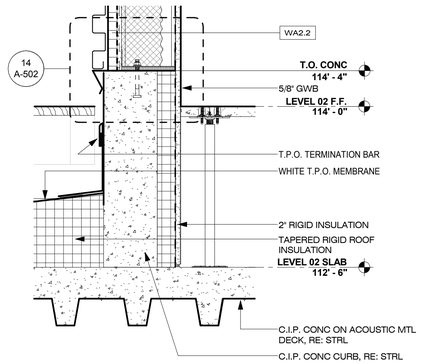
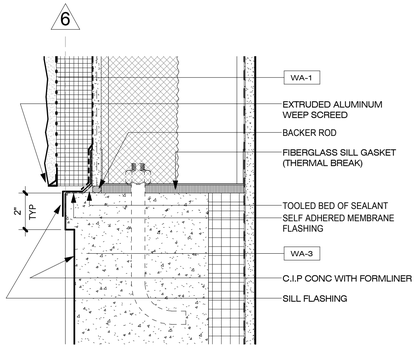


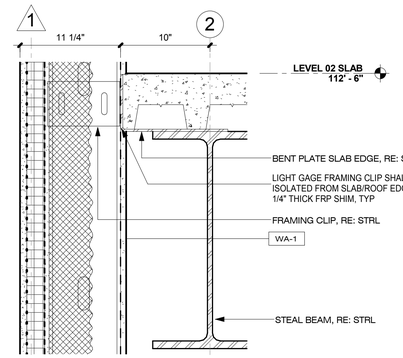
14 / A-502 SECTION DTL - MTL CLADDING SILL
3" = 1'-0"



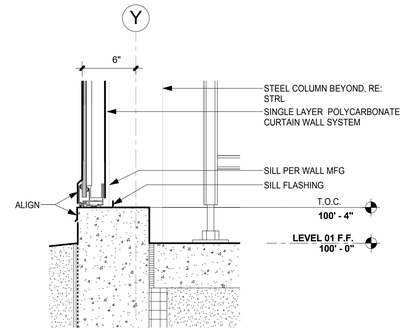
13 / A-502 CONC WALL @ COURTYARD
1 1/2" = 1'-0"



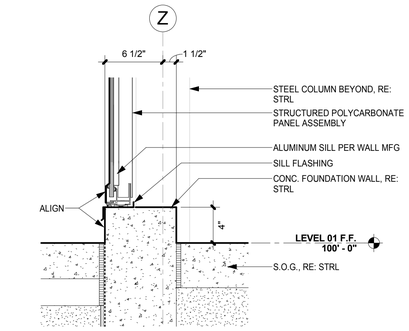
12 / A-502 SECTION DTL - FLASHING @ STUCCO SILL
3" = 1'-0"



11 / A-502 LEVEL 2 SLAB EDGE
1 1/2" = 1'-0"



10 / A-502 SECTION DTL - QUADWALL SILL
1 1/2" = 1'-0"



9 / A-502 SECTION DTL - POLYGARB SILL
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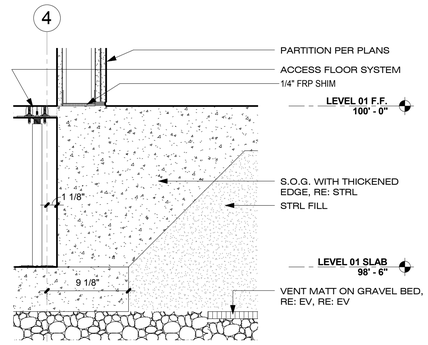
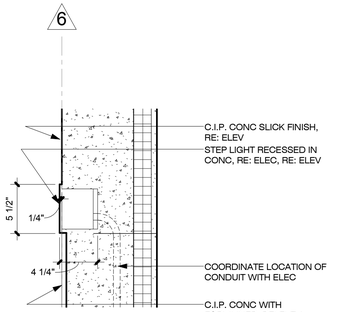
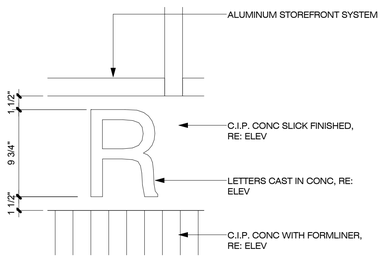


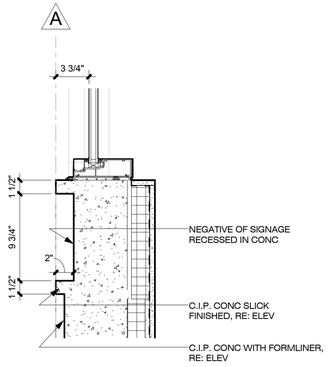
8 / A-502 SECTION DTL - SOG @ DEPRESSED SLAB
1 1/2" = 1'-0"



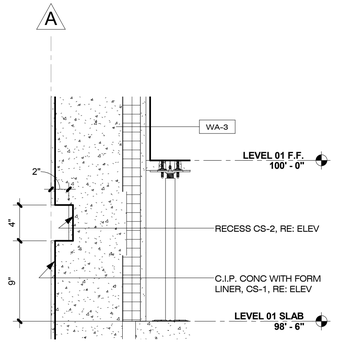
7 / A-502 SECTION DTL - RECESSED LIGHT
1 1/2" = 1'-0"



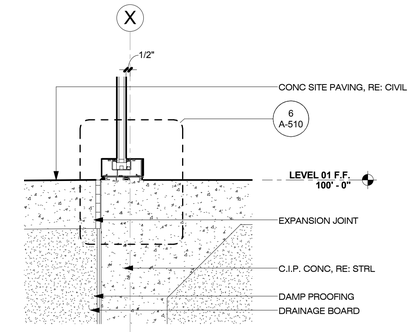
6 / A-502 SECTION DTL - CAST IN PLACE CONCRETE LETTERS
1 1/2" = 1'-0"



10 / A-502 SECTION DTL - QUADWALL SILL
1 1/2" = 1'-0"



5 / A-502 SECTION DTL - RECESS IN CONC
1 1/2" = 1'-0"



4 / A-502 SECTION DTL - SLAB @ EAST VESTIBULE
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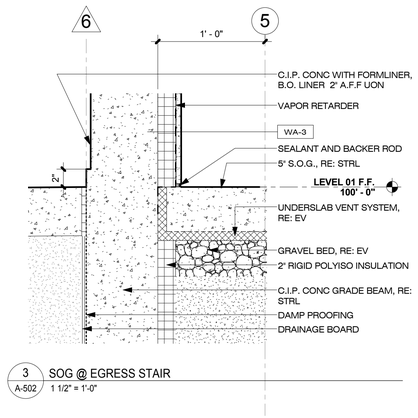

3 / A-502 SOG @ EGRESS STAIR
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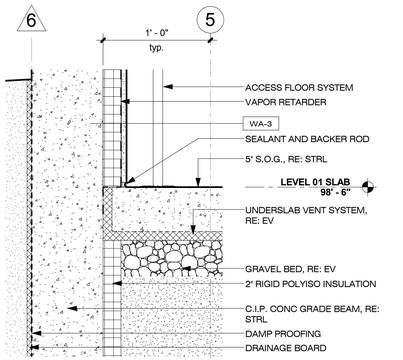

2 / A-502 TYP WALL SECTION
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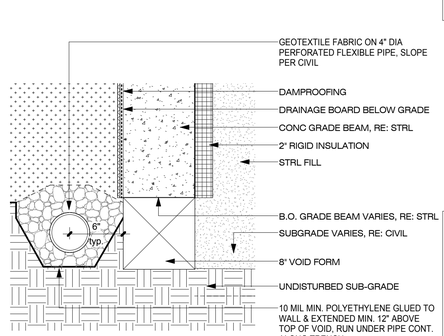

1 / A-502 SECTION DTL - SUB-SURFACE DRAIN, TYP
1 1/2" = 1'-0"

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EXTERIOR DETAILS

A-502

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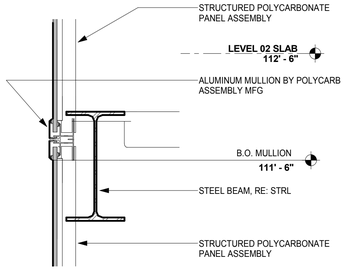
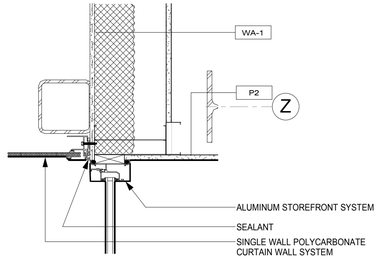
1/13/2012 2:58:02 AM



15 A-503 SECTION DTL - INTERMIDIATE MULLION - POLYCARB
1 1/2" = 1'-0"



14 A-503 PLAN DTL - POLYCARB JAMB @ STOREFRONT
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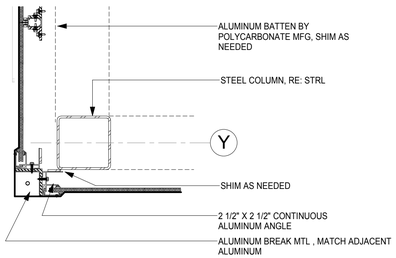

13 A-503 PLAN DTL - POLYCARB CORNER
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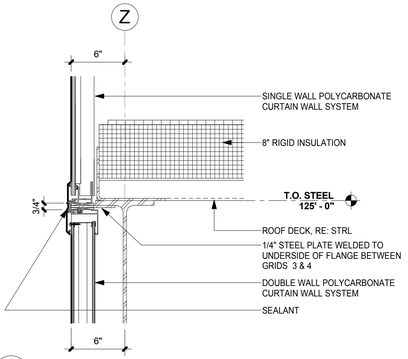

12 A-503 SECTION DTL - POLYCARB @ COURTYARD
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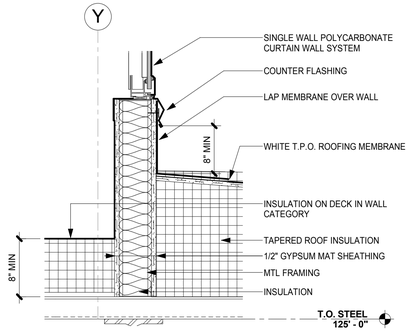
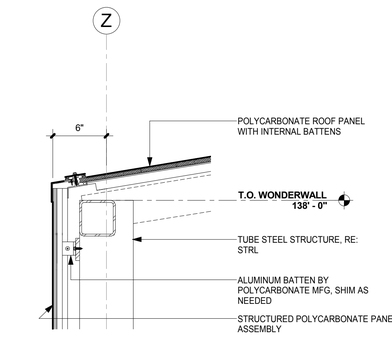


11 A-503 SECTION DTL - POLYCARB SILL @ ROOF
1 1/2" = 1'-0"

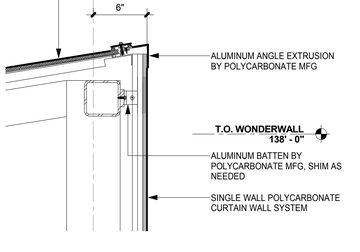
10 A-503 PLAN DTL - POLYCARB JAMB @ CONC
1 1/2" = 1'-0"

9 A-503 PLAN DTL - POLYCARB JAMB @ STUCCO
1 1/2" = 1'-0"

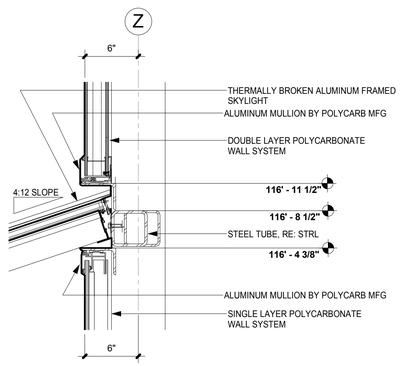
8 A-503 SECTION DTL - EXT BOOK RETURN
1 1/2" = 1'-0"



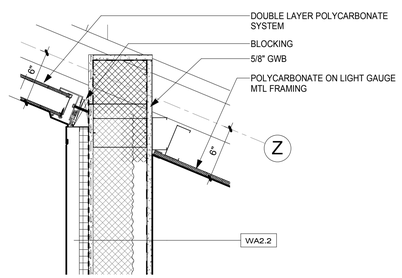
7 A-503 SECTION DTL - SKYLIGHT JAMB
1 1/2" = 1'-0"



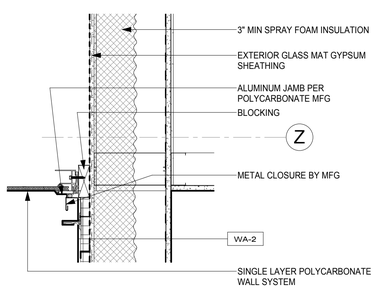
6 A-503 SECTION DTL - SKYLIGHT SILL
1 1/2" = 1'-0"



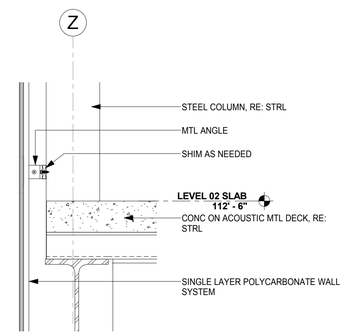
5 A-503 SECTION DTL - POLYCARB @ SKYLIGHT
1 1/2" = 1'-0"



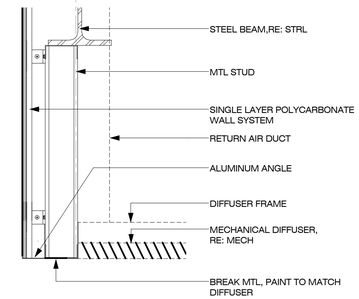
4 A-503 PLAN DTL - QUADWALL JAMB @ STUCCO
1 1/2" = 1'-0"



3 A-503 PLAN DTL - POLYCARB JAMB @ MTL PANEL
1 1/2" = 1'-0"



2 A-503 SECTION DTL - POLYCARB TRANSITION
1 1/2" = 1'-0"



1 A-503 DIFFUSER @ POLYCARB
1 1/2" = 1'-0"

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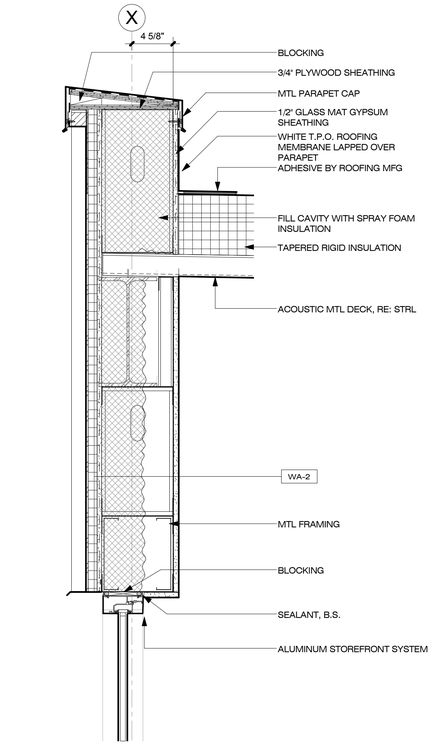
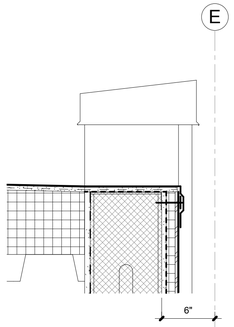
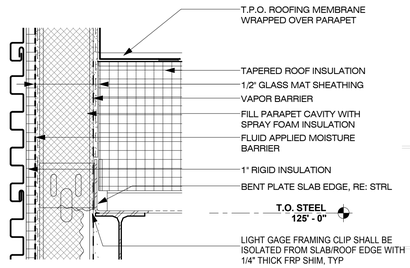


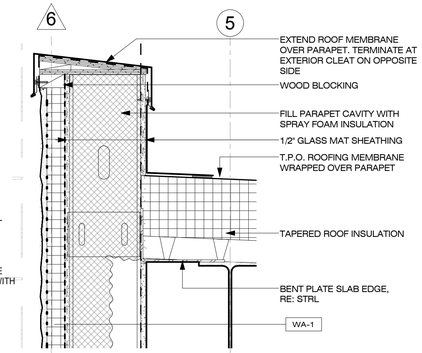
14 A-504 SECTION DTL - PARAPET @ CONFRENCE ROOM
1 1/2" = 1'-0"



12 A-504 SECTION DTL - SCUPPER @ ELEVATOR
1 1/2" = 1'-0"



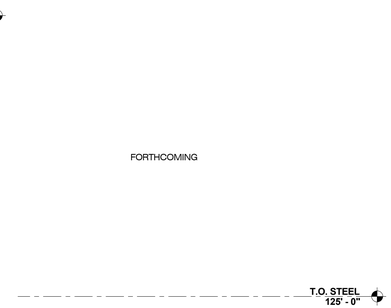
09 A-504 SECTION DTL - WALL @ ROOF EDGE
1 1/2" = 1'-0"



08 A-504 SECTION DTL - STUCCO WALL @ ROOF EDGE
1 1/2" = 1'-0"

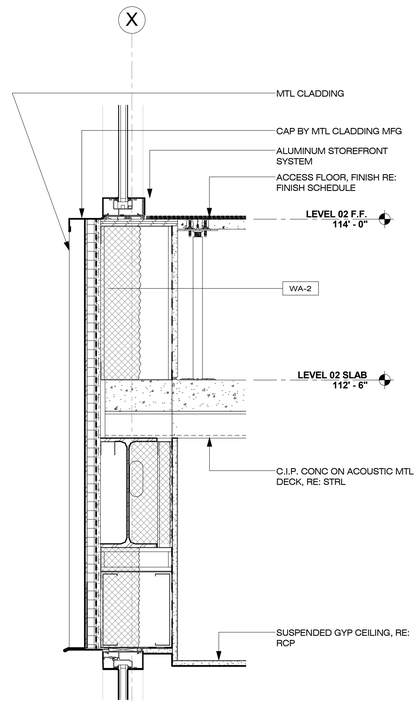
FORTHCOMING

11 A-504 SECTION DTL - SCUPPER @ STORYTIME
1 1/2" = 1'-0"

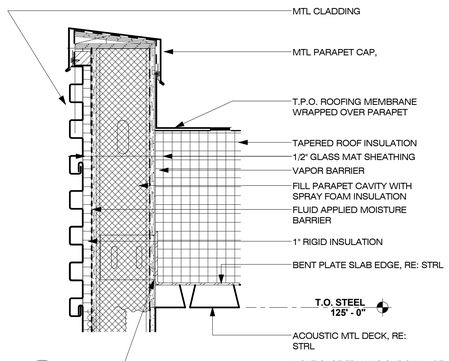


FORTHCOMING

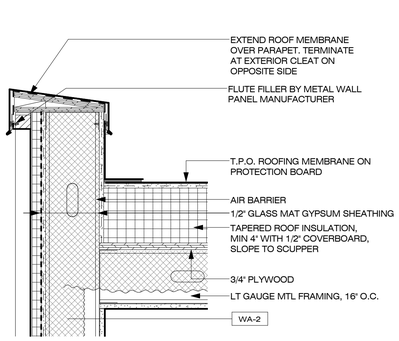
13 A-504 SECTION DTL - EAST ROOF EDGE
1 1/2" = 1'-0"



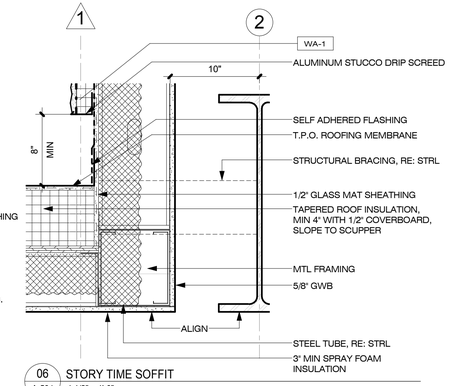
05 A-504 SECTION DTL - @ EAST VESTIBULE
1 1/2" = 1'-0"



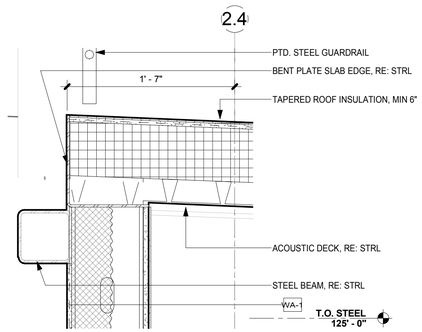
04 A-504 ROOF @ COURTYARD
1 1/2" = 1'-0"



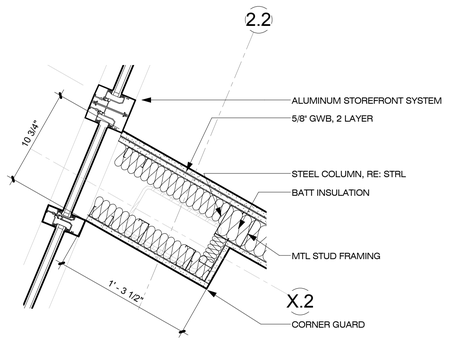
07 A-504 STORY TIME WALL HEAD
1 1/2" = 1'-0"



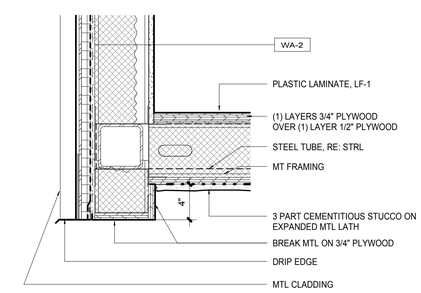
06 A-504 STORY TIME SOFFIT
1 1/2" = 1'-0"



10 A-504 SECTION DTL - ROOF EDGE IN WONDER WALL
1 1/2" = 1'-0"



03 A-504 PLAN DTL - COLUMN @ VESTIBULE
1 1/2" = 1'-0"



02 A-504 STORYTIME BASE
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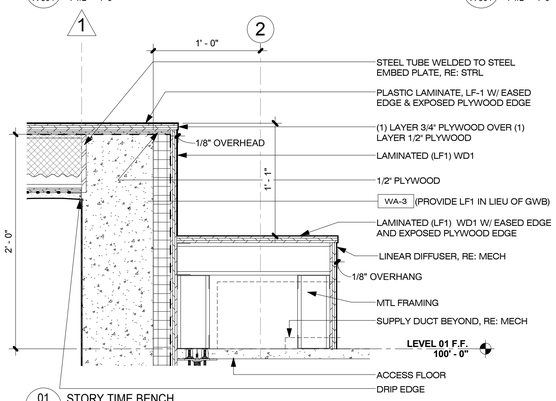

01 A-504 STORY TIME BENCH
1 1/2" = 1'-0"

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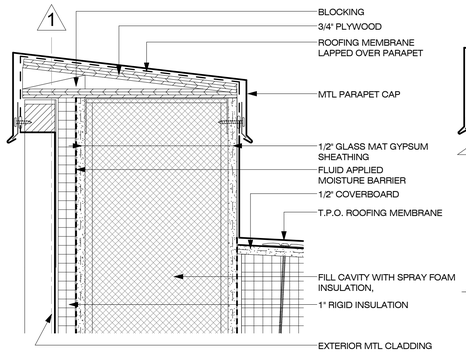
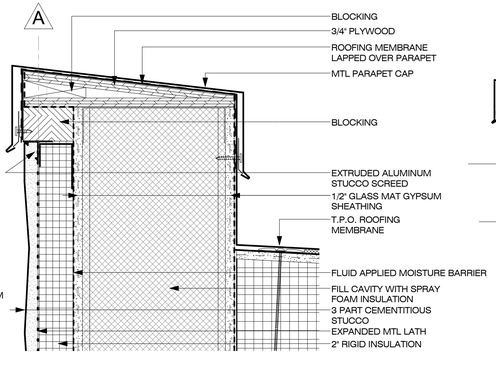
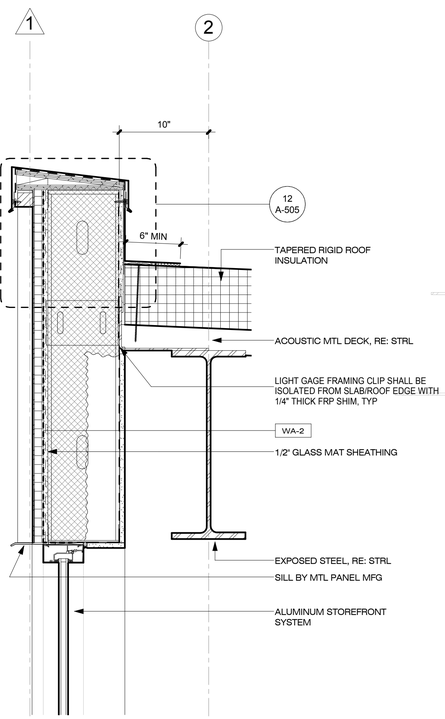


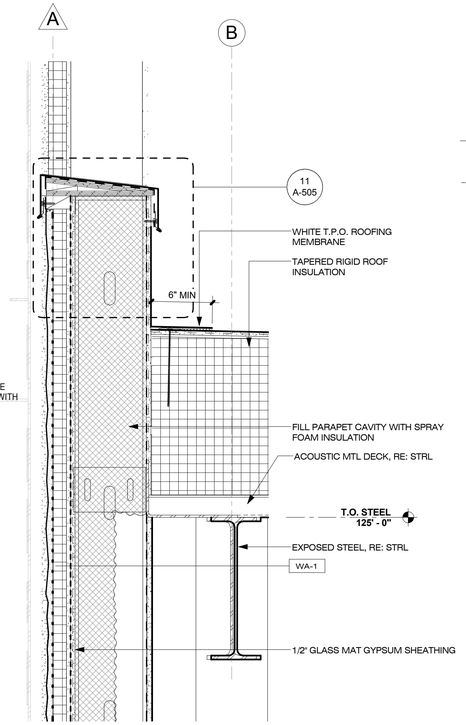
12 A-505 PARAPET @ MTL PANEL
3" = 1'-0"



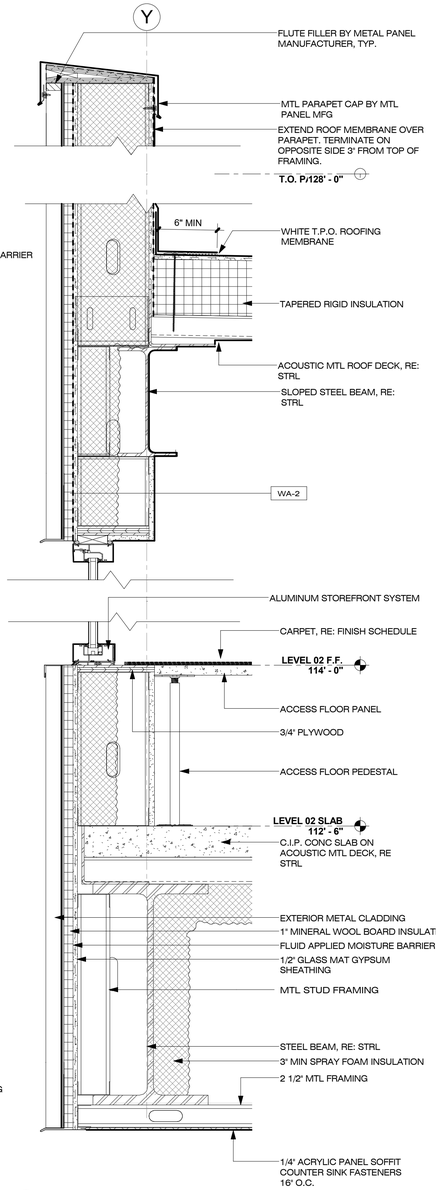
11 A-505 PARAPET @ STUCCO WALL
3" = 1'-0"



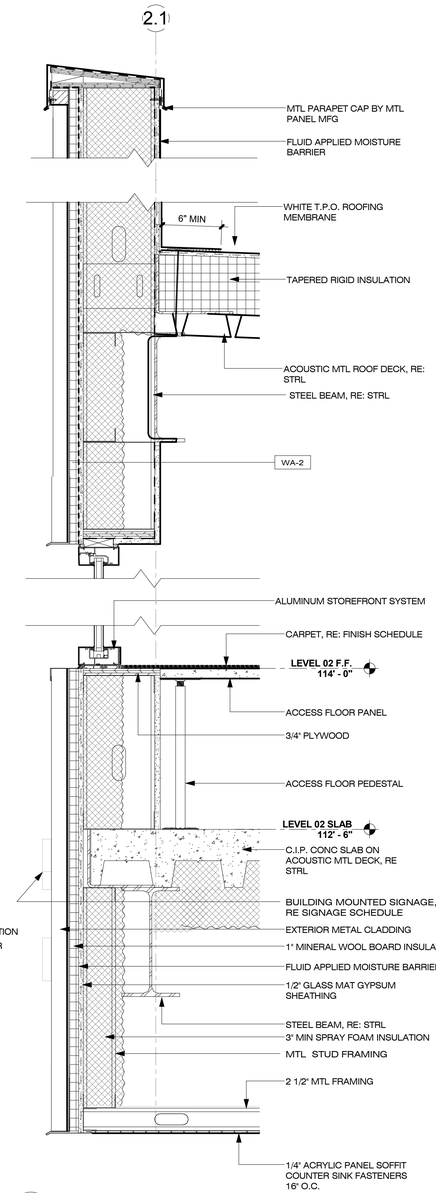
10 A-505 WALL PANEL @ PARAPET
1 1/2" = 1'-0"



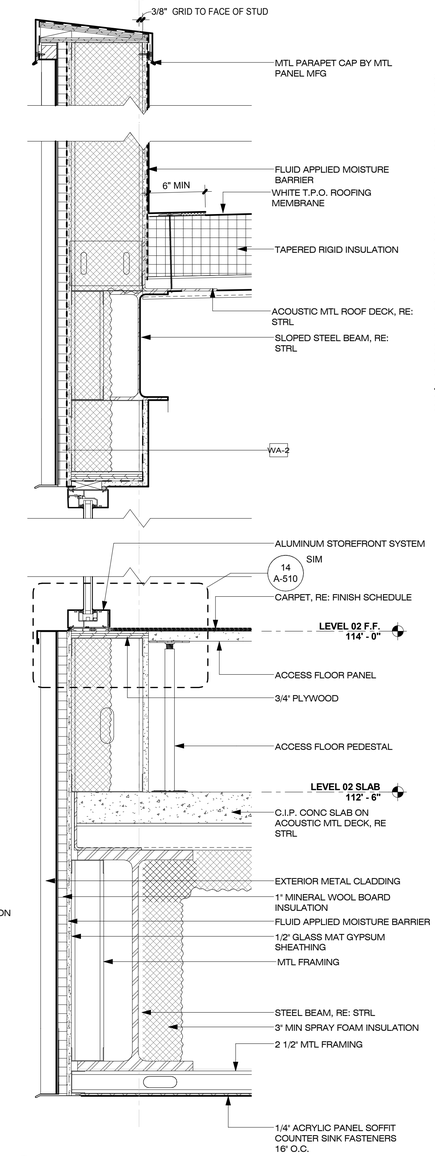
09 A-505 MTL SCREEN @ ROOF
1 1/2" = 1'-0"



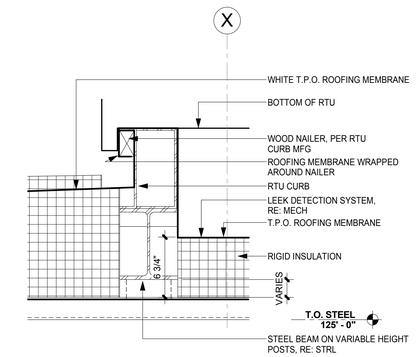
8 A-505 SOFFIT - CANTELEAVER SOUTH
1 1/2" = 1'-0"



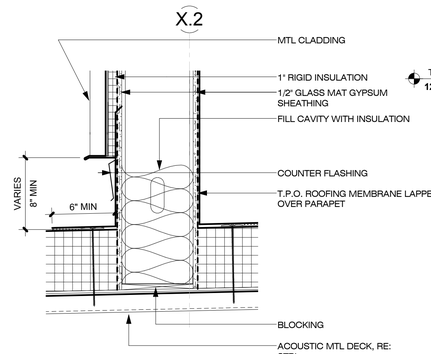
7 A-505 SOFFIT - CANTALEAVER WEST
1 1/2" = 1'-0"



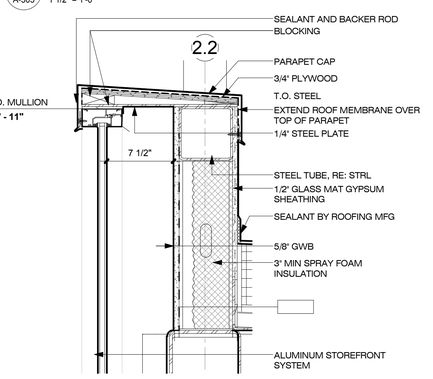
6 A-505 SOFFIT @ CANTALEAVER NORTH
1 1/2" = 1'-0"



4 A-505 SECTION DTL - RTU CURB
1 1/2" = 1'-0"



2 A-505 SECTION DTL - PARAPET EXTENSION
1 1/2" = 1'-0"



1 A-505 SECTION DTL - PARAPET @ STOREFRONT
1 1/2" = 1'-0"

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PROJECT:
WEST DENVER BRANCH LIBRARY
1498 NORTH IRVING STREET
DENVER, COLORADO 80204

sDC PROJECT NO: 1020.00
COOD PROJECT NO: CE 02069

ISSUE DATE
01-12-2012

PHASE
100% CD

EXTERIOR DETAILS

A-505

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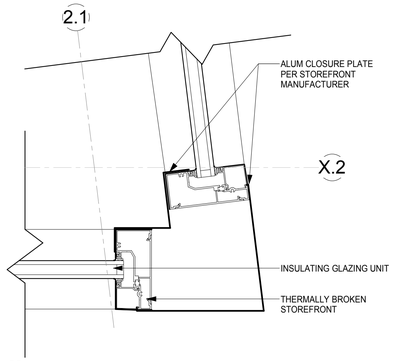
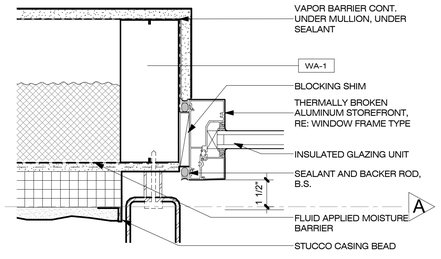
1/13/2012 2:58:22 AM



18 A-510 PLAN DTL STOREFRONT CORNER
3" = 1'-0"



17 A-510 PLAN DTL STOREFRONT 406
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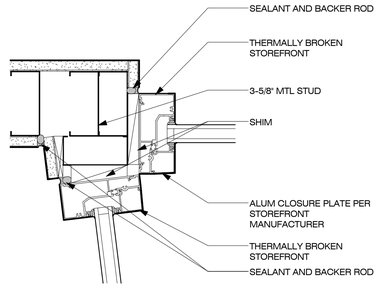

16 A-510 PLAN DTL 406 MULLION TO WALL
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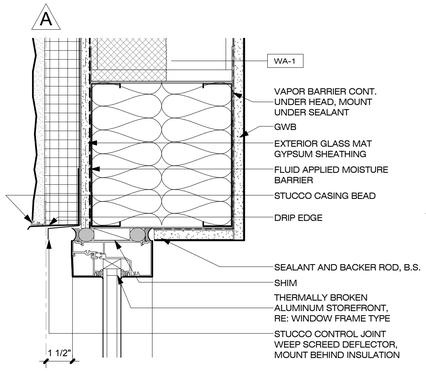

15 A-510 WINDOW SEC DTL 403 HEAD NORTH
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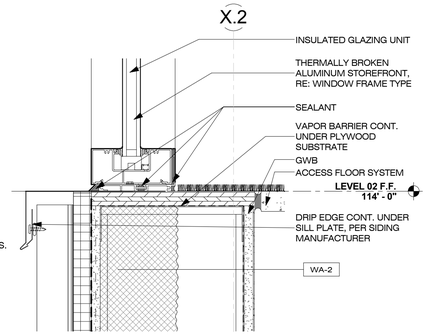

14 A-510 SEC - DTL SILL 403 MULLION @ CANTALEVER
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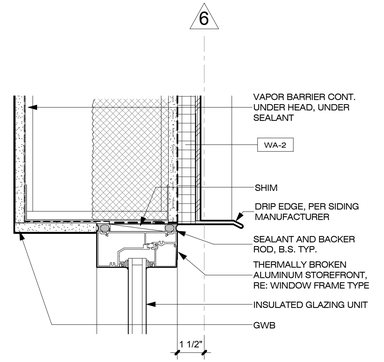
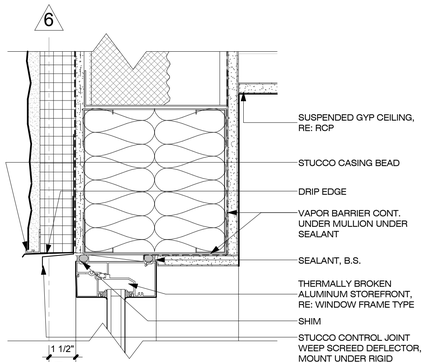
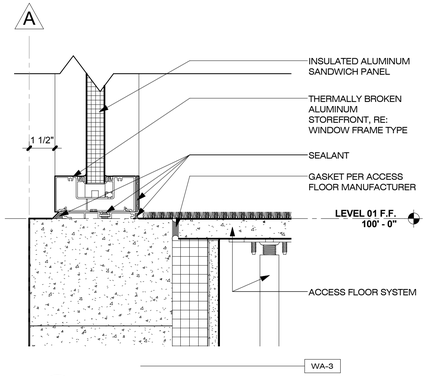


13 A-510 SEC - DTL 403 HEAD TO MTL PANEL
3" = 1'-0"



12 A-510 SECTION DTL - WDW HEAD 403 TYP
3" = 1'-0"



11 A-510 WINDOW SEC DTL SILL 403 NORTH
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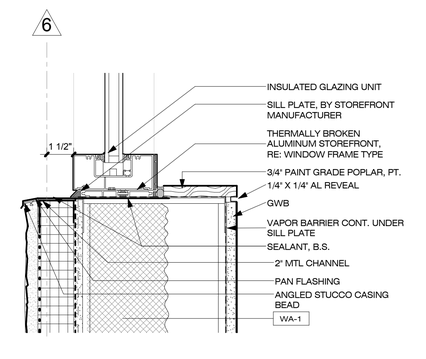

10 A-510 SECTION DTL - WDW SILL 403 TYP
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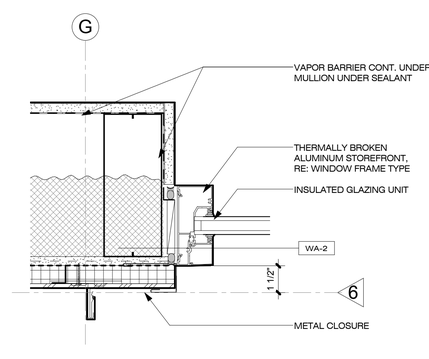
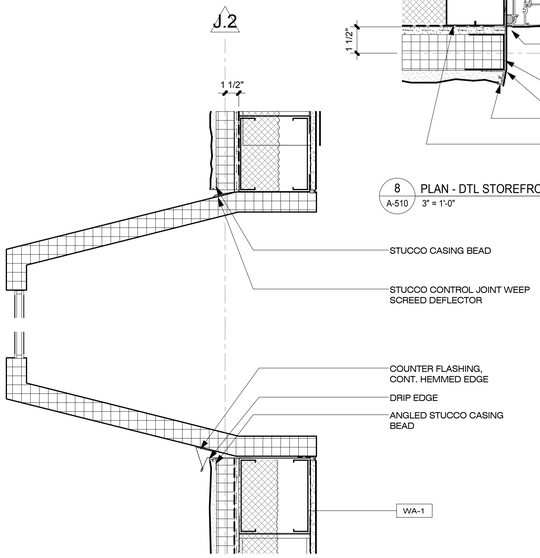
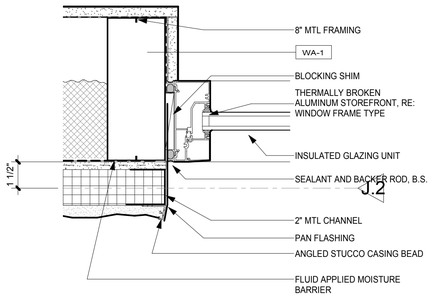


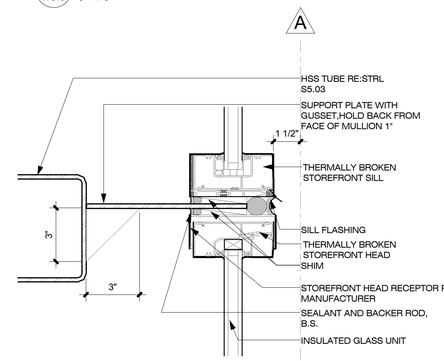
9 A-510 PLAN - DTL STOREFRONT @ METAL PANL
3" = 1'-0"



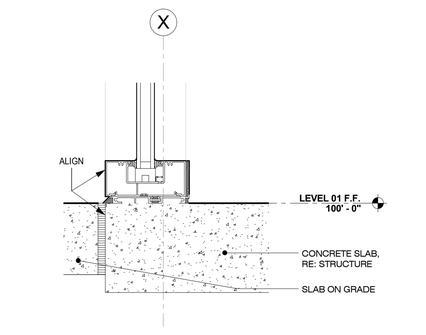
4 A-510 SEC - DTL EYEBALL WINDOW
1 1/2" = 1'-0"



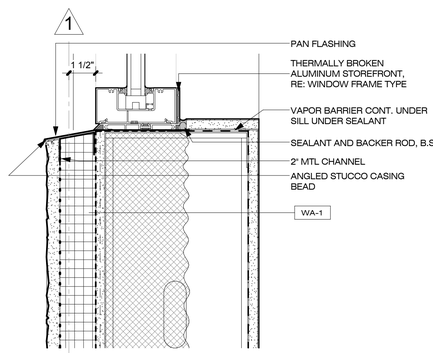
8 A-510 PLAN - DTL STOREFRONT AT STUCCO
3" = 1'-0"



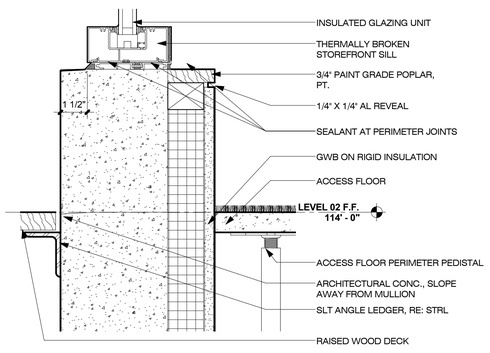
7 A-510 WINDOW SEC DTL HEAD SILL 403
3" = 1'-0"



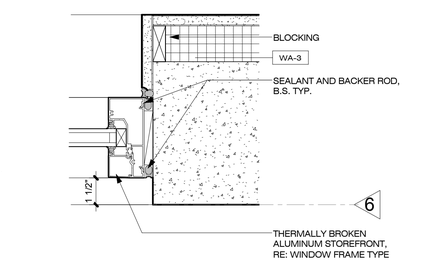
6 A-510 SECTION DTL - 403 SILL @ VESTIBULE
3" = 1'-0"



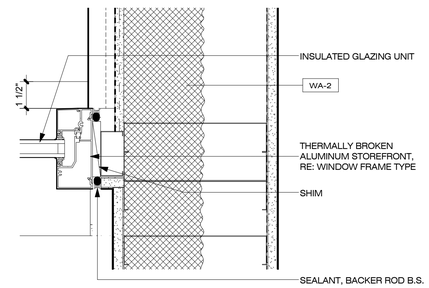
5 A-510 SECTION DTL - STOREFRONT SILL
3" = 1'-0"



3 A-510 SECTION - DTL @ 403 TO CONC.
3" = 1'-0"



2 A-510 PLAN - DTL 403 JAMB AT CONC
3" = 1'-0"



1 A-510 PLAN - DTL 403 JAMB ELEVATOR WALL @ COURTYARD
3" = 1'-0"

WINDOW DETAILS

A-510

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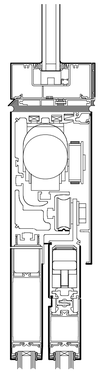
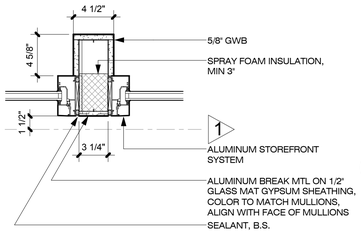
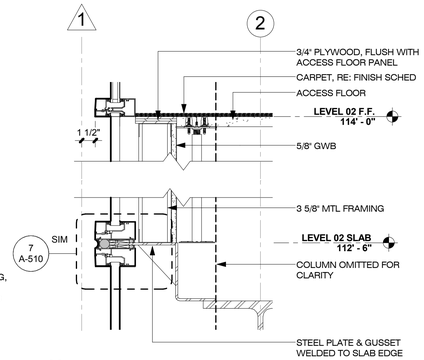


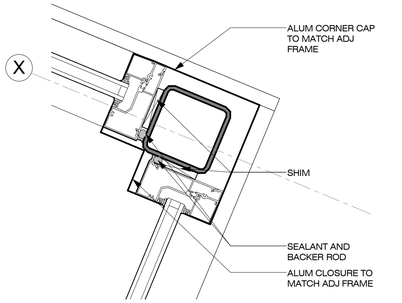
19 SEC - DTL SLIDING DR HD
A-511 3" = 1'-0"



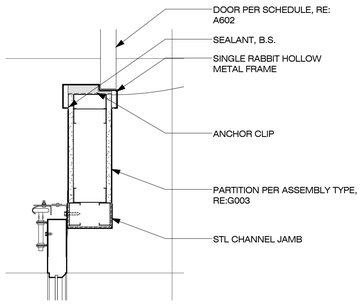
18 PLAN DTL - TYP WIND GIRT
A-511 1 1/2" = 1'-0"



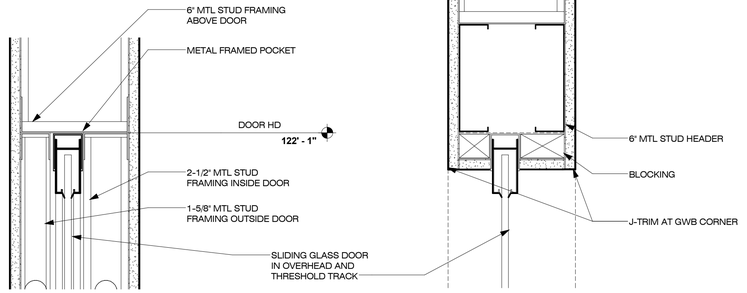
17 SECTION DTL - DOUBLE MULLION
A-511 1 1/2" = 1'-0"



16 PLAN - DTL 406 CORNER @ VESTIBULE
A-511 3" = 1'-0"

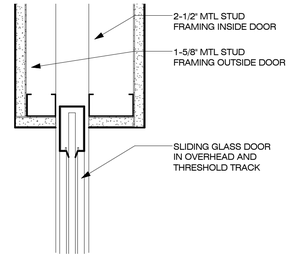


15 PLAN - DTL SECTIONAL DOOR
A-511 1 1/2" = 1'-0"

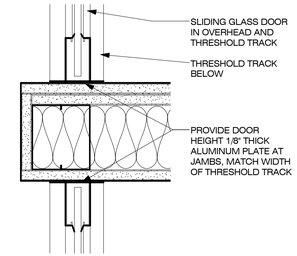


14 SEC-DTL STUDY POCKET DOOR WALL
A-511 3" = 1'-0"

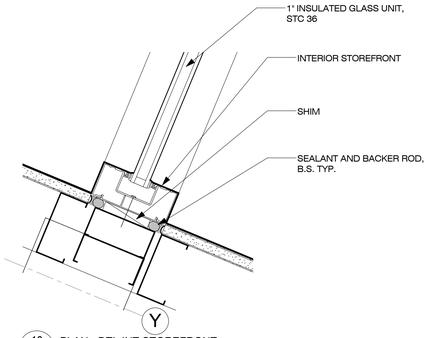
13 SEC-DTL STUDY POCKET DOOR HEAD
A-511 3" = 1'-0"



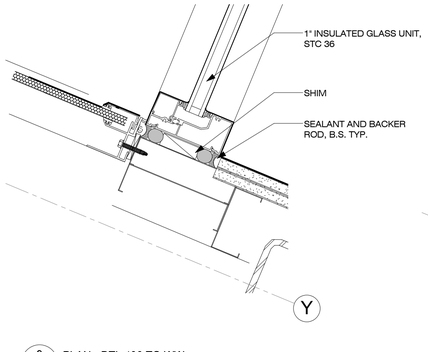
12 PLAN - DTL POCKET DOOR JAMB
A-511 3" = 1'-0"



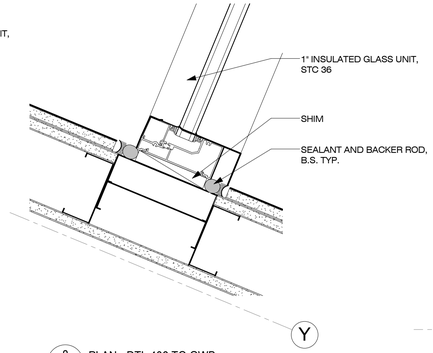
11 PLAN - DTL DOOR STRIKE @ STUDY
A-511 3" = 1'-0"



10 PLAN - DTL INT STOREFRONT
A-511 3" = 1'-0"



9 PLAN - DTL 406 TO WW
A-511 3" = 1'-0"



8 PLAN - DTL 406 TO GWB
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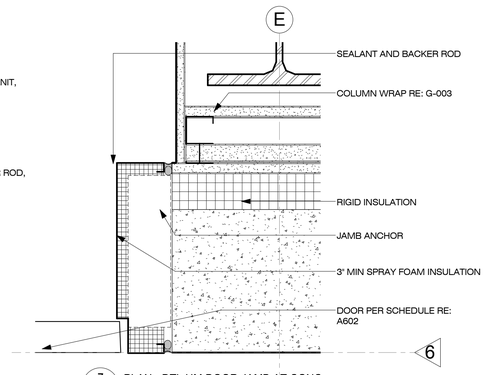
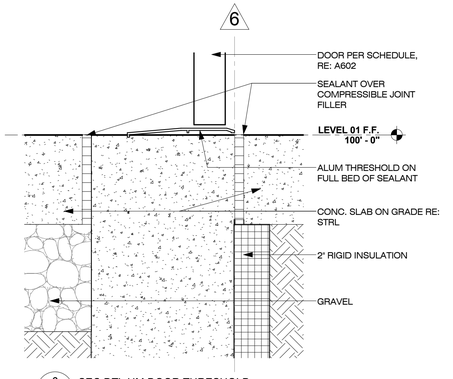
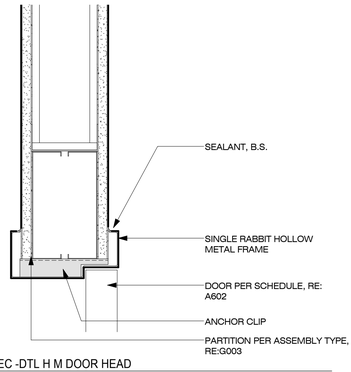


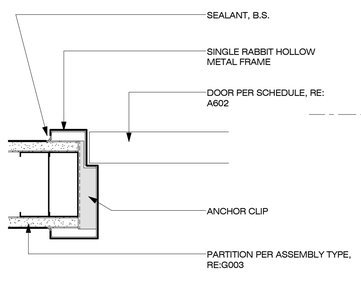
7 PLAN - DTL HM DOOR JAMB AT CONC.
A-511 3" = 1'-0"



6 SEC DTL HM DOOR THRESHOLD
A-511 3" = 1'-0"



5 SEC -DTL H M DOOR HEAD
A-511 3" = 1'-0"



4 PLAN - DTL H M FRAME JAMB
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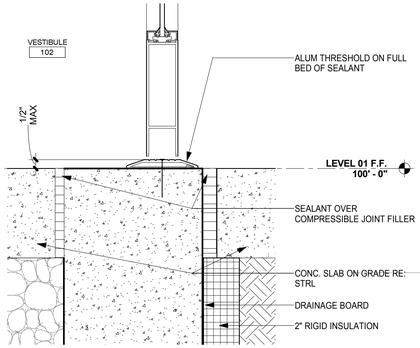
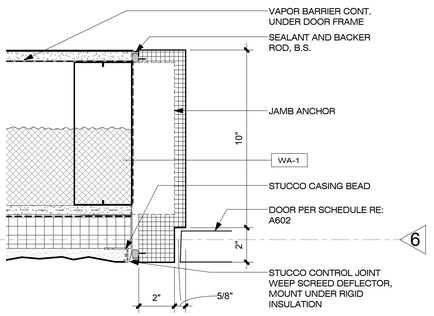
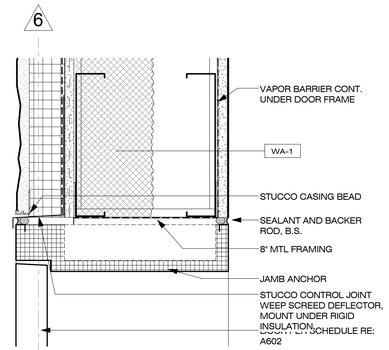


3 SEC - DTL ALUM DOOR THRESHOLD
A-511 3" = 1'-0"



2 PLAN DTL HM DR JAMB
A-511 3" = 1'-0"



1 SEC DTL HM DR HEAD
A-511 3" = 1'-0"

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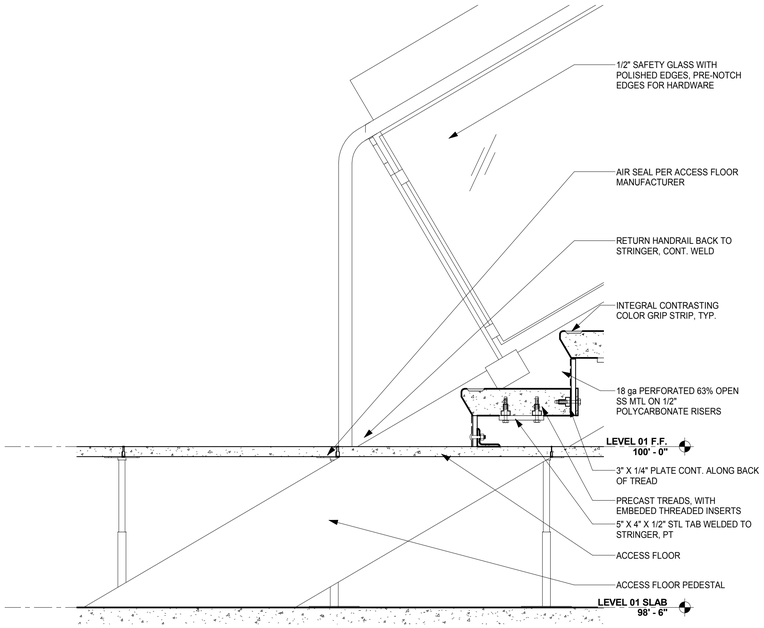
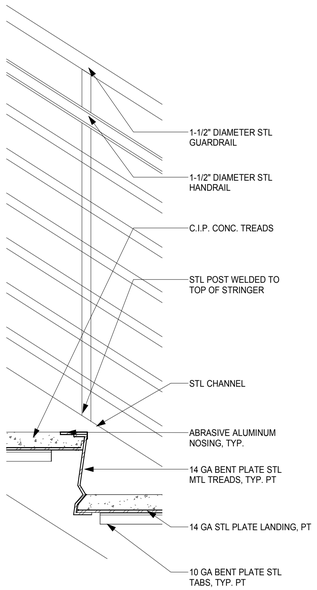
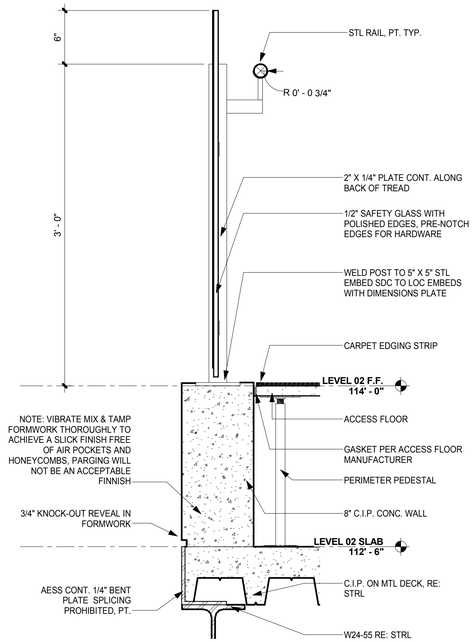


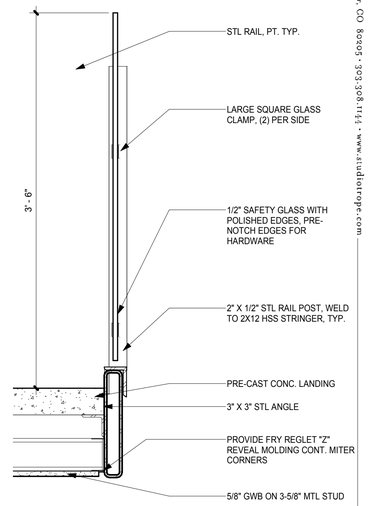
9 A-520 SEC - DTL STAIR POST @ FLOOR
1 1/2" = 1'-0"



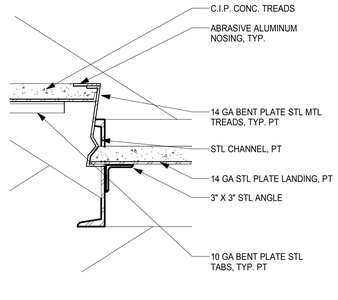
11 A-520 SEC - DTL STAIR B RAIL
1 1/2" = 1'-0"



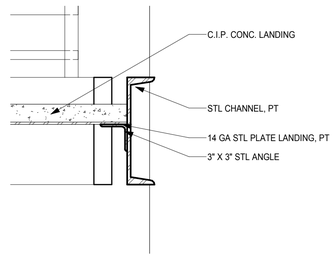
10 A-520 SEC - DTL RAIL @ LEVEL 02
1 1/2" = 1'-0"



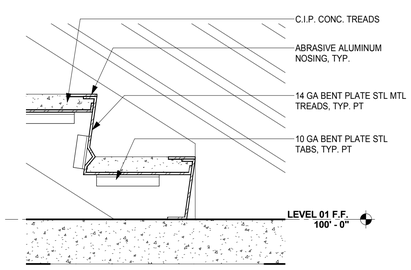
8 A-520 SEC - DTL MAIN STAIR LANDING
1 1/2" = 1'-0"



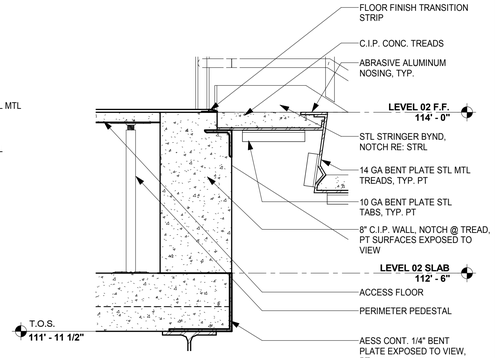
7 A-520 SEC - DTL STAIR B @ LANDING
1 1/2" = 1'-0"



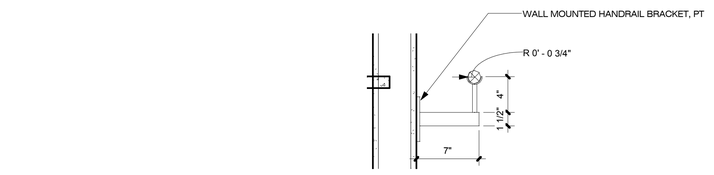
6 A-520 SEC - DTL STAIR B @ LANDING WALL
1 1/2" = 1'-0"



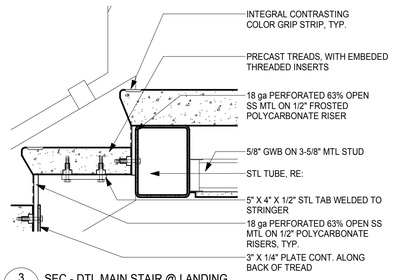
5 A-520 SEC - DTL STAIR B @ LEVEL 01
1 1/2" = 1'-0"



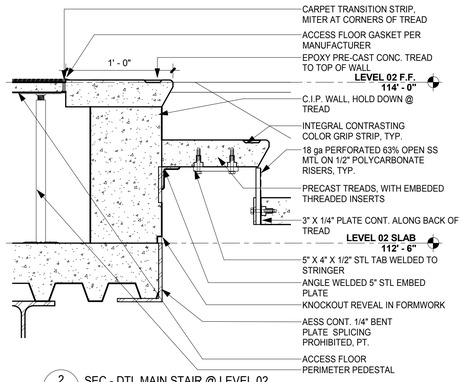
4 A-520 SECTION - DTL RAISED FLOOR CLOSURE
1 1/2" = 1'-0"



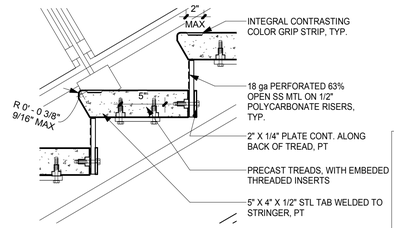
12 A-520 SEC - DTL WALL BRACKET
1 1/2" = 1'-0"



3 A-520 SEC - DTL MAIN STAIR @ LANDING
1 1/2" = 1'-0"



2 A-520 SEC - DTL MAIN STAIR @ LEVEL 02
1 1/2" = 1'-0"



1 A-520 SEC DTL MAIN STAIR TREAD
1 1/2" = 1'-0"

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sDC PROJECT NO: 1020.00
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INTERIOR DETAILS

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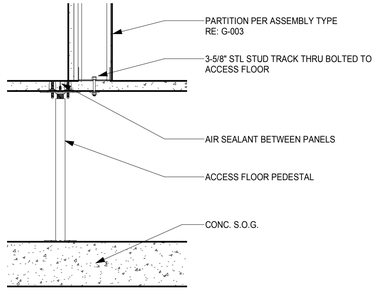
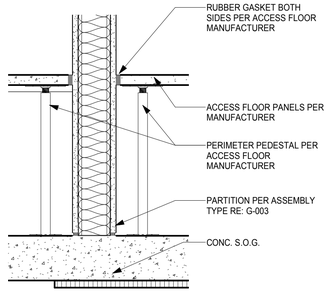
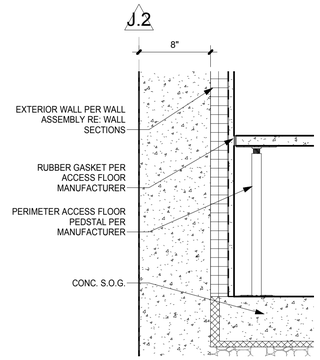


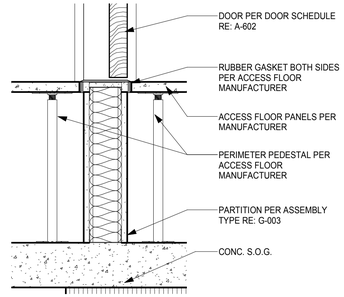
16 A-522 RAISED FLOOR @ PATITION ABOVE RAISED FLOOR
1 1/2" = 1'-0"



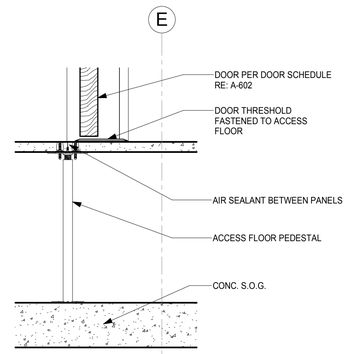
15 A-522 RAISED FLOOR @ PARTITION TO SUBFLOOR
1 1/2" = 1'-0"



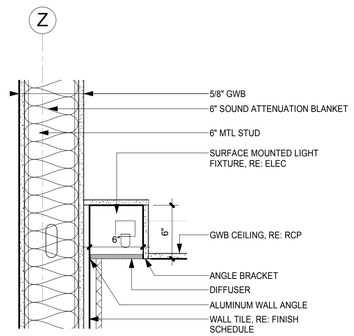
14 A-522 RAISED FLOOR @ EXTERIOR WALL
1 1/2" = 1'-0"



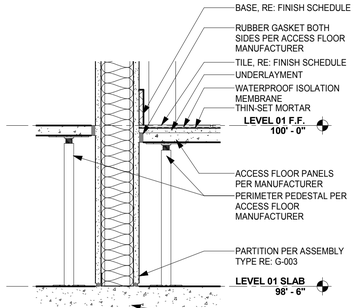
13 A-522 RAISED FLOOR @ DOOR THRESHOLD
1 1/2" = 1'-0"



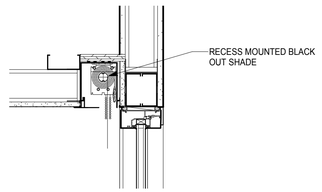
12 A-522 RAISED FLOOR @ DOOR ABOVE RAISED FLOOR
1 1/2" = 1'-0"



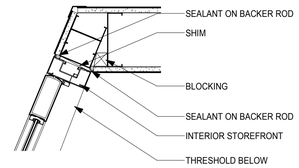
18 A-522 SECTION DTL - TYP COVE LIGHT
1 1/2" = 1'-0"



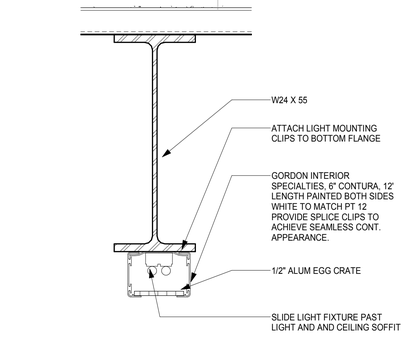
17 A-522 SEC - DTL RAISED FLOOR WITH TILE
1 1/2" = 1'-0"



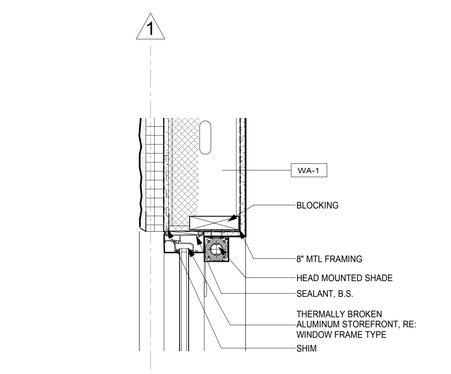
11 A-522 SEC - DTL MECHO SHADE @STORY TIME
1 1/2" = 1'-0"



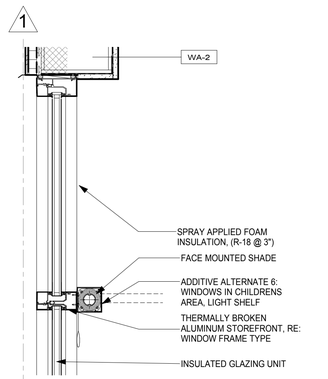
10 A-522 PLAN - DTL STORE FRONT TO GWB CORNER
1 1/2" = 1'-0"



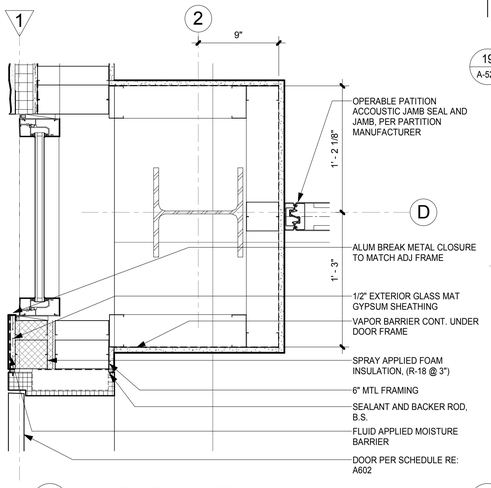
9 A-522 SECTION - DTL LINEAR BEAM LIGHT
1 1/2" = 1'-0"



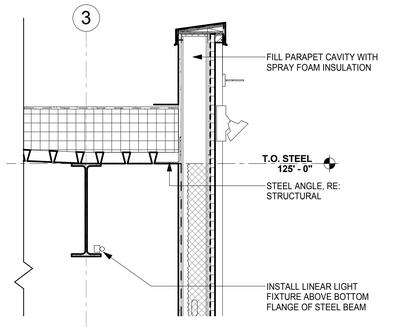
8 A-522 SEC - DTL MECHO SHADE SURFACE MOUNT @HEAD
1 1/2" = 1'-0"



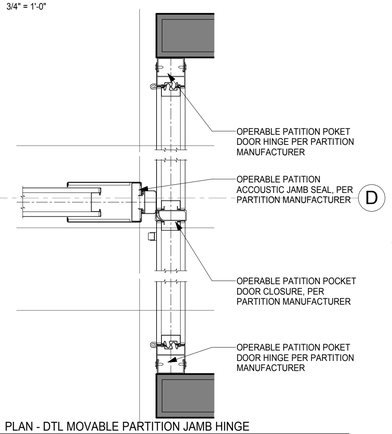
7 A-522 SEC - DTL MECHO SHADE SURFACE MOUNT @ INT MUL
1 1/2" = 1'-0"



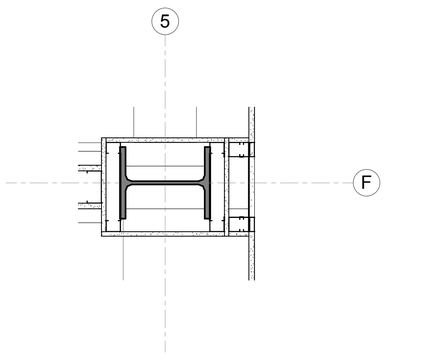
3 A-522 PLAN - DTL OPERABLE PARTITION JAMB
1 1/2" = 1'-0"



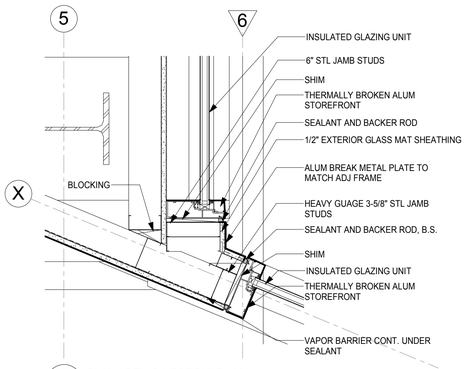
19 A-522 SECTION - WALL @ COURTYARD
3/4" = 1'-0"



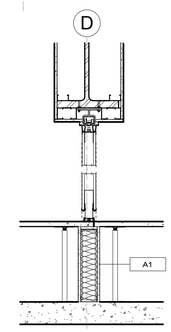
2 A-522 PLAN - DTL MOVABLE PARTITION JAMB HINGE
1 1/2" = 1'-0"



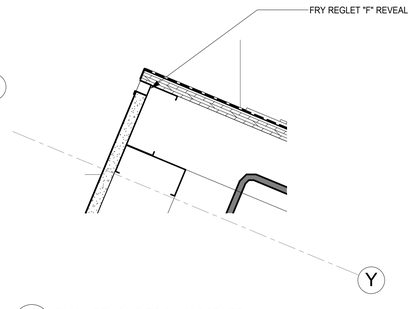
6 A-522 PLAN - DTL COL WRAP
1 1/2" = 1'-0"



5 A-522 PLAN - DTL @ VESTIBULE 102
1 1/2" = 1'-0"



4 A-522 SECTION - DTL OPERABLE PARTITION
3/4" = 1'-0"



1 A-522 PLAN - DTL GWB TO PLAM CORNER
3" = 1'-0"

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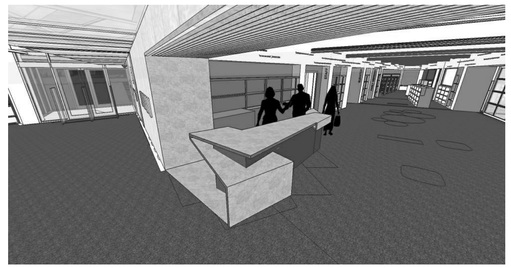
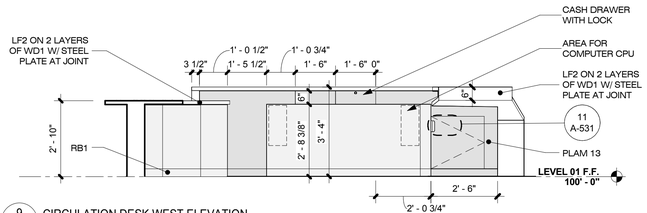
7 A-530 CIRCULATION DESK SKETCH C (FOR INFO ONLY)
3/4" = 1'-0"

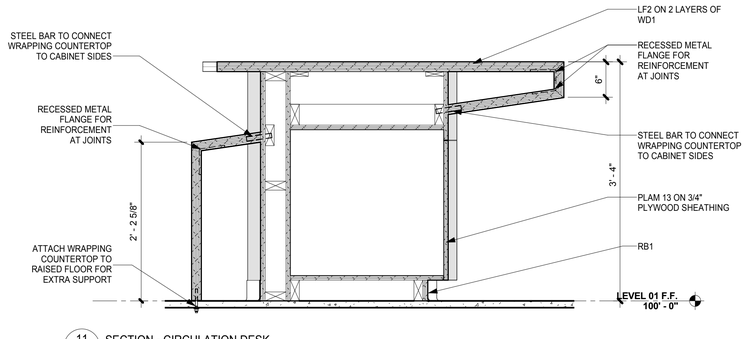
6 A-530 CIRCULATION DESK SKETCH B (FOR INFO ONLY)
3/4" = 1'-0"



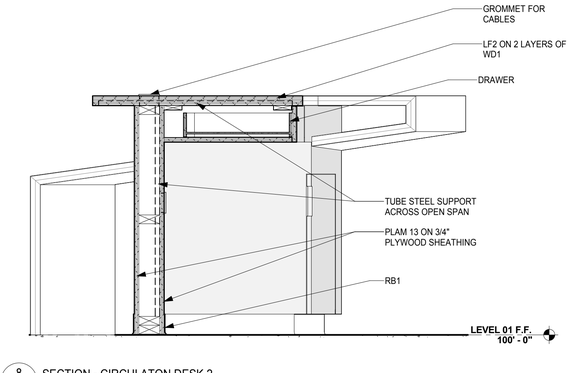
CIRCULATION DESK SKETCH A (FOR INFO ONLY)
3/4" = 1'-0"



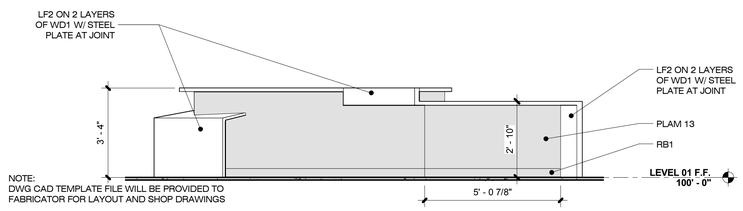
9 A-530 CIRCULATION DESK WEST ELEVATION
3/8" = 1'-0"



11 A-530 SECTION - CIRCULATION DESK
1" = 1'-0"

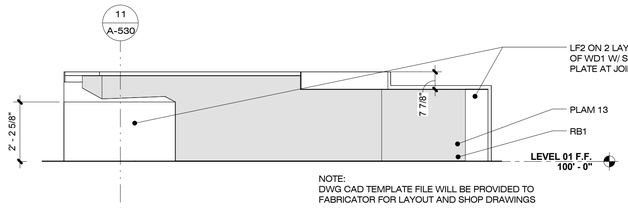


8 A-530 SECTION - CIRCULATON DESK 2
1" = 1'-0"



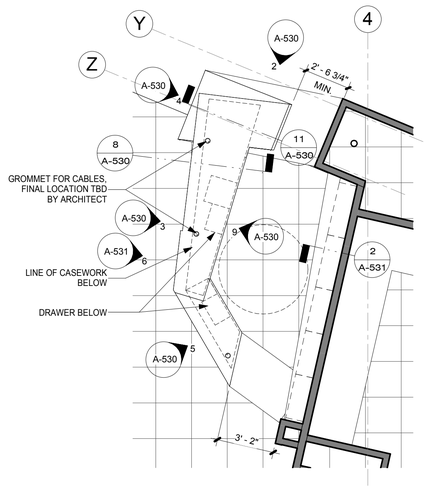
NOTE:
DWG CAD TEMPLATE FILE WILL BE PROVIDED TO FABRICATOR FOR LAYOUT AND SHOP DRAWINGS

5 A-530 CIRCULATION DESK NE ELEVATION
3/8" = 1'-0"



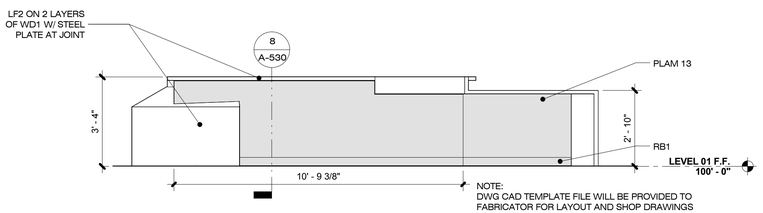
NOTE:
DWG CAD TEMPLATE FILE WILL BE PROVIDED TO FABRICATOR FOR LAYOUT AND SHOP DRAWINGS

4 A-530 CIRCULATION DESK SE ELEVATION
3/8" = 1'-0"



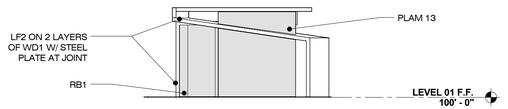
NOTE:
ELECTRONIC DWG CAD TEMPLATE FILE WILL BE PROVIDED TO FABRICATOR FOR LAYOUT OF SHOP DRAWINGS

1 A-530 ENLARGED LEVEL 01 DESK
1/4" = 1'-0"



NOTE:
DWG CAD TEMPLATE FILE WILL BE PROVIDED TO FABRICATOR FOR LAYOUT AND SHOP DRAWINGS

3 A-530 CIRCULATION DESK EAST ELEVATION
3/8" = 1'-0"



NOTE:
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2 A-530 CIRCULATION DESK SOUTH ELEVATION
3/8" = 1'-0"

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CASEWORK DETAILS

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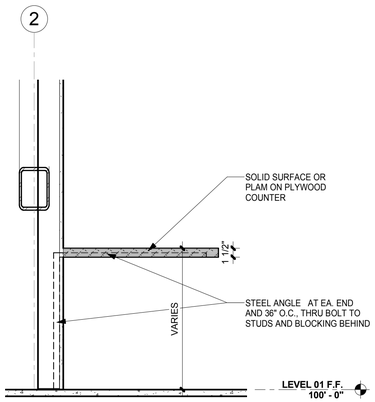
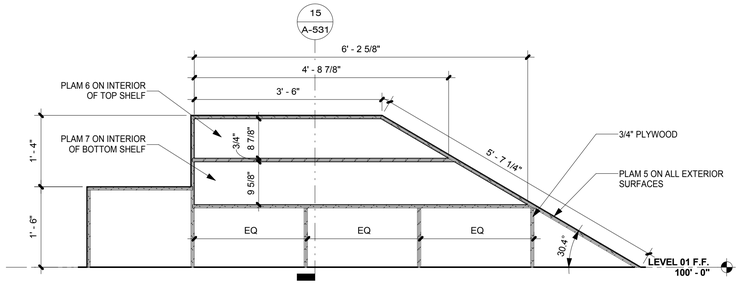


18 A-531 SECT DTL - BUILT-IN COUNTER TYP
1" = 1'-0"



17 A-531 KIOSK SECTION DTL
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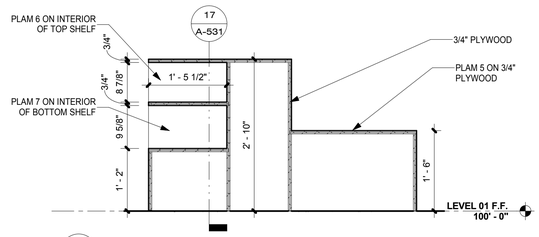
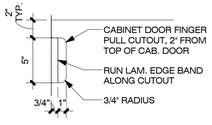
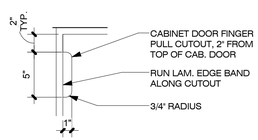


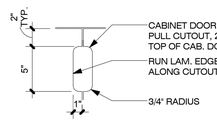
15 A-531 KIOSK DETAIL
3/4" = 1'-0"



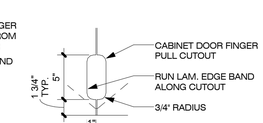
11 A-531 SINGLE DOOR PULL DETAIL
1 1/2" = 1'-0"



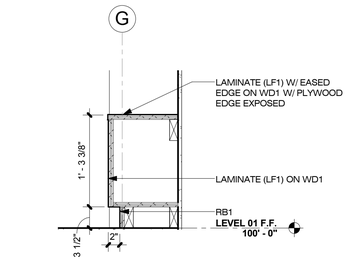
10 A-531 SLIDING DOOR PULL DTL
1 1/2" = 1'-0"



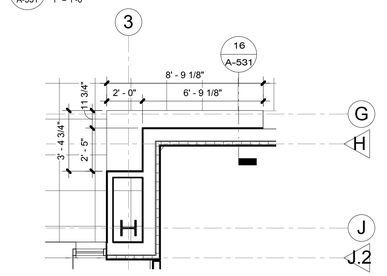
9 A-531 BASE CABINET PULL DETAIL
1 1/2" = 1'-0"



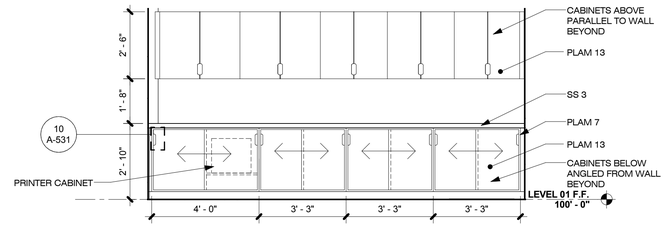
8 A-531 UPPER CABINET PULL DETAIL
1 1/2" = 1'-0"



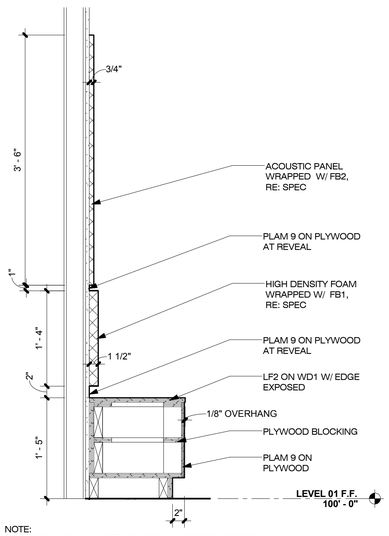
16 A-531 DTL BUILT IN BENCH
1" = 1'-0"



14 A-531 ENLARGED LEVEL 01 BUILT IN BENCH
1/4" = 1'-0"



6 A-531 CASEWORK BEHIND CIRCULATION DESK
3/8" = 1'-0"



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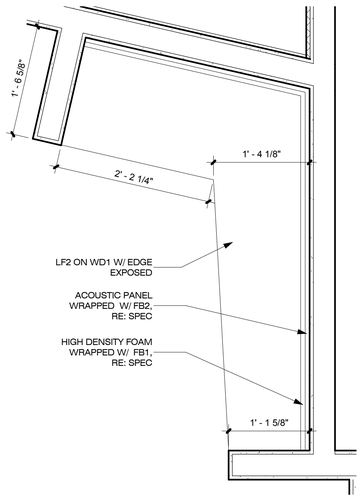
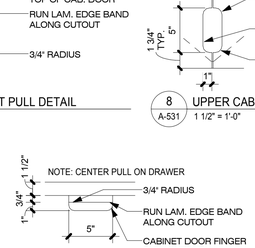
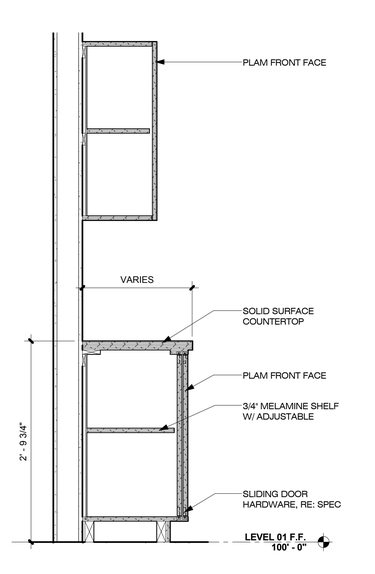
13 A-531 SECT DTL - CHILDREN'S BUILT IN BENCH
1" = 1'-0"



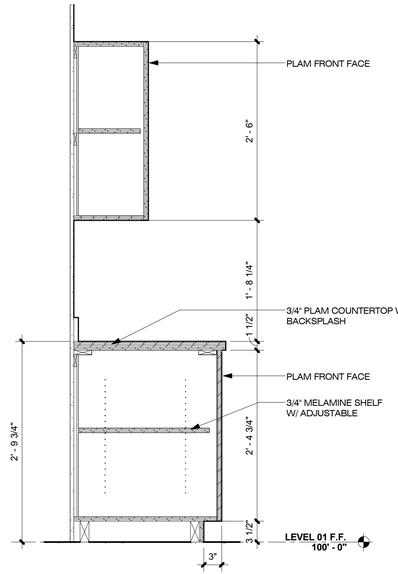
12 A-531 PLAN - DTL CHILDREN'S BUILT IN
1" = 1'-0"



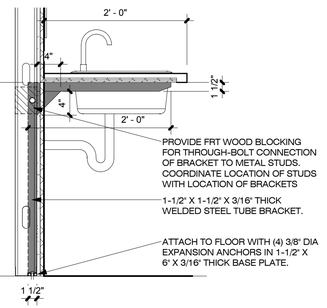
7 A-531 DRAWER PULL DETAIL
1 1/2" = 1'-0"



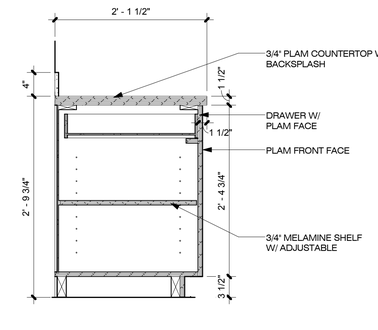
2 A-531 DTL - CABINET/SHELVING AT CIRCULATION
1" = 1'-0"



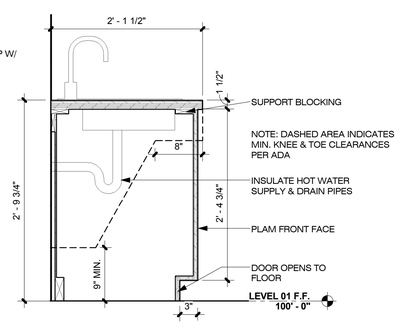
1 A-531 CASEWORK SECTION
1" = 1'-0"



5 A-531 SEC - DTL COUNTER SUPPORT
1" = 1'-0"



4 A-531 BASE CABINET SECTION
1" = 1'-0"



3 A-531 TYP. DTL ADA ROLL-IN SINK
1" = 1'-0"

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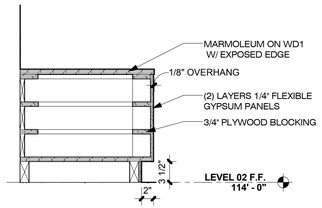
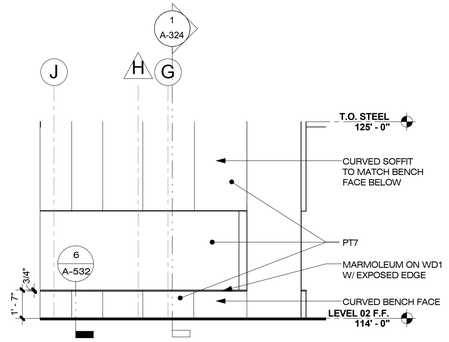
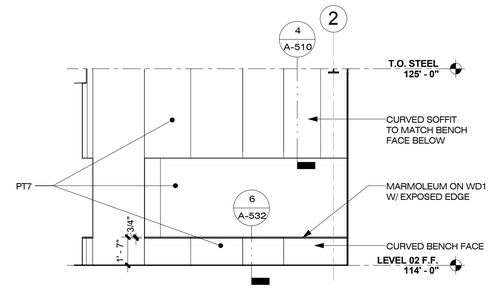


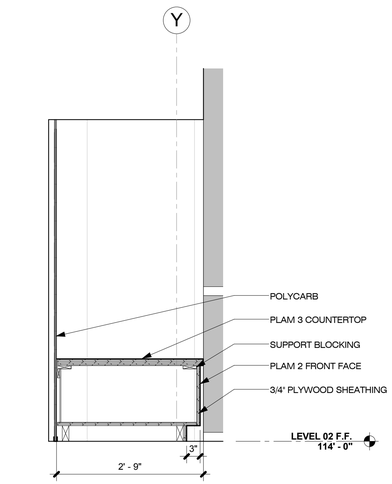
6 A-532 SECT DTL - STORY TIME TOWER BENCH
1" = 1'-0"



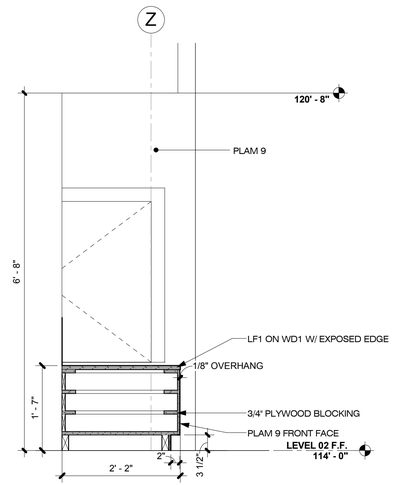
5 A-532 STORY TIME TOWER BENCH - 2ND FLOOR - NORTH ELEVATION
1/4" = 1'-0"



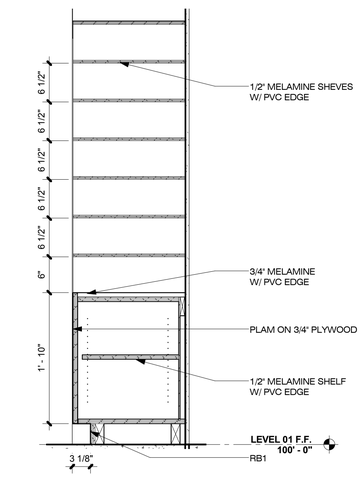
4 A-532 STORY TIME TOWER BENCH - SECOND FLOOR - WEST ELEVATION
1/4" = 1'-0"



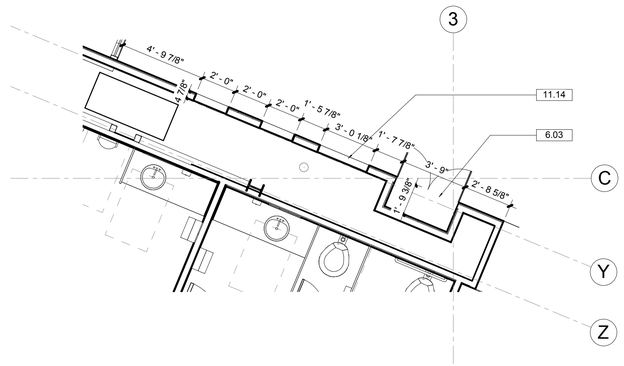
2 A-532 DTL - PRINTER CABINET - OPEN COMPUTING
3/4" = 1'-0"



8 A-532 SECTION DTL - ACCESS DOOR LEVEL 2
3/4" = 1'-0"



7 A-532 DTL - MAILBOXES @ SORTING
1" = 1'-0"



1 A-532 ENLARGED LEVEL 01 WONDER WALL BUILT-INS
1/4" = 1'-0"

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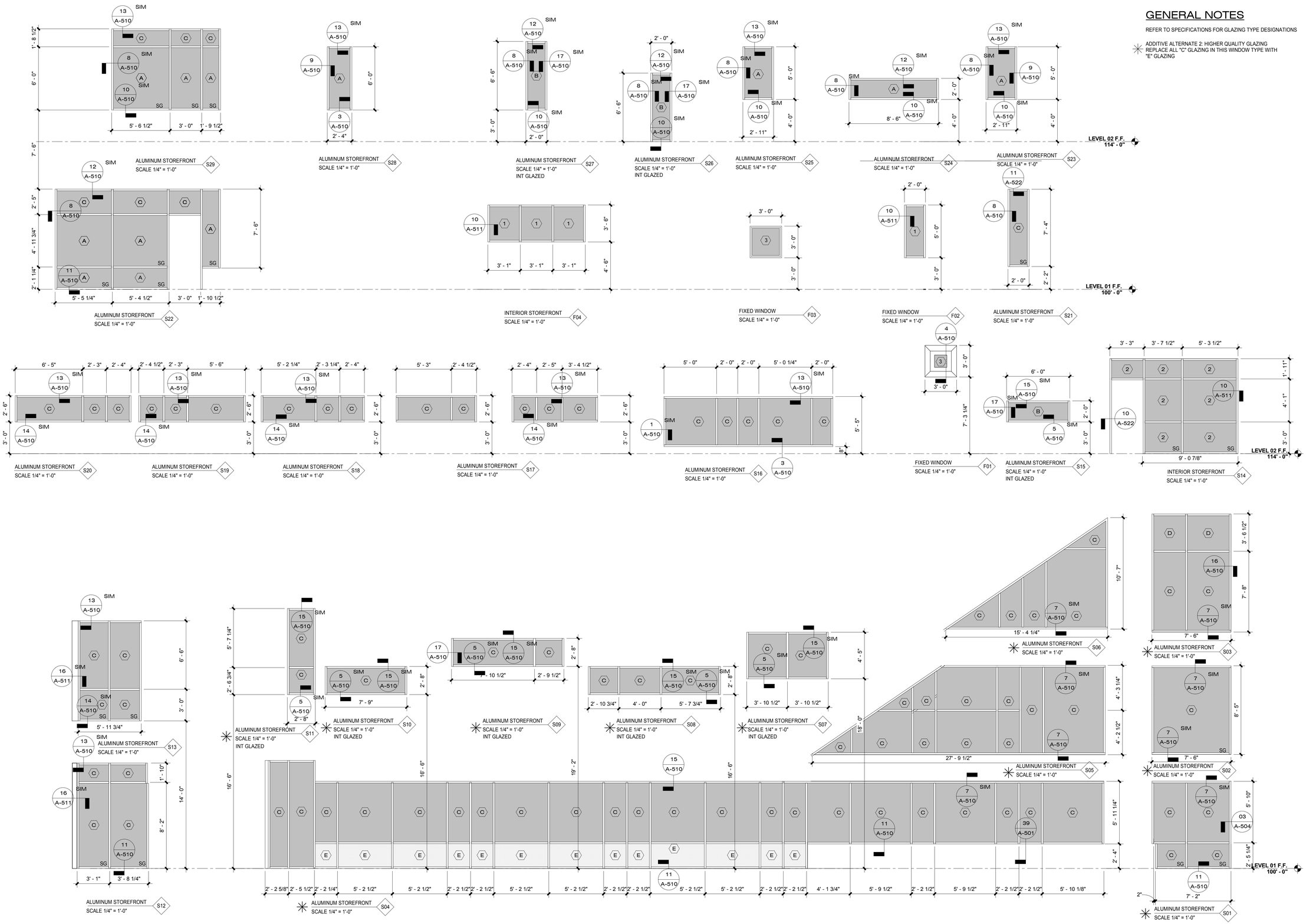
GENERAL NOTES

REFER TO SPECIFICATIONS FOR GLAZING TYPE DESIGNATIONS

✳ ADDITIVE ALTERNATE 2: HIGHER QUALITY GLAZING
REPLACE ALL "C" GLAZING IN THIS WINDOW TYPE WITH "E" GLAZING



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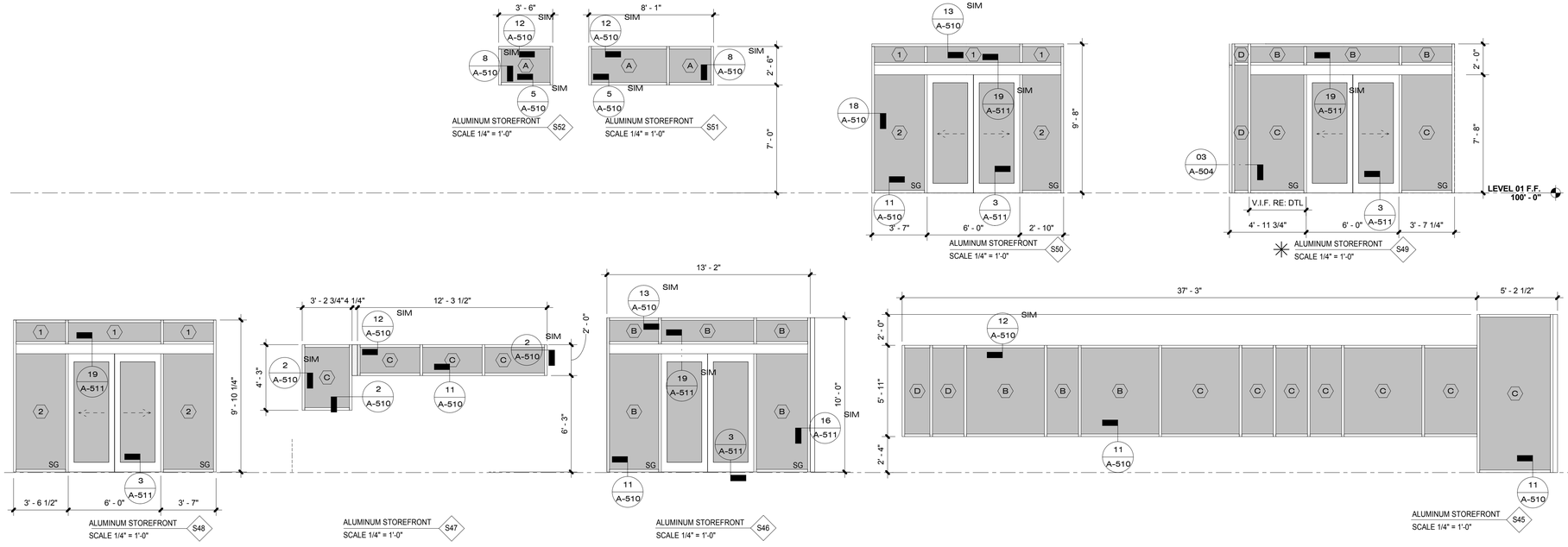

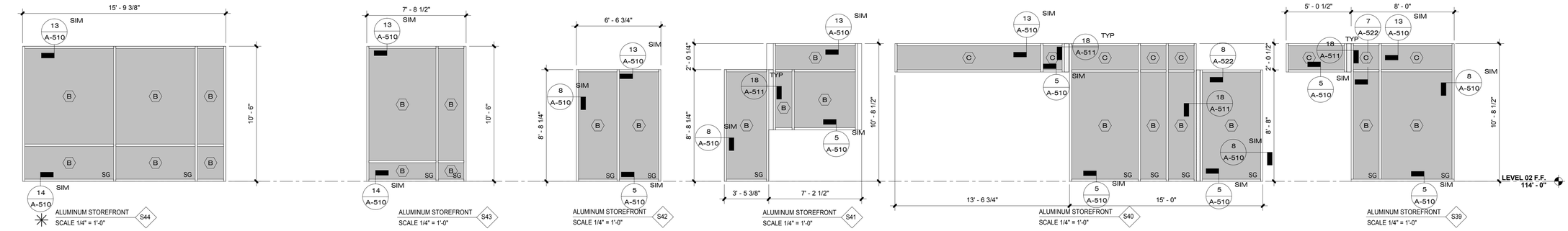

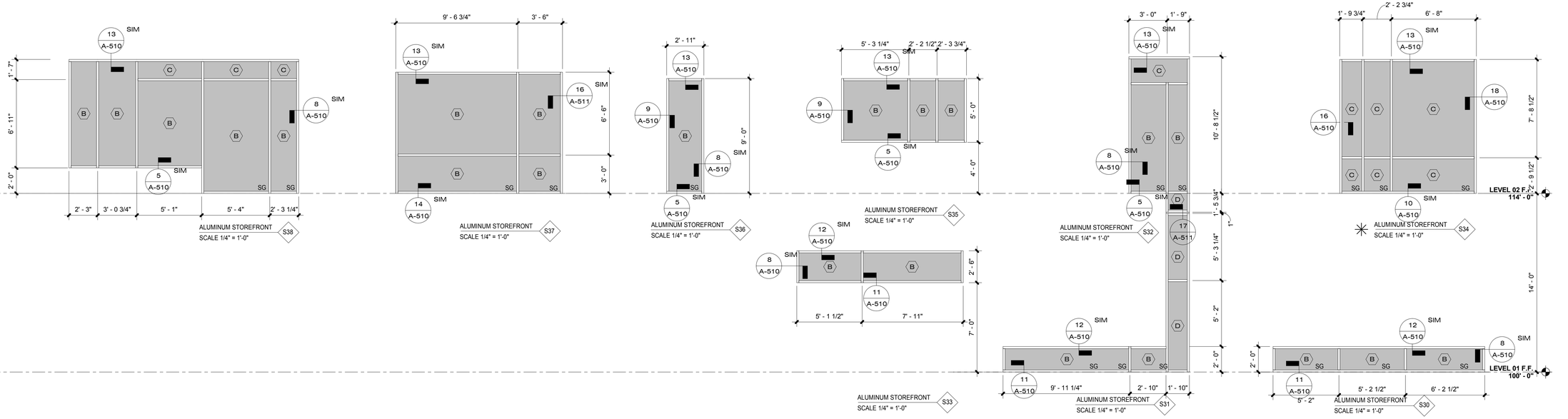

GENERAL NOTES

REFER TO SPECIFICATIONS FOR GLAZING TYPE DESIGNATIONS

ADDITIVE ALTERNATE 2: HIGHER QUALITY GLAZING
REPLACE ALL "C" GLAZING IN THIS WINDOW TYPE WITH "E" GLAZING

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1498 NORTH IRVING STREET
DENVER, COLORADO 80204

01/12/12

#DC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02089

ISSUE DATE
01-12-2012

PHASE
100% CD

WINDOW SCHEDULE

A-601

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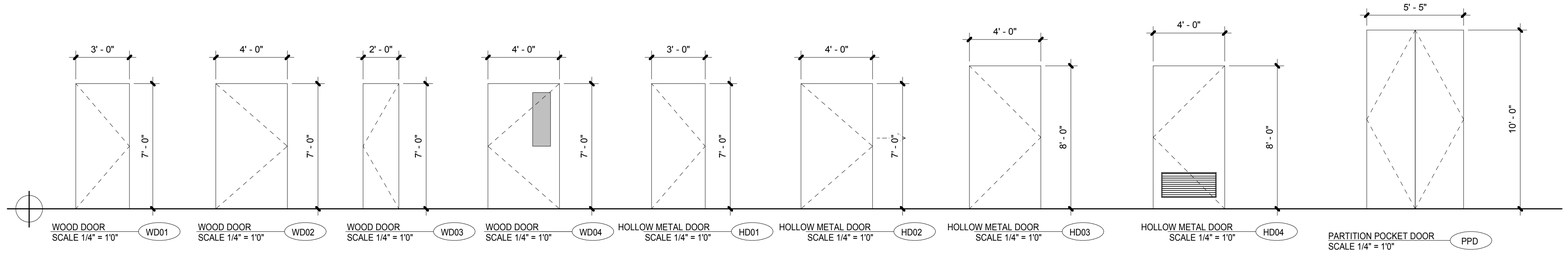
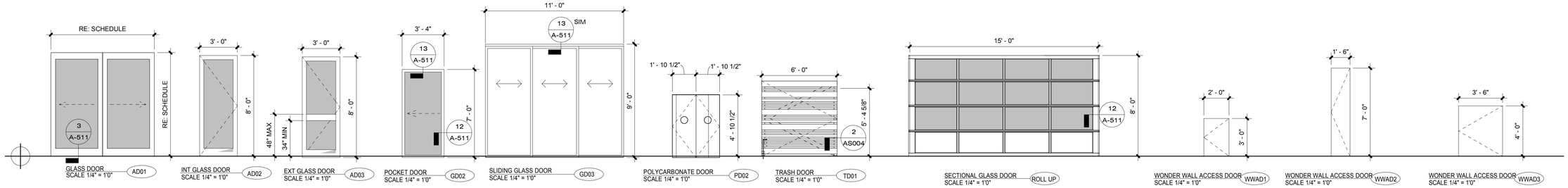
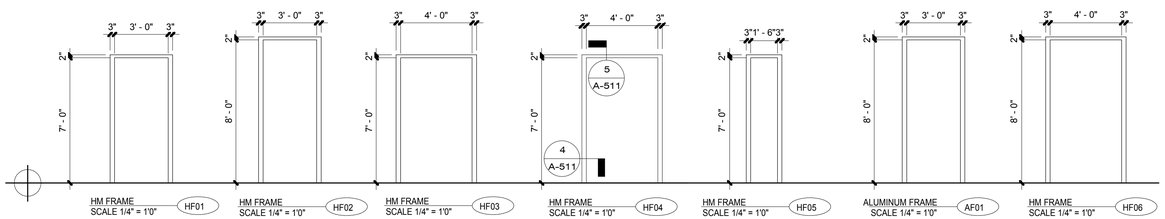




DOOR TYPES
1/4" = 1'-0"



FRAME TYPES
1/4" = 1'-0"

GENERAL DOOR NOTES

ALL DOORS TO BE PAINTED IN SEMI-GLOSS FINISH SAME COLOR AS ADJACENT WALL UNLESS OTHERWISE NOTED.

Door Schedule

Door Number	Room Name	Level	Height	Width	Pair	Door Type	Door Finish	Frame Type	Frame Finish	Fire Rating	STC Rating	HW Group	Comments
101A	VESTIBULE	LEVEL 01 F.F.	7' - 8"	6' - 0"	Yes	AD01	-	AF	AS25/A601			REFER TO SPEC	DA.02
101B	LOBBY	LEVEL 01 F.F.	7' - 8"	6' - 0"	Yes	AD01	-	AF	AS26/A601			REFER TO SPEC	DA.02
101C	VESTIBULE	LEVEL 01 F.F.	7' - 0"	1' - 6"		WWAD2	PT	HF5	PT			REFER TO SPEC	
102A	VESTIBULE	LEVEL 01 F.F.	7' - 8"	6' - 0"	Yes	AD01	-	AF	AS20/A601			REFER TO SPEC	DA.02
102B	LOBBY	LEVEL 01 F.F.	7' - 8"	6' - 0"	Yes	AD01	-	AF	AS23/A601			REFER TO SPEC	
102E	LOBBY	LEVEL 01 F.F.	5' - 0"	3' - 9"	Yes	PD02	-					REFER TO SPEC	
113	MENS RR	LEVEL 01 F.F.	7' - 0"	3' - 0"		WD01	PT	HF01	PT			REFER TO SPEC	
114	WOMENS RR	LEVEL 01 F.F.	7' - 0"	3' - 0"		WD01	PT	HF01	PT			REFER TO SPEC	
115	FAMILY RR	LEVEL 01 F.F.	7' - 0"	3' - 0"		WD01	PT	HF01	PT			REFER TO SPEC	
116	CUSTODIAL	LEVEL 01 F.F.	7' - 0"	3' - 0"		WD01	PT	HF01	PT			REFER TO SPEC	
120	SORTING	LEVEL 01 F.F.	7' - 0"	4' - 0"		WD04	PT	HF03	PT			REFER TO SPEC	
121	STAIR B	LEVEL 01 F.F.	8' - 0"	4' - 0"		HD03	PT	HF06	PT	1HR		REFER TO SPEC	
122	STORAGE	LEVEL 01 F.F.	8' - 0"	4' - 0"		HD03	PT	HF06	PT	1HR		REFER TO SPEC	
130A	CLP	LEVEL 01 F.F.	9' - 0"	34' - 4"		OPERABLE PARTITION	RE: SPEC	4/A522	RE: SPEC			REFER TO SPEC	
130B	CLP	LEVEL 01 F.F.	10' - 0"	5' - 5"		PPD	RE: SPEC	2/A522	RE: SPEC			REFER TO SPEC	
130C	CLP	LEVEL 01 F.F.	7' - 0"	3' - 0"		HD01	PT	HF01	PT			REFER TO SPEC	
130D	CLP	LEVEL 01 F.F.	7' - 0"	3' - 0"		HD01	PT	HF01	PT			REFER TO SPEC	
130H	CLP	LEVEL 01 F.F.	7' - 0"	3' - 0"		WD01	PT	HF01	PT			REFER TO SPEC	
130J	CLP	LEVEL 01 F.F.	7' - 0"	3' - 0"		WD01	PT	HF01	PT			REFER TO SPEC	
130K	CLP	LEVEL 01 F.F.	8' - 0"	15' - 0"		ROLL UP	-	AF	ANNOD			REFER TO SPEC	
131	STORAGE	LEVEL 01 F.F.	7' - 0"	3' - 0"		WD01	PT	HF01	PT			REFER TO SPEC	
133A	ARTS/CRAFTS	LEVEL 01 F.F.	9' - 0"	11' - 0"		GD03	-	NA	ANNOD			REFER TO SPEC	
133B	ARTS/CRAFTS	LEVEL 01 F.F.	9' - 0"	11' - 0"		GD03	-	NA	ANNOD			REFER TO SPEC	
134	AV STORAGE	LEVEL 01 F.F.	7' - 0"	3' - 0"		WD01	PT	HF01	PT			REFER TO SPEC	
135	STORAGE	LEVEL 01 F.F.	7' - 0"	4' - 0"		WD02	PT	HF04	PT			REFER TO SPEC	
141	CHILDRENS COLLECTION	LEVEL 01 F.F.	7' - 0"	3' - 0"		AD03	-	HF01	ANNOD			REFER TO SPEC	
152	LANDSCAPE STORAGE	LEVEL 01 F.F.	8' - 0"	4' - 0"		HD04	PT	HF06	PT			REFER TO SPEC	
153	MECH/ELEC	LEVEL 01 F.F.	8' - 0"	4' - 0"		HD03	PT	HF06	PT	1HR		REFER TO SPEC	
153B	MECH/ELEC	LEVEL 01 F.F.	7' - 0"	3' - 0"		HD01.	PT	HF01	PT	1HR		REFER TO SPEC	
154	ELEV MACH	LEVEL 01 F.F.	7' - 0"	3' - 0"		HD01.	PT	HF01	PT	1HR		REFER TO SPEC	
155A	TRASH ENC	LEVEL 01 F.F.	6' - 0"	6' - 0"		TD01	-	-	-			REFER TO SPEC	
155B	TRASH ENC	LEVEL 01 F.F.	6' - 0"	6' - 0"		TD01	-	-	-			REFER TO SPEC	
210	OUTDOOR READING	LEVEL 02 F.F.	8' - 0"	3' - 0"		AD03	-	HF02	ANNOD			REFER TO SPEC	
210A	OUTDOOR READING	LEVEL 02 F.F.	8' - 0"	3' - 0"		AD03	-	HF02	ANNOD			REFER TO SPEC	
220	MEETING RM	LEVEL 02 F.F.	7' - 0"	3' - 0"		AD02	-	HF01	ANNOD			REFER TO SPEC	
221	STAIR	LEVEL 02 F.F.	7' - 0"	3' - 0"		WD01.	PT	HF01	PT	1HR		REFER TO SPEC	
221A	STAIR	LEVEL 02 F.F.	7' - 0"	3' - 0"		WD01.	PT	HF01	PT	1HR		REFER TO SPEC	
222	STUDY	LEVEL 02 F.F.	7' - 0"	3' - 4"		GD02	-	TRACK	ANNOD			REFER TO SPEC	
223	STUDY	LEVEL 02 F.F.	7' - 0"	3' - 4"		GD02	-	TRACK	ANNOD			REFER TO SPEC	
224	STUDY	LEVEL 02 F.F.	7' - 0"	3' - 4"		GD02	-	TRACK	ANNOD			REFER TO SPEC	
225	STUDY	LEVEL 02 F.F.	7' - 0"	3' - 4"		GD02	-	TRACK	ANNOD			REFER TO SPEC	
226	STUDY	LEVEL 02 F.F.	7' - 0"	3' - 4"		GD02	-	TRACK	ANNOD			REFER TO SPEC	
228	STUDIO	LEVEL 02 F.F.	7' - 0"	3' - 0"		WD01	PT	HF01	PT			REFER TO SPEC	ACCOUSTICAL DOOR
233	COLLABORATIVE	LEVEL 02 F.F.	3' - 0"	2' - 0"		WWAD1	PT	HF07				REFER TO SPEC	
234	LOBBY	LEVEL 02 F.F.	5' - 0"	3' - 9"	Yes	PD02	-					REFER TO SPEC	
244	RESTROOM	LEVEL 02 F.F.	7' - 0"	3' - 0"		WD01	PT	HF01	PT			REFER TO SPEC	
246	STAFF RR	LEVEL 02 F.F.	7' - 0"	3' - 0"		WD01	PT	HF01	PT			REFER TO SPEC	
246A	STAFF RR	LEVEL 02 F.F.	7' - 0"	2' - 0"		WD03	PT	HM	PT			REFER TO SPEC	
251	LOCKERS	LEVEL 02 F.F.	7' - 0"	3' - 0"		WD01	PT	HF01	PT			REFER TO SPEC	
252	CONFERENCE	LEVEL 02 F.F.	7' - 0"	3' - 0"		WD01	PT	HF01	PT			REFER TO SPEC	
254	SHARED OFFICE	LEVEL 02 F.F.	7' - 0"	3' - 0"		WD01	PT	HF01	PT			REFER TO SPEC	
255	STAFF WORKROOM	LEVEL 02 F.F.	7' - 0"	3' - 0"		WD01	PT	HF01	PT			REFER TO SPEC	
257	IT	LEVEL 02 F.F.	7' - 0"	3' - 0"		WD01	PT	HF01	PT			REFER TO SPEC	
261	JAN	LEVEL 02 F.F.	7' - 0"	3' - 0"		WD01	PT	HF01	PT			REFER TO SPEC	
301	ROOF ACCESS	ROOF	4' - 0"	3' - 6"		WWAD3	PT	HM	PT			REFER TO SPEC	

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DENVER, COLORADO 80204

sDC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02089

ISSUE DATE
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DOOR SCHEDULE

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Finish Schedule											
Number	Name	Area	Level	Floor Finish	Base Finish	North Wall	East Wall	South Wall	West Wall	Ceiling Finish	Comments
100	LOBBY	998 SF	LEVEL 01 F.F.	CPT1, 2, 3, 8	RB1	N/A	PT1	PT1, PLAM2, 3	PT1	N/A	REFER TO A4.10, FINISH PLAN, AND INTERIOR ELEVATIONS
101	VESTIBULE	143 SF	LEVEL 01 F.F.	WM1	RB1	PT1	N/A	PT1	N/A	N/A	
102	VESTIBULE	150 SF	LEVEL 01 F.F.	WM1	RB1	PT1	N/A	PT1	N/A	N/A	
103	STACKS	1898 SF	LEVEL 01 F.F.	CPT1, 2, 3, 8	RB1	PT1	PT1	N/A	PT1	N/A	
104	WAITING	183 SF	LEVEL 01 F.F.	CPT1, 2, 3, 8	RB1	PT1	N/A	PT1	PT1	N/A	
113	WOMENS	120 SF	LEVEL 01 F.F.	CT5	CT8, 9, 10, 11, 12, 13	CT5	PT11	PT11	PT11, CT5	PT12	REFER TO INTERIOR ELEVATIONS
114	MENS	148 SF	LEVEL 01 F.F.	CT5	CT8, 9, 10, 11, 12, 13	CT5	PT11, CT5	PT11	PT11	PT12	REFER TO INTERIOR ELEVATIONS
115	FAMILY RESTROOM	81 SF	LEVEL 01 F.F.	CT2, 3, 4	CT8, 9, 10, 11, 12, 13	PT11	CT1, 2, 3, 4	CT1, CT2, PT11	PT11	PT12	REFER TO INTERIOR ELEVATIONS
116	CUSTODIAL	16 SF	LEVEL 01 F.F.	BBT2	RB1	PT1, FRP	PT1, FRP	PT1, FRP	PT1, FRP	PT12	REFER TO INTERIOR ELEVATIONS
120	SORTING	1461 SF	LEVEL 01 F.F.	RR1	RB1	PT1	PT1	PT1	PT1	ACT	
121	STAIR B	287 SF	LEVEL 01 F.F.	SC	RB1	PT1	PT1	PT1	PT1	N/A	
122	STORAGE	302 SF	LEVEL 01 F.F.	RR1	RB1	PT8	PT8	PT8	PT8	ACT	
130	CLP	1347 SF	LEVEL 01 F.F.	CPT3	RB1	PT1/ AP2 30%	PT1	PT1/AP2 30%	PT1/ AP2 30%	AP2 25%	REFER TO INTERIOR ELEVATIONS, AP2 = ADD ALT 10
131	STORAGE	52 SF	LEVEL 01 F.F.	CPT3	RB1	PT1	PT1	PT1	PT1	N/A	
133	ARTS & CRAFTS	227 SF	LEVEL 01 F.F.	RR6	RB1	PT1	PT7	PT1	PT7	ACT	
134	AV STORAGE	41 SF	LEVEL 01 F.F.	CPT 3	RB1	PT1	PT1	PT1	PT1	N/A	
135	CHAIR & TABLE STORAGE	239 SF	LEVEL 01 F.F.	CPT 3	RB1	PT1	PT1	PT1	PT1	N/A	
139	CIRCULATION	1140 SF	LEVEL 01 F.F.	CPT1, LF2	RB1, RB2	PT1	PT1, 3, 7	N/A	PT1, PT3	EXPOSED STRUCTURE, PT18 ON GRILL	REFER TO INTERIOR ELEVATIONS AND FINISH PLAN
140	CHILDREN'S ENTRY	296 SF	LEVEL 01 F.F.	CPT1	RB1	N/A	PT1, 3, 7	N/A	PT1, PT7	N/A	REFER FINISH PLAN AND INTERIOR ELEVATIONS
141	CHILDREN'S COLLECTION	1968 SF	LEVEL 01 F.F.	CPT1, 3, 5, 6	RB1	PT1, PT7	PT1, PT7	PT1, PT7	PT1	ACT	REFER TO A4.11, FINISH PLAN, AND INTERIOR ELEVATIONS
144	STORY TIME	161 SF	LEVEL 01 F.F.	CPT1, 3, 5, 6	RB1	N/A	N/A	PT1, 7, 8, 9, AP3, AP4	PT1, 7, 8, 9, AP3, AP4	PT12	REFER TO A4.11, FINISH PLAN, AND INTERIOR ELEVATIONS
145	CHILDREN'S TECHNOLOGY	213 SF	LEVEL 01 F.F.	CPT1, 3, 5, 6	RB1	PT1	N/A	N/A	PT1	ACT	REFER TO A4.11, FINISH PLAN, AND INTERIOR ELEVATIONS
152	LANDSCAPE STORAGE	106 SF	LEVEL 01 F.F.	SC	RB1	PT1	PT1	PT1	PT1	N/A	
153	MECH/ ELEC	456 SF	LEVEL 01 F.F.	SC	RB1	PT1	PT1	PT1	PT1	N/A	
154	ELEV MECH	47 SF	LEVEL 01 F.F.	SC	RB1	PT1	PT1	PT1	PT1	N/A	
201	OPEN COMPUTING	2069 SF	LEVEL 02 F.F.	CPT1, 2	RB1	PT1, PT10, PT13	PT1	PT1, PLAM 2, POLYCARB	PT1	N/A	REFER TO INTERIOR ELEVATIONS AND FINISH PLAN
203	AUDIO BOOKS/CD'S	476 SF	LEVEL 02 F.F.	CPT2	RB1	PT1, PT10	N/A	PT1, PT10	PT1	N/A	REFER TO INTERIOR ELEVATIONS AND FINISH PLAN
210	OUTDOOR READING ROOM	824 SF	LEVEL 02 F.F.	N/A	N/A					N/A	
220	MEETING ROOM	313 SF	LEVEL 02 F.F.	CPT1, 2	RB1	PT1, PT14	PT1, PT14	PT1, AP1	PT1	MP1 25%	REFER TO INTERIOR ELEVATIONS AND FINISH PLAN
221	STAIR B	292 SF	LEVEL 02 F.F.	BBT1	RB1	PT1	PT1	PT1	PT1	PT12	RAILING, RISER, STRINGER, UNDERSIDE OF TREAD TO BE PT10
222	STUDY	69 SF	LEVEL 02 F.F.	CPT3	RB1	PT1	PT10	PT1	PT1	PT12	
223	STUDY	71 SF	LEVEL 02 F.F.	CPT3	RB1	PT1	PT10	PT1	PT1	PT12	
224	STUDY	71 SF	LEVEL 02 F.F.	CPT3	RB1	PT1	PT10	PT1	PT1	PT12	
225	STUDY	71 SF	LEVEL 02 F.F.	CPT3	RB1	PT1	PT10	PT1	PT1	PT12	
226	STUDY	68 SF	LEVEL 02 F.F.	CPT3	RB1	PT1, PT10, PT13	PT10	PT1	PT1	PT12	REFER TO INTERIOR ELEVATIONS AND FINISH PLAN
227	MEETING SPACE	1805 SF	LEVEL 02 F.F.	CPT2, 3, 7	RB1	PT1	PT1	N/A	PT1	N/A	REFER TO A4.12, FINISH PLAN, AND INTERIOR ELEVATIONS
228	STUDIO	195 SF	LEVEL 02 F.F.	CPT3	RB1	PT7	PT7	PT7	PT7	ACT	Add Alt. 02
230	ADULT FICTION	1327 SF	LEVEL 02 F.F.	CPT2, 3, 7	RB1	N/A	PT1	N/A	PT1	N/A	REFER TO A4.12, FINISH PLAN, AND INTERIOR ELEVATIONS
231	ADULT NONFICTION AND PERIODICALS	1713 SF	LEVEL 02 F.F.	CPT2, 3, 7	RB1	N/A	PT1, PT9	PT1, PT7	PT1, PT7	N/A	REFER TO A4.12, FINISH PLAN, AND INTERIOR ELEVATIONS
240	COLLABORATIVE	533 SF	LEVEL 02 F.F.	CPT2, CPT4	RB1	PT1, PT9	PT1	PT9	PT1, PT2	N/A	REFER TO INTERIOR ELEVATIONS AND FINISH PLAN
244	RESTROOM	62 SF	LEVEL 02 F.F.	CT3	CT3	PT11	PT11	CT3	PT11	PT12	REFER TO INTERIOR ELEVATIONS
246	STAFF RR	69 SF	LEVEL 02 F.F.	CT3	CT3	PT11, CT3	PT11, CT3	CT3	PT11, CT3	PT12	REFER TO INTERIOR ELEVATIONS
251	LOCKER	317 SF	LEVEL 02 F.F.	BBT1	RB1	PT1	PT1	PT1	PT1	ACT	
252	CONFERENCE	100 SF	LEVEL 02 F.F.	CPT3	RB1	PT1	PT1	PT1	PT1	ACT	
253	STAFF LOUNGE	313 SF	LEVEL 02 F.F.	CPT3, BBT1	RB1	PT1	PT1, PLAM14 11	PT1	PT1	ACT	REFER TO INTERIOR ELEVATIONS AND FINISH PLAN
254	SHARED OFFICE	176 SF	LEVEL 02 F.F.	CPT3	RB1	PT1	PT1	PT1	PT1	ACT	
255	STAFF WORKROOM	406 SF	LEVEL 02 F.F.	CPT3	RB1	PT1	PT1	PT1	PT1	ACT	
256	STORAGE	80 SF	LEVEL 02 F.F.	BBT1	RB1	PT1	PT1	PT1	PT1	ACT	
257	IT	134 SF	LEVEL 02 F.F.	SR1	RB1	PT1	PT1	PT1	PT1	PT12	
261	JANITOR	47 SF	LEVEL 02 F.F.	BBT1	RB1	PT1, FRP	PT1, FRP	PT1, FRP	PT1, FRP	PT12	

GENERAL NOTES - FINISHES

1. ALL INTERIOR WALL FINISHES TO BE PT1 UNLESS OTHERWISE NOTED.

2. ALL INTERIOR GWB CEILING FINISH TO BE PT12 UNLESS OTHERWISE NOTED.

3. ALL SOFFITS TO BE PAINTED SAME COLOR AS WALL BELOW (FACE AND UNDERSIDE).

4. WHERE MULTIPLE FLOOR FINISHES ARE INDICATED FOR ONE SPACE, REFER TO SHEET A410.

5. ALL EXPOSED CONCRETE FLOORS SHALL RECEIVE SEALER.

6. EXPOSED ACOUSTICAL DECK CEILINGS ARE FACTORY FINISHED.

7. NOT USED

8. ALL STRUCTURE TO BE PT11 UNLESS OTHERWISE NOTED.

9. WHERE MULTIPLE WALL FINISHES ARE INDICATED, REFER TO CORRESPONDING ELEVATIONS.

10. ALL DOORS, DOOR TRIM, CHAIR RAILS, ETC. TO BE PAINTED IN SEMI GLOSS FINISH IN SAME COLOR AS ADJACENT WALL.

11. PLEASE ALLOW RUBBER TILE IN ELEVATOR TO OFF-GAS BY LEAVING ELEVATOR DOOR OPEN DURING CONSTRUCTION AS MUCH AS POSSIBLE.

12. REFER TO PROJECT MANUAL FOR SCHEDULE OF FINISHES.

13. TILE IN RESTROOMS TO SLOPE AT FLOOR DRAINS.

14. FLOORING TRANSITIONS TO BE CENTERED AT DOOR UNLESS OTHERWISE NOTED.

LEGEND - FINISHES

- ***BBT*** - BIO-BASED TILE
- ***CG*** - CORNER GUARD - STAINLESS STEEL
- ***CPT*** - CARPET TILE
- ***CT*** - CERAMIC TILE
- ***GL*** - GLASS
- ***LF*** - LINOLEUM
- ***PC*** - POLISHED CONCRETE
- ***RB*** - RUBBER BASE
- ***RR*** - RECYCLED RUBBER
- ***SC*** - SEALED CONCRETE
- ***SR*** - STATIC CONTROL RESILIENT FLOORING
- ***WM*** - WALK OFF MAT
- ***WD*** - WOOD DECKING

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PROJECT:
WEST DENVER BRANCH LIBRARY
1498 NORTH IRVING STREET
DENVER, COLORADO 80204

#DC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02089

ISSUE DATE
01-12-2012

PHASE
100% CD

FINISH SCHEDULE

A-603

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1/13/2012 2:59:33 AM

SIGN TYPE SCHEDULE

No.	COPY {DESRIPTION}
1.00	ADA PICTORIAL + TACTILE + BRAILLE
1.01	elevator
1.02	elevator
1.03	men
1.04	women
1.05	family
1.06	stair
1.07	stair
1.08	stair
1.09	unisex
1.10	unisex
1.11	elevator
1.12	stair
2.00	ADA TACTILE + BRAILLE
2.01	116 custodial
2.02	120 sorting
2.03	130 community room
2.04	130 community room
2.05	131 storage
2.06	133 arts and crafts
2.07	133 arts and crafts
2.08	135 chair/table storage
2.09	152 landscape
2.10	153 mechanical
2.11	154 elevator machanical
2.12	210 outdoor reading room
2.13	maximum occupancy

No.	COPY {DESRIPTION}
2.14	210 outdoor reading room
2.15	maximum occupancy
2.16	220 meeting room
2.17	maximum occupancy
2.18	222 study room
2.19	maximum occupancy
2.20	223 study room
2.21	maximum occupancy
2.22	224 study room
2.23	maximum occupancy
2.24	225 study room
2.25	maximum occupancy
2.26	226 study room
2.27	maximum occupancy
2.28	228 studio
2.29	251 staff
2.30	252 conference
2.31	254 shared office
2.32	255 staff workroom
2.33	261 janitor
2.34	257 IT
2.35	maximum occupancy
2.36	maximum occupancy
3.00	ADA TACTILE + BRAILLE
3.01	in case of fire use stairs
3.02	in case of fire use stairs
3.03	in case of fire use stairs

No.	COPY {DESRIPTION}
4.00	PLOT CUT VINYL
4.01	returns
4.02	elevator
4.03	restrooms
4.04	community room
4.05	family restrooms
4.06	holds
4.07	movies
4.08	check it out
4.09	elevator
4.10	music + audio books
4.11	print + copy
4.12	teens
4.13	teens
4.14	fiction
4.15	fiction
4.16	non-fiction
4.17	non-fiction
4.18	magazines
4.19	studio
4.20	restroom
4.21	staff
4.22	meeting room

No.	COPY {DESRIPTION}
5.00	CUSTOM VINYL
5.01	{elevator directory}
5.02	{elevator directory}
5.03	{stair directory}
5.04	{library hours}
5.05	{library hours}
5.06	{DLP + logo + branch name}
5.07	{children's wall graphic}
5.08	{sustainable explanation}
5.09	{sustainable information} *
5.10	A
5.11	B
5.12	A
5.13	B
5.14	C
5.15	D
5.16	E
5.17	returns {exterior}
5.18	{soffit quotes}
5.19	{wall map}
5.20	{no smoking} **
5.21	{no smoking} **
5.22	{egress map}
5.23	{egress map}

No.	COPY {DESRIPTION}
6-10	CUSTOM DIMENSIONAL
6.01	library {flat cut metal letters}
7.01	library {iLight letters}
8.01	library {cast in concrete}
9.01	A {custom dry erase board}
9.02	B {custom dry erase board}
9.03	C {custom dry erase board}
9.04	D {custom dry erase board}
9.05	E {custom dry erase board}
10.01	{no smoking line template}
	NOT IN CONTRACT
10.02	{donor names in concrete}
11	{end range vinyl}

* LOCATION TO BE DETERMINED.

** REFERE TO SITE FURNISHING PLAN FOR LOCATIONS. SHOWN AS SINGLE LINE ON LANDSCAPE DRAWINGS.

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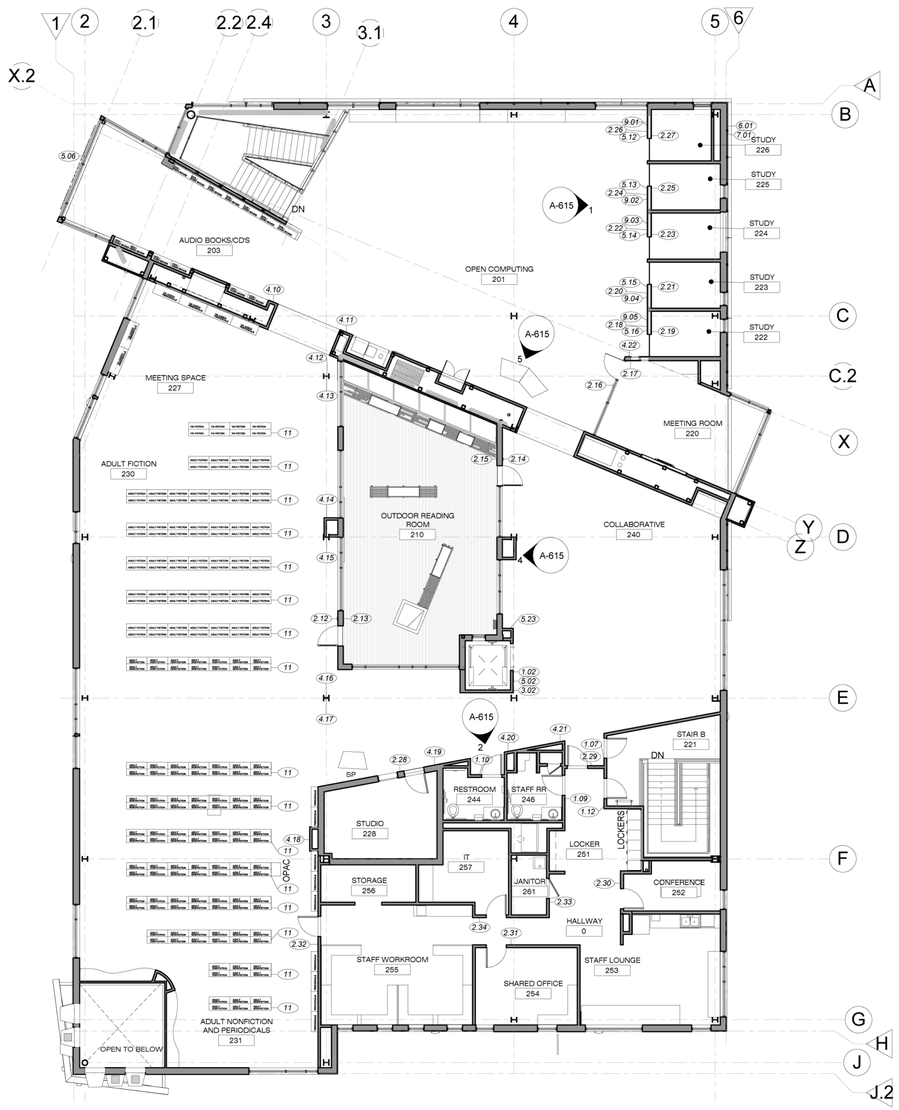
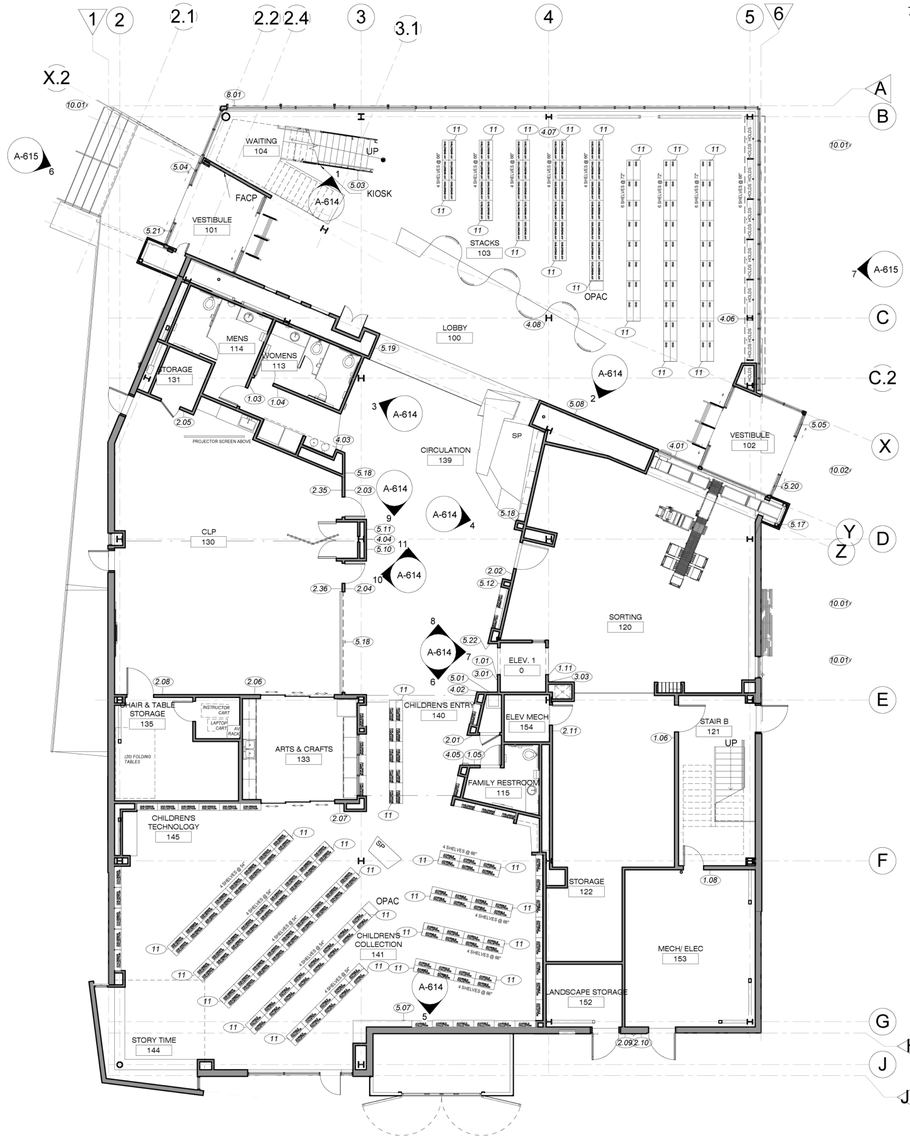
6. REFERE TO AS001 FOR SITE GRAPHICS NOT SHOWN HERE
7. ALL FURNITURE AND SHELVING ARE N.I.C. SHOWN FOR INFORMAION ONLY



2 LEVEL 02 - GRAPHICS
A-610 3/32" = 1'-0"



1 LEVEL 1 REFLECTED CEILING PLAN -
A-610 3/32" = 1'-0"

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1498 NORTH IRVING STREET
DENVER, COLORADO 80204

EXPIRES: 09/30/2012
01/12/12

eDC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02089

ISSUE DATE 01-12-2012
PHASE 100% CD

GRAPHICS

A-610

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RESTROOM

4.00 VINYL WAYFINDING, TYPICAL
1-1/2"= 1'-0" (FONT SIZE: 6" LETTERS)

I am a sustainable building when you see text like this

how I am sustainable. In general I utilize less water and energy then other. I save money. It will tell you a story about buildings.

and natural resources.

FOLLOW MEII

5.08 SUSTAINABLE EXPLANATION
3/4"=1' (NOMINAL WALL AREA: 17' W X 3'5" H)

FINAL ART TO FOLLOW

LIBRARY HOURS

Monday — Closed
Tuesday — Noon -8 p.m.
Wednesday — Noon - 8p.m.
Thursday — Closed
Friday — 10 a.m. - 6 p.m.
Saturday — 9 a.m. - 5 p.m.
Sunday — Closed

5.04 LIBRARY HOURS
3"= 1'-0" (NOMINAL WALL AREA: 24" W X 24" H)

FINAL ART TO FOLLOW

RETURNS

5.17 RETURNS
1/4" = 1'-0" (NOMINAL AREA: 1'-11" W X 11'-9 1/2" H)

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- MEETING ROOM
- STUDY ROOMS
- AUDIO BOOKS + CD
- TEENS
- MAGAZINES
- STUDIO
- COMPUTERS
- FICTION
- NON-FICTION

2

1

- COMMUNITY ROOM
- CHILDREN'S
- HOLDS
- MAGAZINES

FINAL ART TO FOLLOW

5.01 ELEVATOR DIRECTORY
1-1/2"= 1'-0" (NOMINAL WALL AREA: 31" W X 40" H)

DENVER PUBLIC LIBRARY
WEST DENVER BRANCH LIBRARY

5.05 DPL LOGO + BRANCH NAME
1"= 1'-0" (NOMINAL WALL AREA: 10'6" W X 2'6" H)

FINAL ART TO FOLLOW

I AM A MOTION SENSOR LIGHT. I SAVE ONE BILLION WATTS OF ELECTRICITY A YEAR — WHICH IS ENOUGH TO POWER A SMALL TOWN FOR THREE DAYS OR ALLOW YOU TO WATCH NEW JERSEY BOARDWALKS FOR 7 DAYS STRAIGHT WITOUT BLINKING. — I TURN ON AND OFF EVERY TIME YOU ENTER OR LEAVE THE ROOM.

5.09 SUSTAINABLE INFORMATION :: 20 LOCATIONS
6"= 1'-0" (FONT SIZE: 27pt LETTERS) (INSTALLED AROUND LIGHT SWITCH AND OTHER ELEMENTS)

FINAL ART TO FOLLOW

"As you see yourself, I once saw myself; as you see me now, you will be seen." — ANONYMOUS

5.18 SOFFIT QOTES :: 50 LOCATIONS
1 1/2" = 1'-0" (NOMINAL WALL AREA: 3'5" W X 7" H [X 50 QUANTITY])

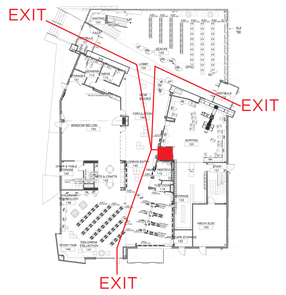
FINAL ART TO FOLLOW

My Head Is Full Of Colors
Story by Catherine Friend
Illustrations by Kiki Suarez

5.07 CHILDREN'S WALL GRAPHIC
1"= 1'-0" (NOMINAL WALL AREA: 4' W X 5'6" H)

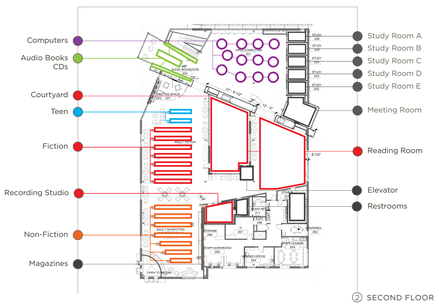
FINAL ART TO FOLLOW

EMERGENCY EXIT MAP

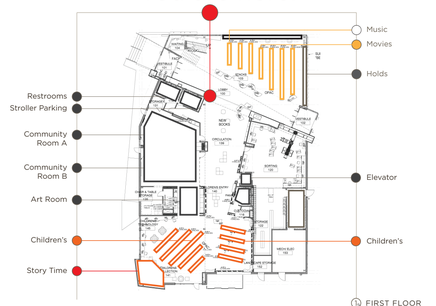


EMERGENCY EXIT MAP

5.22 EGRESS MAPS
3"= 1'-0" (NOMINAL WALL AREA: 15.5" W X 18.25" H)



WELCOME
You are here!



5.19 WALL MAP
3"= 1'-0" (NOMINAL WALL AREA: 2' W X 3'-3" H)

FINAL ART TO FOLLOW

STUDY ROOMS
MEETING ROOM
TEENS
MAGAZINES
STUDIO
COMPUTERS
FICTION
NON-FICTION

5.03 STAIR DIRECTORY
3/4"= 1'-0" (NOMINAL WALL AREA: 117.5" W X 55" H | FONT SIZE = 4" LETTERS)

NO SMOKING WITHIN 25 FEET OF ENTRANCE

5.20-.21 VINYL NO SMOKING SIGN
3"= 1'-0" (NOMINAL AREA: 15" W X 3" H)

A

5.10-5.16 ROOM LETTERS
3/4"= 1'-0" (NOMINAL WALL AREA: 66" W X 66.5" H)

GRAPHICS - DETAILS

A-611

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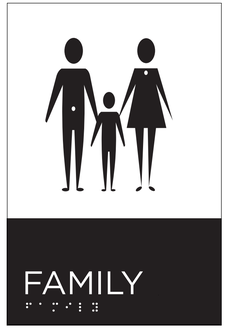


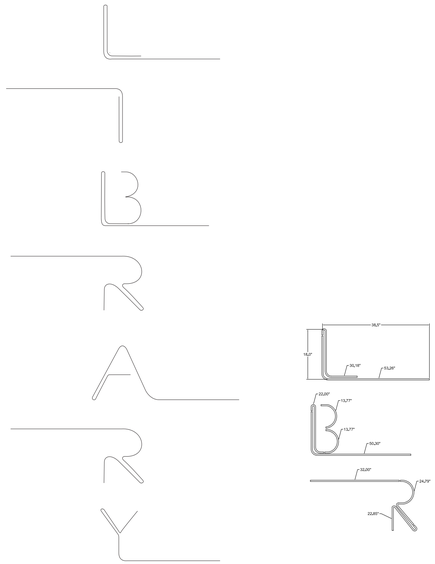
1.00 ADA PICTORAL + TACTILE + BRAILLE
6"= 1'-0" (6" W X 9" H)

2.00 ADA TACTILE + BRAILLE
6"= 1'-0" (9" W X 3" H)

2.00 ADA TACTILE + BRAILLE
6"= 1'-0" (6" W X 9" H)

3.00 ADA TACTILE + BRAILLE
6"= 1'-0" (6" W X 4" H)

6.01 FLAT CUT METAL LETTERS (EXTERIOR)
1/2"= 1'-0" (FONT SIZE: 18" LETTERS)



7.01 iLIGHT LED LETTERS (EXTERIOR)
1/2"= 1'-0" (FONT SIZE: 18" LETTERS)

FINAL ART TO FOLLOW

9.01-9.05 DRY ERASE RESERVE BORAD
3"= 1'-0" (24" W X 24" H)

10.01 NO SMOKING LINE (SPRAY PAINT TEMPLATE)
1"= 1'-0" (NOMINAL AREA: 47.3" W X 46" H)

11 + 12.00 END RANGE SIGNAGE — VINYL AND INSERTS
VINYL= 6"W X 48"H :: INSERT= 6"W X 12"H :: NOT IN CONTRACT

10.02 SAND BLASTED DONOR NAMES
NOT IN CONTRACT

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01.12.12

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GRAPHICS - DETAILS

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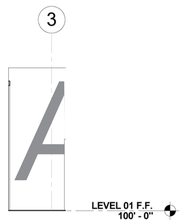
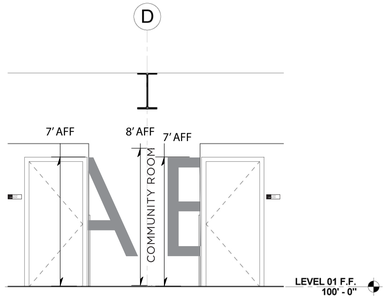
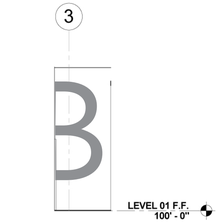


11 GRAPHICS - CIRCULATION NORTH
A-614 1/4" = 1'-0"

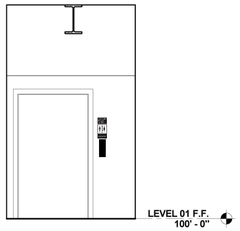


10 GRAPHICS - CIRCULATION, COMMUNITY ROOM WEST
A-614 1/4" = 1'-0"

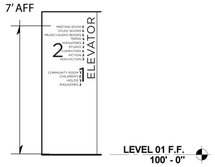


9 GRAPHICS - CIRCULATION SOUTH
A-614 1/4" = 1'-0"

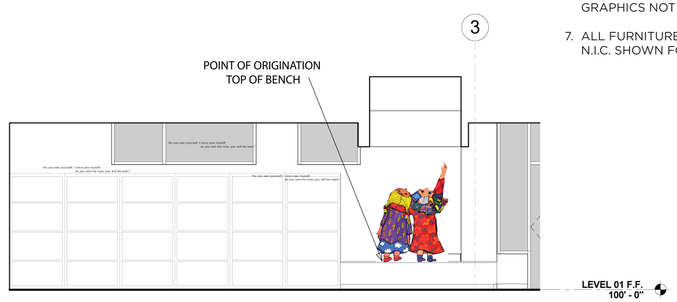
8 GRAPHICS - ELEVATOR 1ST FLOOR NORTH
A-614 1/4" = 1'-0"



7 GRAPHICS - ELEVATOR 1ST FLOOR EAST
A-614 1/4" = 1'-0"



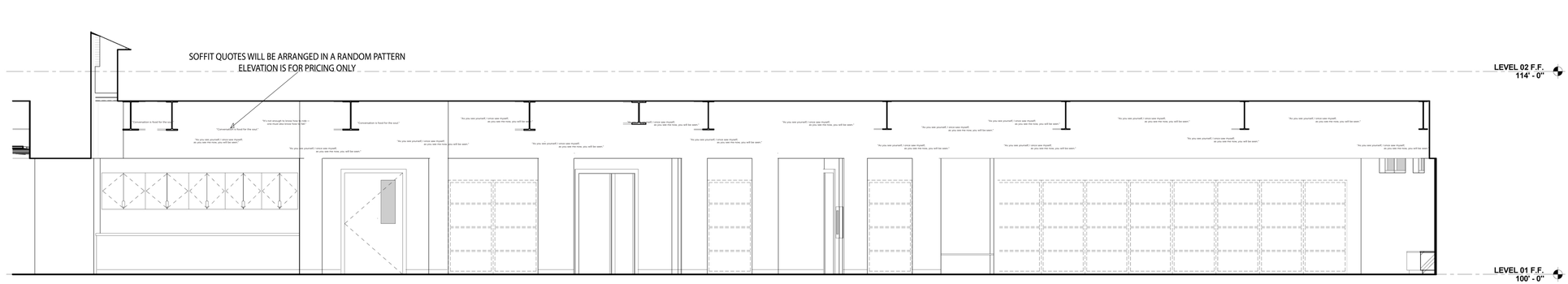
6 GRAPHICS - ELEVATOR FIRST FLOOR SOUTH
A-614 1/4" = 1'-0"



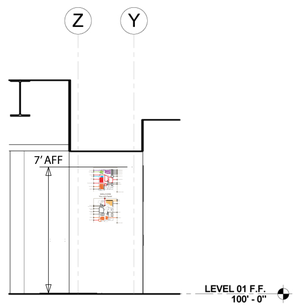
5 GRAPHICS - CHILDREN'S AREA - SOUTH
A-614 1/4" = 1'-0"

GENERAL NOTES:

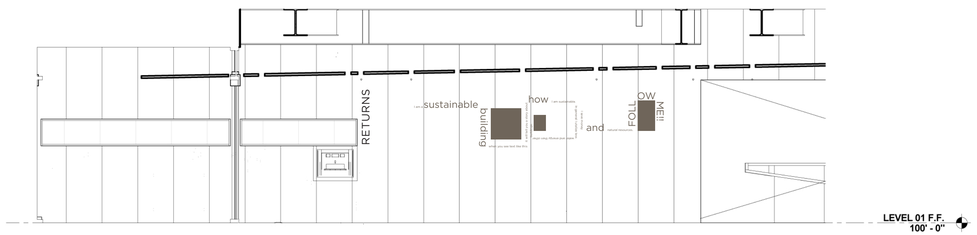
1. MOUNT ALL SIGNS AS INDICATED ON ELEVATION 4/A-615 OR PER DESIGNER INSTRUCTIONS
2. ADD OPAQUE ACRYLIC BACKERS TO ALL SIGNS MOUNTED ON GLASS
3. REFERENCE A-611--613 FOR SPECIFIC SIZES AND ART
4. REFERENCE SPECIFICATION SECTION 101400 – SIGNAGE FOR MATERIALS
5. BACKGROUND FOR FIRE EXIT FLOOR PLAN PROVIDED BY ARCHITECT UPON REQUEST
6. REFERE TO AS001 FOR SITE GRAPHICS NOT SHOWN HERE
7. ALL FURNITURE AND SHELVING ARE N.I.C. SHOWN FOR INFORMAION ONLY



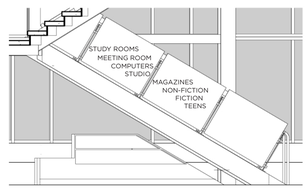
4 GRAPHICS - CIRCULATION EAST
A-614 1/4" = 1'-0"



3 GRAPHICS - WONDER WALL WEST
A-614 1/4" = 1'-0"



2 GRAPHICS - FIRST FLOOR WONDER WALL SOUTH
A-614 1/4" = 1'-0"



1 GRAPHICS - INT ELEVATION KIOSK
A-614 1/4" = 1'-0"

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GRAPHICS - ELEVATIONS

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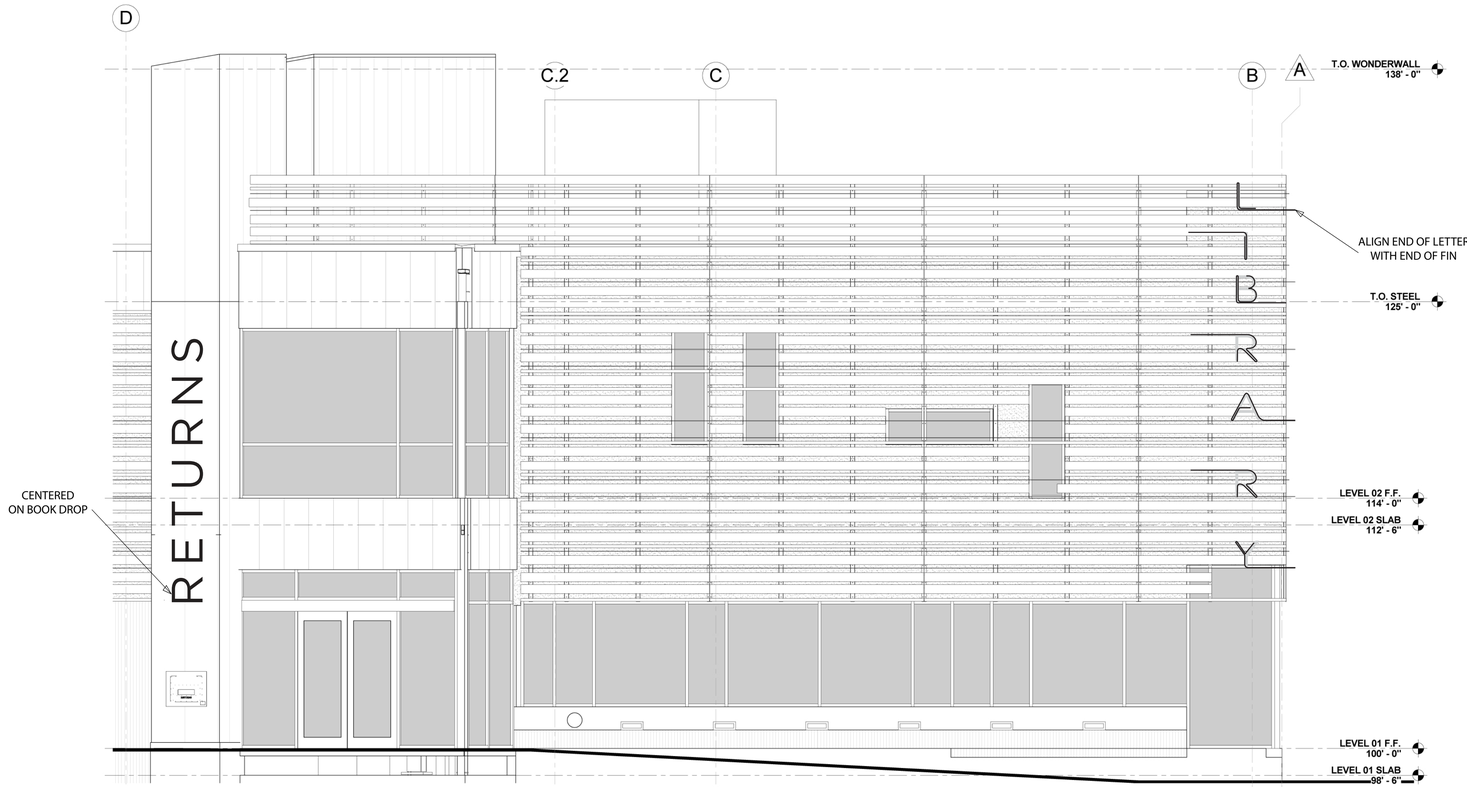
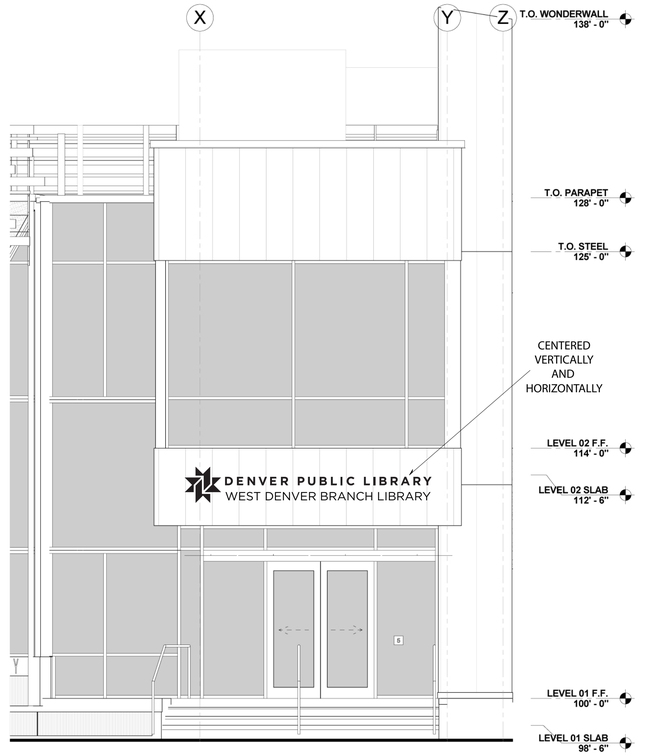
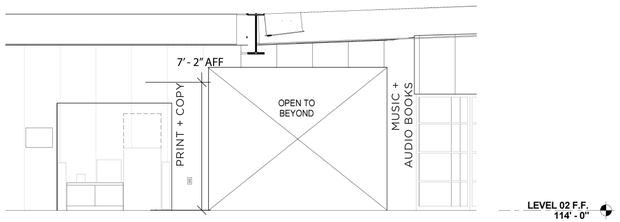


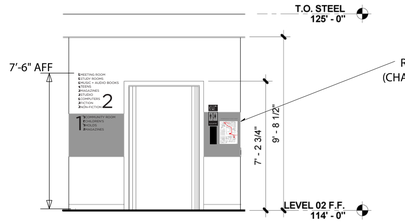
7 GRAPHICS - ENLARGED ELEVATION EAST
A-615 1/4" = 1'-0"



6 GRAPHICS - NW CORNER ELEVATION
A-615 1/4" = 1'-0"

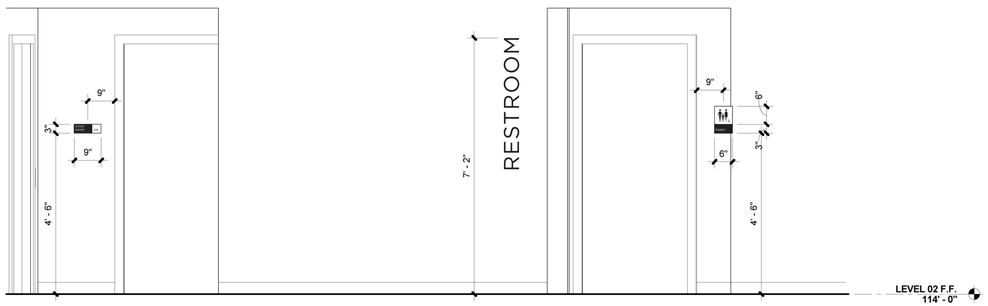


5 GRAPHICS - SECOND FLOOR WONDER WALL SOUTH
A-615 1/4" = 1'-0"



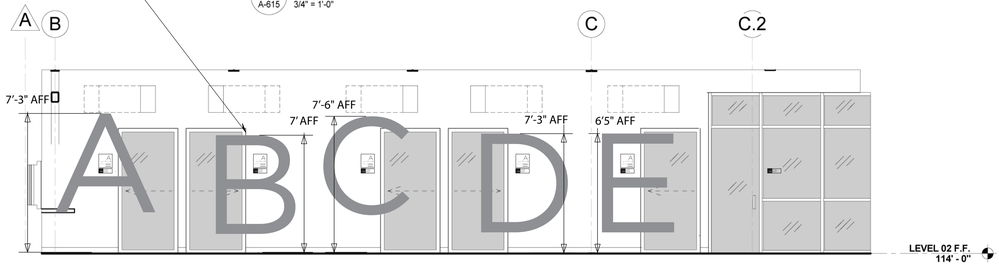
4 GRAPHICS - ELEVATOR SECOND FLOOR WEST
A-615 1/4" = 1'-0"

3 TEEN, FICTION, NON-FICTION SIGNAGE FOR REFERENCE
A-615 3/4" = 1'-0"



2 GRAPHICS - TYPICAL MOUNTING MEASUREMENTS FOR SIGN TYPE 1, 2, 4
A-615 1/2" = 1'-0"

VINYL SHALL BE CUT TO WRAP FROM WALL
ONTO DOOR JAMB OR HEAD, FRAME, AND GLASS, TYP.



1 GRAPHICS - OPEN COMPUTING 201 - EAST
A-615 1/4" = 1'-0"

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GRAPHICS - ELEVATIONS

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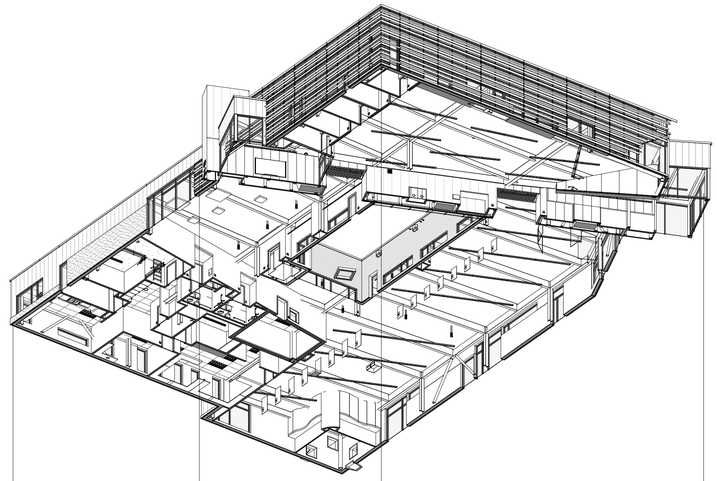
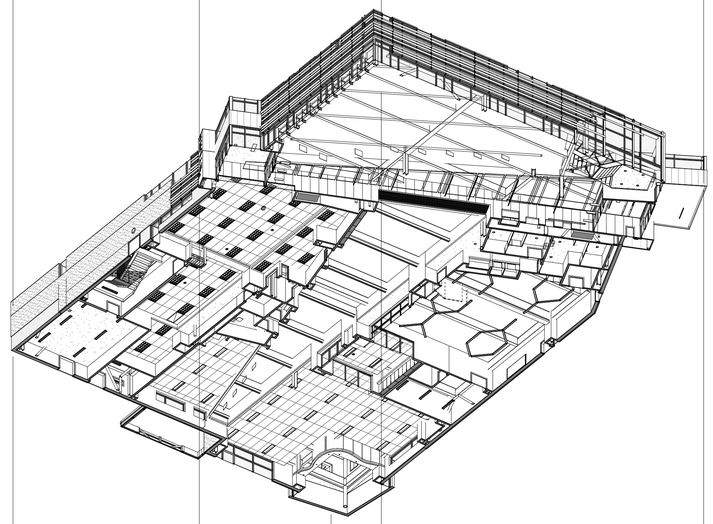
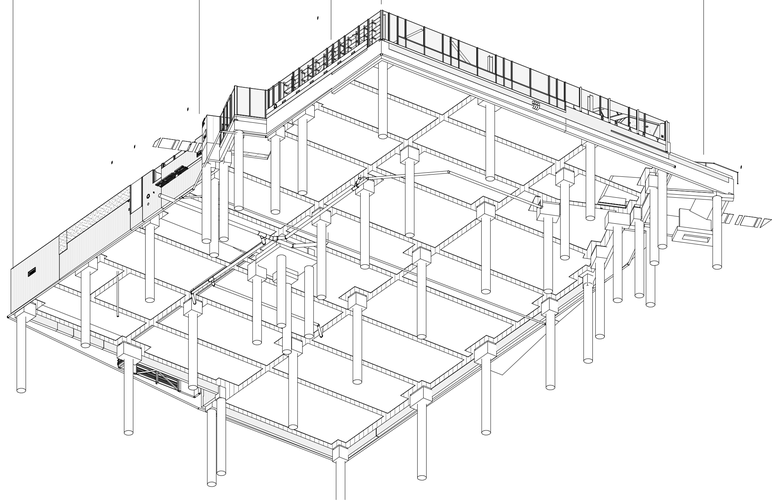
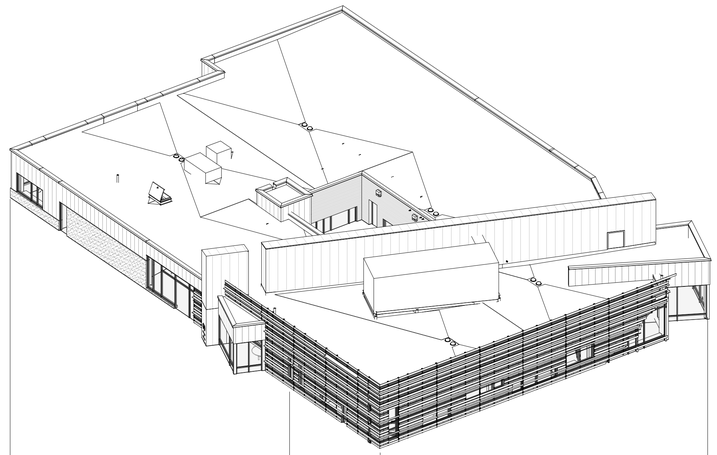
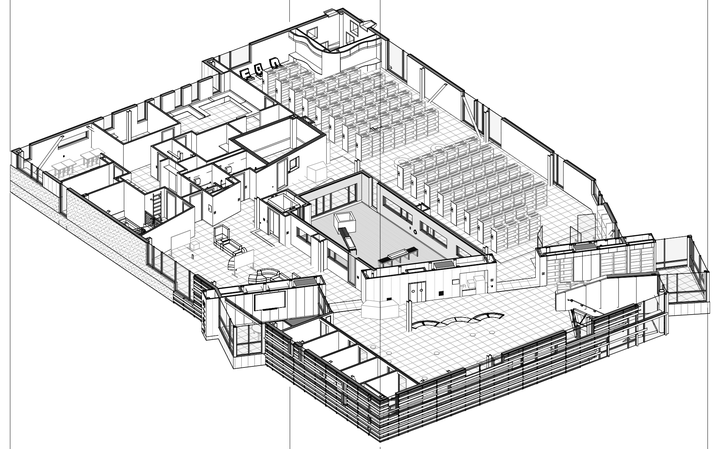


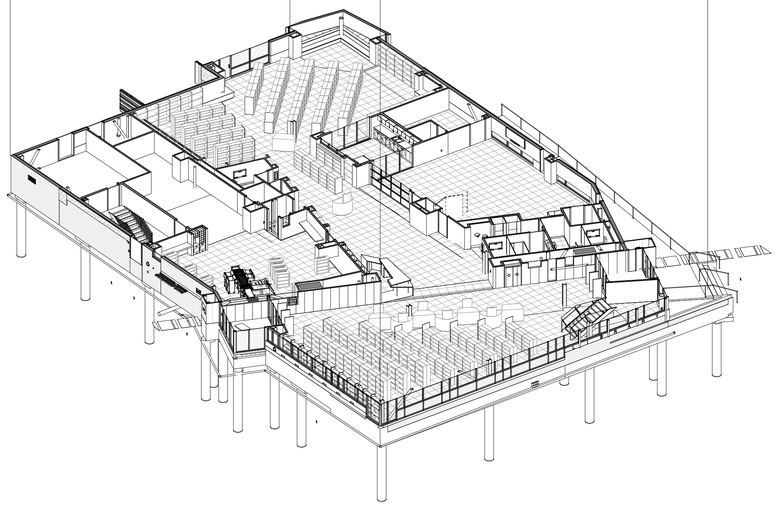




2 A-901 EXPLODED AXON - RCP







1 A-901 EXPLODED AXON - FLOOR PLAN

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11-23-2011	75% CD
12-19-2011	99% CD

EXPLODED AXON

A-901

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1/13/2012 3:00:04 AM

GENERAL NOTES

PROJECT SCOPE: THESE STRUCTURAL DRAWINGS MAY ONLY BE USED TO CONSTRUCT THE PROJECT LOCATED AT WEST DENVER BRANCH LIBRARY, W. COLFAX AND IRVING STREET, DENVER, COLORADO

BUILDING CODE: THESE PLANS HAVE BEEN PREPARED IN ACCORDANCE WITH THE INTERNATIONAL BUILDING CODE (2009 EDITION). ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THIS CODE AND THE CITY AND COUNTY OF DENVER, CO 2011 AMENDMENTS.

DESIGN LOADS: THIS STRUCTURE SHALL BE CLASSIFIED AS A CATEGORY II STRUCTURE AS PER TABLE 1604.5.
A. DEAD LOADS ARE THE WEIGHT OF THE CONSTRUCTION MATERIALS AND SHALL BE IN ACCORDANCE WITH SECTION 1606.

B. LIVE LOADS SHALL BE IN ACCORDANCE WITH SECTION 1607.

OCCUPANCY OR USE	UNIFORM [PSF]	CONCENTRATED [LBS]
STACK LOADS (SECOND FLOOR)	150	1000
STACK LOADS (FIRST FLOOR)	150	1000
EGRESS ROUTES	100	---
RESTROOMS	60	---
LOBBIES	100	---
OFFICES	50	2000

C. SNOW LOADS SHALL BE IN ACCORDANCE WITH SECTION 1608

GROUND SNOW:	30 PSF
(IN ACCORDANCE WITH SECTION 7 OF ASCE 7)	
SNOW FACTOR:	1.0
(IN ACCORDANCE WITH BUILDING CLASSIFICATION)	
UNBALANCED SNOW LOADS PER SECTION 7.5 OF ASCE 7	
DRIFTING SNOW LOADS ON LOWER ROOFS PER SECTION 7.7 OF ASCE 7	
DRIFTING SNOW LOADS ON ROOF PROJECTIONS PER SECTION 7.8 OF ASCE 7	

D. WIND LOADS SHALL BE IN ACCORDANCE WITH SECTION 1609

V3S	90 MPH
EXPOSURE	B
WIND FACTOR	1.0
(IN ACCORDANCE WITH BUILDING CLASSIFICATION)	
HEIGHT AND EXPOSURE COEFFICIENT AS PER EACH AREA.	

E. EARTHQUAKE LOADS SHALL BE IN ACCORDANCE WITH SECTION 1613

SEISMIC IMPORTANCE FACTOR	1.0
SEISMIC USE GROUP	II
SITE CLASS	D
Ss	0.2215
S1	0.057
S DS	0.236
S D1	0.091
SEISMIC DESIGN CATEGORY	B
BASIC SEISMIC FORCE RESISTING SYSTEM	STL. SYSTEMS NOT SPECIFICALLY DETAILED FOR SEISMIC RESISTANCE
DESIGN BASE SHEAR	196.212 KIPS
RESPONSE COEFFICIENT (Cs)	0.0788 - (LRFD)
RESPONSE MODIFICATION FACTOR (R)	3.0
ANALYSIS PROCEDURE	EQUIVALENT LATERAL FORCE

F. FROST DEPTH SHALL BE 36"

CONSTRUCTION METHOD:
A. THE STRUCTURAL DRAWINGS REPRESENT THE FINAL STRUCTURE. THE DRAWINGS DO NOT INDICATE THE CONTRACTORS MEANS, METHODS, TECHNIQUES, SEQUENCES OF CONSTRUCTION AND JOB SITE SAFETY. THE ENGINEER OF RECORD IS NOT RESPONSIBLE FOR THE CONTRACTOR'S FAILURE TO FOLLOW PLANS, SPECIFICATIONS, AND/OR ENGINEERING RECOMMENDATIONS, NOR IS THE ENGINEER OF RECORD RESPONSIBLE FOR ECONOMIC LOSS AND/OR DELAYS OF THE CONTRACTOR OR SUBCONTRACTORS.
B. ALL CONSTRUCTION SHALL BE ADEQUATELY BRACED TO PREVENT DISTORTION AND DAMAGE DUE TO CONSTRUCTION LOADS AND NATURAL FORCES.
C. THE CONTRACTOR SHALL MAKE ALLOWANCES FOR DIFFERENCE BETWEEN TEMPERATURE DURING ERECTION AND MEAN TEMPERATURE WHEN STRUCTURE IS COMPLETED AND IN SERVICE

TRADE COORDINATION:
A. THE STRUCTURAL DRAWINGS ARE INTENDED TO BE USED IN CONJUNCTION WITH THE ARCHITECTURAL, ELECTRICAL, MECHANICAL, PLUMBING AND SITE DRAWINGS. CONFLICTS IN DIMENSION AND INTERFERENCE SHALL BE DIRECTED TO THE ARCHITECT PRIOR TO CONSTRUCTION.

SPECIFICATIONS:
A. IF CONFLICT ARISES FROM THE RECOMMENDATIONS OF THESE DRAWINGS AND THOSE CONTAINED IN THE SPECIFICATIONS, THE ARCHITECT SHALL BE NOTIFIED OF THE DISCREPANCY PRIOR TO CONSTRUCTION.

OPENINGS:
A. OPENINGS, SLEEVES, POCKETS, ETC. SHALL NOT BE PLACED IN BEAMS, JOISTS, COLUMNS, ETC. UNLESS SPECIFICALLY DETAILED ON THE STRUCTURAL DRAWINGS. NOTIFY THE ARCHITECT WHEN DRAWINGS BY OTHERS SHOW OPENINGS, SLEEVES, POCKETS, ETC. NOT SHOWN ON THE STRUCTURAL DRAWINGS, BUT WHICH ARE LOCATED IN STRUCTURAL MEMBERS (CONC. OR STL.).

STRUCTURAL LAYOUT:
A. ALL STEEL MEMBERS ARE CENTERED ON PLAN GRIDS, AND ALL EXTERIOR FACE OF CONCRETE IS ON PLAN GRIDS UNLESS DIMENSIONED OTHERWISE ON PLANS.
B. REFER TO ARCHITECTS DRAWINGS TO RELATE 100'-0" TO SITE DATUM.

CONSTRUCTED STRUCTURE: THE CONTRACTOR SHALL CONSTRUCT THE STRUCTURE IN ACCORDANCE WITH THE STRUCTURAL CONTRACT DOCUMENTS. IF THE CONTRACTOR DEVIATES FROM THIS THE CONTRACTOR IS RESPONSIBLE FOR SUBMITTING A PROPOSED REPAIR TO THE ENGINEER OF RECORD FOR REVIEW PRIOR TO MAKING THAT REPAIR, AND THEN COMPLETING THE APPROVED REPAIR TO THE SATISFACTION OF THE ENGINEER OF RECORD.

FOUNDATIONS

GEOTECHNICAL INVESTIGATION:
A. A GEOTECHNICAL REPORT BY ACURA ENGINEERING, COLORADO LLC. OF SHERIDAN, CO DATED AUGUST 8, 2011 (# C11-0021G) WITH THREE AMENDMENTS DATED 9/16/11, 9/29/11 AND 12/14/11 IS AVAILABLE. THE CONTRACTOR SHALL FAMILIARIZE HIMSELF WITH ALL OF THE REPORT REQUIREMENTS. THE FOLLOWING DESIGN PARAMETERS HAVE BEEN ASSUMED BASED ON THIS REPORT. SHOULD THE FOLLOWING DESIGN PARAMETERS VARY FROM THOSE OF THE GEOTECHNICAL REPORT, THE MORE STRINGENT REQUIREMENTS SHALL APPLY. IF CONDITIONS DIFFER FROM THOSE PRESENTED HEREIN, THE ARCHITECT SHALL BE NOTIFIED BEFORE CONTINUATION OF THE WORK.

SCREW PILES:
A. SCREW PILES SHALL BE INSTALLED TO MANUFACTURER'S DETAILS AND RECOMMENDATIONS FOLLOWING THE DESIGN LOADS SHOWN ON THE DRAWINGS.
B. SCREW PILES CAN BE OBTAINED THROUGH ALPINE SITE SERVICES, INC. OR AN EQUIVALENT APPROVED SUBCONTRACTOR. SCREW PILES ARE A PERFORMANCE SPECIFIED SUBCONTRACT AND SHALL BE REVIEWED AS SUCH BY THE ENGINEER OF RECORD.
C. SCREW PILE BEARING PLATES TO RESIST THE COMPRESSION AND TENSION LOADS (WORKING LOADS ON THE DRAWINGS) SHALL BE DESIGNED BY THE SCREW PILE CONTRACTOR'S ENGINEER AND SHALL BE STAMPED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF COLORADO.
D. A GEOTECHNICAL ENGINEER, REGISTERED IN THE STATE OF COLORADO, SHALL BE PRESENT DURING ALL DRILLING OPERATIONS, AND SHALL RECORD AND SUBMIT A PIER DRILLING LOG, SIGNED AND SEALED BY THE SUPERVISING GEOTECHNICAL ENGINEER.
E. A MINIMUM OF TWO LOAD TESTS (PER GEOTECHNICAL ENGINEER) SHALL BE PERFORMED ON SCREW PILES. (THESE SCREW PILES SHALL NOT BE INCORPORATED IN THE FINAL WORK)

SITE RETAINING WALLS:
A. SITE RETAINING WALLS HAVE BEEN DESIGNED FOR AN EQUIVALENT FLUID PRESSURE OF 60 PCF. PASSIVE PRESSURE OF 250 PCF AND FRICTION FACTOR OF 0.3.
B. BACKFILL FROM REAR FACE OF WALL FOR 2 FEET WITH FREE-DRAINING GRANULAR BACKFILL MATERIAL APPROVED BY GEOTECHNICAL ENGINEER.
C. FOR WEEPHOLE DETAILS SEE DRAWINGS.

GRADE BEAMS:
A. 4" VOID FORM REQUIRED BENEATH BOTTOM OF GRADE BEAMS/FOUNDATION WALLS AND UNDERLYING SOILS.
B. BOTTOMS OF GRADE BEAMS SHALL BE A MINIMUM OF 3'-0" BELOW FINISHED GRADE.
C. REBAR SPLICES FOR BOTTOM STEEL TO OCCUR AT DRILLED PIER OR INTERRUPTED FOOTING PAD LOCATIONS, REBAR SPLICES FOR TOP STEEL TO OCCUR AT MIDSPAN BETWEEN DRILLED PIER OR INTERRUPTED FOOTING PAD LOCATIONS, UNLESS NOTED OTHERWISE.
D. HOLES IN SILL PLATES FOR ANCHOR BOLTS SHALL BE SNUG TO PREVENT WALL MOVEMENT. PROVIDE ADDITIONAL NAILING AT JOIST SILL PLATE CONNECTION TO PREVENT SLIPPAGE.

COMPACTED FILL:
A. USE ONLY APPROVED, NON-EXPANSIVE, GRANULAR MATERIAL AS FILL AS RECOMMENDED BY THE SUPERVISING GEOTECHNICAL ENGINEER.
B. SUBGRADE COMPACTION SHALL BE MADE AS RECOMMENDED BY THE GEOTECHNICAL ENGINEER. (GEOTECH REPORT SECTION 8.0)

FLOOR SLABS:
A. SLAB-ON-GRADE SHALL BE ISOLATED FROM AT GRADE WALLS, COLUMNS, SERVICE PENETRATIONS WITH 1/2" FIBERBOARD OR EQUIVALENT APPROVED ISOLATION JOINT.
B. PROVIDE 6x6 W1.4xW1.4 IN ALL SLABS (UNO). SAWCUT CONCRETE (WITHIN 18 HOURS OF PLACING CONCRETE) SUCH THAT NO MORE THAN 225 SQUARE FEET OF SLAB ARE WITHIN A GRID. SAWCUT JOINTS SHOULD BE SPACED AT NO MORE THAN 10 FEET ON CENTER OR AS INDICATED ON THE DRAWINGS.
C. PROVIDE UNDER SLAB PREPARATION OF SUBGRADE OR IMPORTED FILL AS DIRECTED BY GEOTECHNICAL ENGINEER.
D. PROVIDE VAPOR BARRIER BENEATH THE CONCRETE SLAB IF REQUIRED PER ARCHITECTS DETAILS.

PERIMETER AND UNDERDRAIN:
A. REFER TO GEOTECH REPORT AND ENVIRONMENTAL ENGINEER REPORT FOR DETAILS OF ANY PERIMETER OR UNDERDRAINS

EXTERIOR GRADE:
A. SLOPE PERIMETER GRADE AWAY FROM BUILDINGS AS SHOWN ON THE FINAL CIVIL GRADING PLAN (RE:CIVIL)

ANCHOR BOLTS:
A. FOR STEEL COLUMNS SHALL BE 3/4" DIA. AS PER ASTM F1554-99. GR. 36 UNO.
B. FOR STEEL COLUMNS SHALL PROTRUDE A MINIMUM OF 2" ABOVE COLUMN BASE PLATE UNO.

CONCRETE:

GENERAL REQUIREMENTS:
A. 28-DAY COMPRESSIVE STRENGTH FOR CONCRETE SHALL BE AS FOLLOWS:

GRADE BEAMS/PIER CAPS	4,000 PSI
LIGHTWEIGHT STRUCTURAL FLOOR SLABS	4,000 PSI
SLAB-ON-GRADE	4,000 PSI

B. MAXIMUM CONCRETE SLUMP SHALL BE AS FOLLOWS:

ALL CONCRETE	4" MAX

C. AIR ENTRAINMENT SHALL BE AS FOLLOWS:

INTERIOR SLABS	0%
ALL OTHER CONCRETE	5-7%

D. CEMENTITIOUS CONTENT SHALL BE REPLACED BY 25% MIN FLY ASH BY WEIGHT
E. ALL CONCRETE SHALL COMPLY WITH AND BE MIXED, TRANSPORTED AND PLACED IN ACCORDANCE WITH ACI 318, AC1 301 "SPECIFICATION FOR STRUCTURAL CONCRETE" AND CRSI'S "MANUAL OF STANDARD PRACTICE".
F. ALL CONCRETE SHALL BE CONSTRUCTED WITHIN THE TOLERANCES SPECIFIED IN ACI STANDARD 117.
G. ALL VERTICAL SURFACES OF CONC SHALL BE FORMED (REF. ARCH FOR TIE/JOINT LOCATIONS).
H. SLAB-ON-GROUND SHALL BE AS INDICATED ON THE DRAWINGS. UNLESS OTHERWISE INDICATED, SLAB SHALL BE FINISHED IN ACCORDANCE WITH ACI STANDARD 302 FOR CLASS 2 FLOORS.
I. CEMENT TO BE TYPE I/II (UNO), OR AS RECOMMENDED BY GEOTECHNICAL ENGINEER FOR BELOW GRADE CONSTRUCTION.
J. ALL OPENINGS THROUGH CONCRETE MARKED ON THESE DRAWINGS SHALL HAVE (2)-#5 BARS AROUND EACH FACE OF THE OPENING AND EXTENDING A MINIMUM OF 2'-0" BEYOND EACH EDGE OF THE OPENING.
K. CONTRACTOR SHALL NOTIFY STRUCTURAL ENGINEER 48 HRS. (AND A MINIMUM OF 24 HRS.) PRIOR TO ANY CONCRETE PLACEMENT.
L. COORDINATE FORMWORK TIE LOCATIONS AT EXPOSED CONCRETE WITH ARCHITECT. PROVIDE MOCK-UP EXPOSED PANEL FOR APPROVAL BY ARCHITECT PRIOR TO CONSTRUCTING EXPOSED CONCRETE ELEMENTS.
M. REFER TO ARCHITECT AND ARCHITECTURAL PLANS FOR FORMWORK REQUIREMENTS INCLUDING BLOCKOUT SIZES/LOCATIONS AND FORMLINER EXTENT/LOCATIONS.

CONCRETE REINFORCING:
A. DETAIL ALL BARS IN ACCORDANCE WITH THE LATEST EDITIONS OF THE ACI DETAILING MANUAL AND ACI BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE
B. PROVIDE ALL ACCESSORIES NECESSARY TO SUPPORT REINFORCING AT POSITIONS SHOWN ON THE PLANS
C. ALL REINFORCING BARS SHALL BE OF NEW BILLET STEEL CONFORMING TO ASTM A615, GRADE 60 FOR #4, #5, #6 & #7 BARS. GRADE 40 FOR #3 BARS. GRADE 60 BARS SHALL NOT BE FIELD-BENT.
D. REINFORCING STEEL SHALL BE PLACED TO PROVIDE THE FOLLOWING MINIMUM CONCRETE TO OUTSIDE FACE OF REBAR IN ACCORDANCE WITH ACI 318:

SLAB-ON-GRADE	MID DEPTH OF SLAB UNO
PIER CAPS AND GRADE BEAMS	2" (3" BOTTOM)

E. REBAR SPLICES SHALL CONSIST OF TIED LAPS AT LEAST 50 BAR DIAMETERS IN ALL CASES. OFFSET SPLICE LOCATION FOR BARS IN ONE LAYER BY AT LEAST 24 INCHES.
F. ALL WELDED WIRE MESH SHALL BE 6x6-W1.4xW1.4 (UNO) CONFORMING TO ASTM A185. ~~COVER~~WIDE 6x6-W1.4xW1.4 WWF AS MINIMUM REINFORCING IN MECHANICAL HOUSEKEEPING PADS. SEE MECHANICAL DRAWINGS FOR PAD SIZES, LOCATIONS AND PADS REQUIRING GREATER REINFORCING
H. ALL STIRRUPS SHALL HAVE A MINIMUM OF 2-#4 HORIZONTAL TOP REINFORCING BARS PROVIDED AS SUPPORT WHEN NO OTHER HORIZONTAL REINFORCING IS SHOWN ON DETAILS.
I. ALL REINFORCING BARS, ANCHOR BOLTS AND OTHER CONCRETE INSERTS SHALL BE WELL SECURED IN POSITION PRIOR TO PLACING CONCRETE.
J. ALL WELDING OF REINFORCING BARS SHALL BE IN COMPLIANCE WITH AWS D1.4-98

CONCRETE STRUCTURAL FLOOR SLABS ON METAL DECKING:
A. CONCRETE SHALL BE LIGHTWEIGHT (115PCF MAX +/- 3PCF).
B. PROVIDE 6x6 W1.4xW1.4 WWF IN ALL SLABS (UNO ON PLANS).
C. CONSTRUCTION JOINTS ARE TO BE SUBMITTED TO THE ENGINEER FOR APPROVAL A MIN. OF 2 WEEKS PRIOR TO CONSTRUCTION.
D. NO SAW-CUT JOINTS IN CONCRETE STRUCTURAL FLOORS.

STRUCTURAL STEEL:

GENERAL REQUIREMENTS:
A. STEEL CONSTRUCTION SHALL CONFORM TO AISC "MANUAL OF STEEL CONSTRUCTION" (NINTH EDITION) AND SHALL BE FABRICATED AND INSTALLED IN ACCORDANCE WITH AISC "CODE OF STANDARD PRACTICE FOR STEEL BUILDINGS AND BRIDGES" LATEST EDITION.
B. STRUCTURAL STEEL SHALL CONFORM TO THE FOLLOWING ASTM SPECIFICATIONS:

BEAMS (W)	A992	PIPES (HSS)	A53, TYPE E, GRADE B
ANGLES (L)	A36	TUBES (HSS)	A500, GRADE B
PLATES (PL)	A36	CHANNELS (C)	A36

C. ALL BOLTED CONNECTIONS SHALL BE MADE USING A325-N BOLTS, 3/4" DIAMETER (UNO) INSTALLED IN ACCORDANCE WITH "SPECIFICATIONS FOR STRUCTURAL JOINTS USING A325 OR A490 BOLTS" LATEST EDITION, UNLESS OTHERWISE DETAILED. MINIMUM TWO BOLTS PER CONNECTION. ALL BOLT HOLES TO BE 1/16" LARGER IN DIAMETER THAN NOMINAL SIZE OF BOLT. ALL BASE PLATE BOLT HOLES TO BE 3/16" LARGER IN DIAMETER THAN NOMINAL SIZE OF ANCHOR BOLT.
D. ALL STEEL SHALL BE SHOP PAINTED WITH A PRIMER. ALL WELDS AND BARE SPOTS SHALL RECEIVE TOUCHUP PAINT. FINISH COAT PAINT TO ARCHITECTURAL DETAILS.
F. ALL STRUCTURAL STEEL SURFACES ENCASED IN CONCRETE OR WITH SPRAYED ON FIREPROOFING, SHALL BE LEFT UNPAINTED. ALL STRUCTURAL STEEL SHALL BE FIREPROOFED IF REQUIRED PER ARCHITECT'S DETAILS.
G. DURING ERECTION, APPROVED TEMPORARY BRACING SHALL BE INSTALLED AS REQUIRED TO PREVENT DISTORTION OF DAMAGE TO THE FRAMEWORK DUE TO THE ERECTION FORCES. COLUMN BASE PLATES ARE TO BE SHIMMED ON ALL SIDES PRIOR TO GROUTING, NOT WITH A CENTRAL SHIM.
H. ALL STEEL PERMANENTLY EXPOSED TO EARTH OR WITH CONCRETE CAST AROUND IT SHALL BE COATED IN ZINC RICH PAINT OR ASPHALTIC MASTIC.
I. PROVIDE PARTIAL AESS ON FEATURE STAIR - SEE SPECS AND STAIR DETAILS (GRIDS 2-3/B) FOR WHICH PARTS OF AESS.

METAL DECKING:
A. COMPOSITE FLOOR DECK SHALL BE PER PLAN NOTES (UNO).
B. STEEL DECK BY OTHER MANUFACTURERS MAY BE SUPPLIED IN LIEU OF THAT SHOWN PROVIDED SECTION PROPERTIES ARE EQUAL TO OR GREATER THAN THOSE SHOWN ABOVE.
C. DECK SUPPLIER SHALL PROVIDE ALL ADDITIONAL FRAMING AS REQUIRED FOR OPENINGS THROUGH DECK GREATER THAN 6".
D. ALL STRUCTURAL FRAMING NECESSARY TO SUPPORT DECK EDGE NOT SHOWN ON PLANS SHALL BE L3x3x1/4.
E. DECK UNITS SHALL BE MANUFACTURED AND INSTALLED IN ACCORDANCE WITH THE CURRENT "DESIGN MANUAL FOR COMPOSITE DECKS, FORM DECKS, AND ROOF DECKS_ PUBLISHED BY THE STEEL DECK INSTITUTE (SDI).
F. DECKING CONTRACTOR SHALL PROVIDE ADDITIONAL STEEL ANGLE SUPPORTS AT ALL COLUMNS AND ELSEWHERE, WHERE FRAMING OR CONNECTIONS INTERFERE INTERRUPT SEATING OF MORE THAN ONE DECK RIB. PERMANENT ANGLES SHALL BE PAINTED.
G. EXCEPT AS NOTED EDGE LAPS SHALL BE CONNECTED TEK SCREWS AT A SPACING TO PROVIDE SUFFICIENT DIAPHRAGM STRENGTH TO MAINTAIN BUILDING ALIGNMENT AND TO SUSTAIN LOCAL CONSTRUCTION LOADS WITHOUT DISTORTION OR SEPARATION. MAXIMUM SPACING SHALL BE 3'_0" O.C.
L. METAL DECK SHALL BE COORDINATED WITH ARCHITECTURAL, ELECTRICAL AND MECHANICAL REQUIREMENTS.
M. EXCEPT AS NOTED DECK SHALL BE CONNECTED TO STRUCTURAL STEEL WITH DIAMETER FUSION WELDS AT SPACING SHOWN ON DRAWINGS AT END, AND INTERIOR SUPPORTS. WELDS MAY BE OMITTED IN RIBS IN WHICH SHEAR CONNECTORS ARE TO BE APPLIED EXCEPT THAT EACH DECK SECTION SHALL HAVE SUFFICIENT WELDS TO ADEQUATELY SECURE THE DECK AND BRING THE DECK INTO DIRECT CONTACT WITH THE SUPPORTING STEEL.

STEEL FRAMING STUDS:
A. COLD-FORMED METAL FRAMING SHALL CONFORM TO ASTM A1011. 16 GA AND HEAVIER MEMBERS SHALL BE GRADE 50. 18 GA AND SMALLER SHALL BE GRADE 33
B. ALL STEEL STUDS SHALL BE INSTALLED ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS USING THE MANUFACTURER'S RECOMMENDED ACCESSORIES
C. COLD-FORMED METAL FRAMING IS A SUBCONTRACTOR DESIGN PACKAGE THAT SHALL BE SUBMITTED FOR REVIEW AND SHALL INCLUDE SHOP DRAWINGS AND CALCULATIONS STAMPED AND SEALED BY A PROFESSIONAL ENGINEER IN THE STATE OF COLORADO.
D. CHANNELS AND ACCESSORIES SHALL HAVE A MINIMUM YIELD STRENGTH OF 33,000 PSI.
E. ALL WELDING SHALL BE PERFORMED IN ACCORDANCE WITH STANDARDS OF THE AMERICAN WELDING SOCIETY.
F. USE SCREWS PRODUCED BY BUILDEX, COMPASS, GRABBER OR EQUIVALENT APPROVED.

WELDING:
A. ALL WELDING SHALL BE PERFORMED IN ACCORDANCE WITH THE STANDARDS OF THE AMERICAN WELDING SOCIETY. ELECTRODES MUST MEET E70XX SERIES REQUIREMENTS, LOW HYDROGEN WITH MINIMUM TENSILE STRESS OF 70,000 PSI. ELECTRODES SHALL BE PRODUCED AND STORED IN ACCORDANCE WITH AWS D1.1 SECTIONS 4.5 OR 4.12.
B. STEEL FABRICATOR SHALL PROVIDE A FIRE WATCH DURING ALL FIELD-WELDING OPERATIONS.
C. MINIMUM WELD SIZE SHALL NOT BE LESS THAN 3/16" CONTINUOUS FILLET WELD, UNO
D. ALL WELDERS ARE TO BE LICENSED AND CERTIFIED TO AWS STANDARDS.
E. REPORTS OF EACH WELD TEST SHALL BE GIVEN TO THE STRUCTURAL ENGINEER. NO FAILED WELD SHALL BE PERMITTED TO REMAIN IN SERVICE. IT IS THE RESPONSIBILITY OF THE TESTING LABORATORY TO PROVIDE TIMELY NOTICE OF FAILED TESTS TO THE CONTRACTOR.
F. WELDING SHALL PROGRESS IN A MANNER, WHICH BALANCES THE STRESSES IN THE MEMBERS, IN ACCORDANCE WITH AWS.
G. PREHEATING REQUIREMENTS FOR BASE METALS SHALL FOLLOW AWS GUIDELINES.
H. THE WELD METAL MATERIAL SHALL MEET THE PROPERTIES OF THE BASE METAL.

STRUCTURAL SUBMITTALS AND SHOP DRAWINGS:

GENERAL REQUIREMENTS:
A. THE APPROVAL OF THE STRUCTURAL ENGINEER OF RECORD MUST BE SECURED ON ALL STRUCTURAL SUBMITTALS.
B. DO NOT REPRODUCE CONTRACT DOCUMENTS OR COPY STANDARD PRINTED INFORMATION AS THE BASIS OF SHOP DRAWINGS
C. VERIFY ALL FOUNDATION, ROOF, FLOOR AND WALL OPENINGS WITH ARCHITECTURAL, MECHANICAL, ELECTRICAL AND PLUMBING DRAWINGS
D. CONTRACTOR SHALL REVIEW AND STAMP ALL SHOP DRAWINGS PRIOR TO SUBMITTAL. ANY ITEMS NOT IN ACCORDANCE WITH THE CONTRACT DOCUMENTS SHALL BE FLAGGED BY THE CONTRACTOR.
E. THE SHOP DRAWINGS DO NOT REPLACE THE CONTRACT DOCUMENTS. THE CONTRACTOR SHALL MAKE SURE THE STRUCTURE IS CONSTRUCTED IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
F. ALL DIMENSIONS AND ELEVATIONS TO BE VERIFIED BY THE ARCHITECT.
G. ALLOW TIME FOR ARCHITECT AND ENGINEER REVIEW PER PROJECT MANUAL, AND PRIOR TO FABRICATION OR CONSTRUCTION.
H. SUBMIT SHOP DRAWINGS DIGITALLY PER PROJECT MANUAL.

ITEMS TO BE SUBMITTED FOR REVIEW:
A. PROVIDE CONCRETE REINFORCING BAR SCHEDULES, ELEVATIONS AND STEEL EMBED DRAWINGS. PROVIDE PRODUCT DATA, CONCRETE MIX DESIGNS AND SUBMITTALS AS REQUIRED BY ACI 301.
B. PROVIDE STRUCTURAL STEEL SHOP DRAWINGS INCLUDING ANCHOR BOLT LAYOUT & DETAILS. PROVIDE STEEL MILL CERTIFICATES, WELDING CERTIFICATES AND SUBMITTALS REQUIRED BY AISC "MANUAL OF STEEL CONSTRUCTION".
C. PROVIDE FLOOR/ROOF DECKING LAYOUT, DETAILS AND CONNECTIONS. PROVIDE MILL CERTIFICATES.
D. PROVIDE COLD-FORMED METAL FRAMING SHOP DRAWINGS, INCLUDING CONNECTIONS AND CALCULATIONS.
E. PROVIDE SCREW PILE FOUNDATION LAYOUT, CONNECTION & CALCULATIONS. PROVIDE LOAD TESTING PER MANUFACTURE/GEOTECHNICAL RECOMMENDATIONS.

SPECIAL STRUCTURAL INSPECTION (SPECIAL INSPECTOR SHALL BE EMPLOYED DIRECTLY BY THE OWNER): REFER TO SHEET S-101 FOR TABLE OF CONTINUOUS OR PERIODIC SPECIAL INSPECTIONS.

GENERAL REQUIREMENTS:
A. SPECIAL STRUCTURAL INSPECTIONS SHALL COMPLY WITH CHAPTER 17 OF THE INTERNATIONAL BUILDING CODE.
B. SPECIAL STRUCTURAL INSPECTION IS REQUIRED IN ADDITION TO ANY INSPECTIONS REQUIRED BY THE LOCAL BUILDING DEPARTMENT OR GOVERNING OFFICIAL.
C. SPECIAL STRUCTURAL INSPECTIONS SHALL BE PERFORMED ON, BUT ARE NOT LIMITED TO THE FOLLOWING ITEMS:

STRUCTURAL WELDING: PER SECTION 1704.3.1
A. ALL WELDING INSPECTIONS SHALL BE COMPLETED BY AN AWS CERTIFIED INSPECTOR.
B. ALL WELDS SHALL BE VISUALLY INSPECTED. 100% OF ALL GROOVE WELDS SHALL RECEIVE RADIOGRAPHIC OR ULTRASONIC TESTING. MAGNETIC PARTICLE TEST 20% OF ALL FILLET WELDS.
C. NON-DESTRUCTIVE TESTING OF ALL COMPLETE PENETRATION WELDS.
D. VERIFICATION OF CURRENT WELDER'S CERTIFICATION.
E. WELD INSPECTION OF SHOP FABRICATIONS

HIGH STRENGTH BOLTING: PER SECTION 1704.3.3
A. VERIFICATION OF SNUG TIGHT OR SLIP-CRITICAL INSTALLATION AS PER PLANS.
B. VERIFICATION IN PLANS WHERE/IF A325-X BOLTS ARE REQUIRED.

CONCRETE: PER SECTION 1704.4
A. DURING THE TAKING OF TEST SPECIMENS.
B. DURING THE PLACEMENT OF REINFORCED CONCRETE
C. POSITION OF ALL REINFORCING STEEL, ANCHOR BOLTS AND EMBED PLATES PRIOR TO AND DURING THE PLACEMENT OF THE CONCRETE

EXPANSION, EPOXY AND ADHESIVE ANCHORS:
A. DURING THE PLACEMENT OF ALL ANCHORS.
B. ALL ANCHORS TO BE INSTALLED PER MANUFACTURERS SPECIFICATIONS AND APPLICABLE ICBO REPORTS.

DUTIES AND RESPONSIBILITIES OF THE SPECIAL STRUCTURAL INSPECTOR:
A. THE SPECIAL STRUCTURAL INSPECTOR SHALL OBSERVE THE WORK ASSIGNED FOR CONFORMANCE TO THE APPROVED DESIGN DRAWINGS AND SPECIFICATIONS.
B. THE SPECIAL STRUCTURAL INSPECTOR SHALL REPORT TO THE CONTRACTOR UPON ARRIVING ON SITE TO DETERMINE WHETHER ANY DESIGN TEAM COMMUNICATIONS TO THE CONTRACTOR AFFECT THE WORK TO BE REVIEWED. THE SPECIAL STRUCTURAL SHALL LEAVE A COPY OF EACH OF HIS REPORTS WITH THE CONTRACTOR UPON LEAVING SITE.
C. THE SPECIAL STRUCTURAL INSPECTOR SHALL FURNISH INSPECTION REPORTS TO THE BUILDING OFFICIAL, THE ENGINEER OR ARCHITECT OF RECORD, AND OTHER DESIGNATED PERSONS WITHIN 24 HOURS. ALL DISCREPANCIES SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE CONTRACTOR FOR CORRECTION, THEN, IF UNCORRECTED, TO THE PROPER DESIGN AUTHORITY AND TO THE BUILDING OFFICIAL.
D. THE SPECIAL STRUCTURAL INSPECTOR IS NOT AUTHORIZED TO APPROVE ANY CHANGES TO THE CONTRACT DOCUMENTS. ANY VARIATIONS SHALL BE BROUGHT TO THE ATTENTION OF THE CONTRACTOR AND ENGINEER OR ARCHITECT OF RECORD.
E. THE CONTRACTOR SHALL PROVIDE SAFE ACCESS TO ALL ITEMS REQUIRING SPECIAL STRUCTURAL INSPECTION. THIS SHALL INCLUDE, BUT IS NOT LIMITED TO LADDERS, SCAFFOLDING AND MAN LIFTS.
F. THE SPECIAL STRUCTURAL INSPECTOR SHALL SUBMIT A FINAL SIGNED REPORT STATING WHETHER THE WORK REQUIRING SPECIAL INSPECTION WAS, TO THE BEST OF THE INSPECTOR'S KNOWLEDGE, IN CONFORMANCE TO THE APPROVED PLANS AND SPECIFICATIONS AND THE APPLICABLE WORKMANSHIP PROVISIONS OF THE CODE.

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ISSUE DATE	PHASE
01-12-2012	100% CD

GENERAL NOTES SHEET 1

S-100

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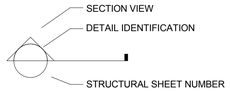
ABBREVIATIONS

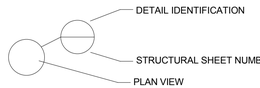
ABRV	DESCRIPTION	ABRV	DESCRIPTION
ABRV	ABBREVIATION	LW	LIGHT WEIGHT
AFF	ABOVE FINISHED FLOOR	LF	LINEAR FOOT
ADJ	ADJUSTABLE	LL	LIVE LOAD
ALT	ALTERNATE	LLH	LONG LEG HORIZONTAL
AB	ANCHOR BOLT	LLV	LONG LEG VERTICAL
/	AND/OR		
A/E	ARCHITECT/ENGINEER	MAX	MAXIMUM
ARCH	ARCHITECT	MECH	MECHANICAL
@	AT	MEZZ	MEZZANINE
		MIN	MINIMUM
BM	BEAM	MISC	MISCELLANEOUS
BP	BEAM POCKET	MT	MONO TRUSS
BRG	BEARING		
BLKG	BLOCKING	NF	NEAR FACE
BOC	BOTTOM OF CONCRETE	(N)	NEW
BOF	BOTTOM OF FOOTING	NOM	NOMINAL
BTM	BOTTOM	NW	NORMAL WEIGHT
BF	BRACED FRAME	N	NORTH
BRDG	BRIDGING	N/A	NOT APPLICABLE
BLDG	BUILDING	NIC	NOT IN CONTRACT
BEJ	BUILDING EXPANSION JOINT	NTS	NOT TO SCALE
		NO/#	NUMBER
CIP	CAST IN PLACE	OC	ON CENTER
℄	CENTERLINE	OPP	OPPOSITE
CLR	CLEAR	OH	OPPOSITE HAND
COL	COLUMN	OD	OUTSIDE DIAMETER
CJP	COMPLETE JOINT	OF	OUTSIDE FACE
CONC	CONCRETE	PERIM	PERIMETER
CMU	CONCRETE MASONRY UNIT	PERP	PERPENDICULAR
CONT	CONTINUOUS	PLT/▱	PLATE
CJ	CONTROL JOINT	PRELIM	PRELIMINARY
COORD	COORDINATE		
		R/RAD	RADIUS
DL	DEADLOAD	RE:	REFER TO
DEP	DEPRESSION	REINF	REINFORCEMENT
DET	DETAIL	REQD	REQUIRED
□/DIA	DIAMETER	RO	ROUGH OPENING
DIAG	DIAGONAL		
DIM	DIMENSION	SCJ	SAW CUT JOINT
DWL	DOWEL	ST	SCISSOR TRUSS
DWG	DRAWING	SECT	SECTION
		SW	SHEARWALL
EF	EACH FACE	SIM	SIMILAR
EW	EACH WAY	SOG	SLAB ON GRADE
E	EAST	S	SOUTH
EL\ELEV	ELEVATION	SL	SNOW LOAD
ENGR	ENGINEER	SPEC	SPECIFICATIONS
EQ	EQUAL, EQUALLY	STAG	STAGGERED
EST	ESTIMATED	STD	STANDARD
(E)	EXISTING	STL	STEEL
EXP	EXPANSION	STRUCT	STRUCTURAL
EXP JT	EXPANSION JOINT		
		TBD	TO BE DETERMINED
F/F	FACE TO FACE	TEMP	TEMPORARY
FV	FIELD VERIFY	THK	THICKNESS
FFL	FINISHED FLOOR ELEV	T&B	TOP & BOTTOM
FTG	FOOTING	TCA	TOP OF CAISSON
		TOC	TOP OF CONCRETE
GA	GAGE	TOL	TOP OF LEDGE
GALV	GALVANIZED	TOS	TOP OF STEEL
GSN	GENERAL STRUCT NOTES	TSL	TOP OF SLAB
GEOTECH	GEOTECHNICAL	TOW	TOP OF WALL
GT	GIRDER TRUSS	T&G	TONGUE AND GROOVE
GLB	GLULAM BEAM	TB	TRUSS BEARING
GYP BD	GYPSUM BOARD	TYP	TYPICAL
℄	GRID LINE		
		U/S	UNDERSIDE
HGR	HANGER	UNO	UNLESS NOTED OTHERWISE
HT	HIP TRUSS		
HVAC	HEATING, VENTILATING	VERT	VERTICAL
	AND AIR CONDITIONING	VIF	VERIFY IN FIELD
HSS	HOLLOW STRUCTURAL TUBE		
HORIZ	HORIZONTAL	WWF	WELDED WIRE FABRIC
		W	WEST
IF	INSIDE FACE	WL	WIND LOAD
		W/	WITH
JT	JOINT	W/O	WITHOUT
JST	JOIST	WDW	WINDOW
JB	JOIST BEARING	WP	WORKING POINT
LP	LAYOUT POINT		
LH	LEFT HAND		
LAW	LENGTH AFTER WELDING		
LT	LIGHT		

STANDARD SYMBOLS LEGEND

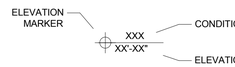
DRAWING/DETAIL IDENTIFICATION SYMBOLS



SECTION CUT SYMBOL

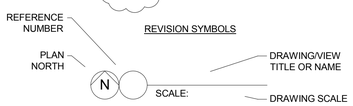


ALTERNATE OR AUXILIARY DETAIL VIEW SYMBOL

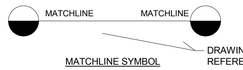


ELEVATION SYMBOL

REVISION SYMBOLS



DRAWING VIEW SYMBOL



MATCHLINE SYMBOL

KEY NOTE/ID TAG SYMBOLS

- HEXAGON KEY NOTE
- CIRCULAR KEY NOTE
- SQUARE KEY NOTE
- FRAMING MEMBER ID TAG

GRID-LINE SYMBOL

DRILLED PIER SYMBOL/NOTATION

MISC. SYMBOLS

- OPENING IN FLOOR/ROOF
- RECESS IN SLAB
- DEPRESSION IN FOUNDATION WALL
- STEP IN SLAB
- STEEL MOMENT CONNECTION
- SPAN DIRECTION
- BEAM W/CRANK CONNECTION

- SLOPE
- COLUMN ABOVE
- COLUMN BELOW
- COLUMN BOTH
- HANGER ABOVE
- HANGER BELOW
- NOMINAL WOOD POST
- MICRO-LAM/ RIM BOARD
- NOMINAL WOOD LUMBER
- HSS COLUMN
- STEEL COLUMN
- HANGER
- TRIMMER/KING STUDS OR BEARING MULTI-PLY 2x WOOD STUDS/POSTS
- MEMBER @ HANGER CONDITION
- MEMBER @ BEARING CONDITION
- TRIMMER/KING STUD

HATCH PATTERNS

- CONCRETE
- EARTH
- GRAVEL
- GROUT/SAND
- STEEL
- SHEATHING
- SHEARWALL (SWX)
- CMU WALL (CMU)
- BEARING WALL (BRG WALL / NO HATCH)
- VOID FORM (FRONT VIEW)
- VOID FORM (SECTION VIEW)

SPECIAL INSPECTION NOTES

1. SPECIAL INSPECTION:
1A SPECIAL INSPECTION SHALL BE PROVIDED PER IBC 2009 SECTION 109 AND CHAPTER 17. THE LISTS BELOW ARE A SUMMERY OF REQUIRED STRUCTURAL VERIFICATIONS AND INSPECTIONS.

1B REFER TO THE SPECIFICATIONS FOR DETAILED TESTING REQUIREMENTS.

2. DEFINITIONS:
2A CONTINUOUS SPECIAL INSPECTIONS IS THE FULL-TIME OBSERVATION OF WORK BY SPECIAL INSPECTOR (EMPLOYED BY OWNER) PRESENT IN THE AREA WHERE THE WORK IS BEING PERFORMED.

2B PERIODIC SPECIAL INSPECTION IS THE PART-TIME OR INTERMITTENT OBSERVATION OF WORK BY THE SPECIAL INSPECTOR PRESENT IN THE AREA WHERE THE WORK HAS BEEN OR IS BEING PERFORMED, AND AT THE TIME OF THE COMPLETION OF WORK.

REQUIRED VERIFICATION AND INSPECTION OF STEEL CONSTRUCTION

REFERENCE IBC 2009, TABLE 1704.3

TASK	CONTINUOUS	PERIODIC
MATERIAL VERIFICATION OF HIGH STRENGTH BOLTS, NUTS AND WASHERS:		
- IDENTIFICATION MARKINGS TO CONFORM TO ASTM STANDARDS SPECIFIED IN THE APPROVED CONSTRUCTION DOCUMENTS.	-	X
- MNFR'S CERTIFICATE OF COMPLIANCE REQ'D.	-	X
INSPECTION OF HIGH STRENGTH BOLTING:		
- BEARING TYPE CONNECTION.	-	X
- SLIP-CRITICAL CONNECTIONS.	-	X
MATERIAL VERIFICATION OF STRUCTURAL STEEL:		
- IDENTIFICATION MARKINGS TO CONFORM TO ASTM STANDARDS SPECIFIED IN THE APPROVED CONSTRUCTION DOCUMENTS.	-	X
- MNFR'S CERTIFIED MILL TEST REPORTS.	-	X
MATERIAL VERIFICATION OF WELD FILLER MATERIALS:		
- IDENTIFICATION MARKINGS TO CONFORM TO AWS SPECIFICATIONS IN THE APPROVED CONSTRUCTION DOCUMENTS.	-	X
- MNFR'S CERTIFICATE OF COMPLIANCE REQ'D.	-	X
INSPECTION OF WELDING:		
- STRUCTURAL STEEL:	-	-
1) COMPLETE AND PARTIAL PEN GROOVE WELDS	X	-
2) MUILTIPASS FILLET WELDS	X	-
3) SINGLE PASS FILLET WELDS > $^5/_{16}$	X	-
4) SINGLE PASS FILLET WELDS ≤ $^5/_{16}$	-	X
5) FLOOR AND ROOF DECK WELDS	-	X
- REINFORCING STEEL:	-	-
1) VERIFICATION OF WELDABILITY OF REINFORCING STEEL OTHER THAN ASTM A706	-	X
2) REINFORCING STEEL RESISTING FLEXURAL AND AXIAL FORCES IN INTERMEDIATE AND SPECIAL MOMENT FRAMES, AND BOUNDARY ELEMENTS OF SPECIAL REINFORCED CONCRETE SHEAR WALLS AND SHEAR REINFORCEMENT.	X	-
3) SHEAR REINFORCEMENT	X	-
4) OTHER REINFORCING STEEL	-	X
INSPECTION OF STEEL FRAME JOINT FOR COMPLIANCE WITH APPROVED CONSTRUCTION DOCUMENTS:		X
- DETAILS SUCH AS BRACING AND STIFFENING	-	X
- MEMBER LOCATIONS	-	X
- APPLICATION OF JOINT DETAILS AT EACH CONNECTION	-	X

REQUIRED VERIFICATION AND INSPECTION OF SOILS

REFERENCE IBC 2009, TABLE 1704.7

TASK	CONTINUOUS	PERIODIC
VERIFY MATERIALS BELOW FOOTINGS ARE ADEQUATE TO ACHIEVE THE DESIGN BEARING CAPACITY.	-	X
VERIFY EXCAVATIONS ARE EXTENDED TO PROPER DEPTH AND HAVE REACH PROPER MATERIAL.	-	X
PERFORM CLASSIFICATION AND TESTING OF CONTROLLED FILL MATERIALS.	-	X
VERIFY USE OF PROPER MATERIALS, DENSITIES AND LIFT THICKNESSES DURING PLACEMENT AND COMPACTION OF CONTROLLED FILL.	X	-
PRIOR PLACEMENT OF CONTROLLED FILL, OBSERVE SUBGRADE AND VERIFY THAT SITE HAS BEEN PREPARED PROPERLY.	-	X
PRIOR PLACEMENT IF CONTROLLED FILL, OBSERVE PERIMETER AND UNDERSLAB DRAIN AND VERIFY THAT THEY HAVE BEEN PROPERLY INSTALLED, SEE CIVIL DRAWINGS.	X	-
OBSERVE VOID FORM INSTALLATION AND VERIFY THAT THE LISTED VOID DEPTH IS MAINTAINED DURING CONSTRUCTION.	-	X

REQUIRED VERIFICATION AND INSPECTION OF CONC. CONSTRUCTION

REFERENCE IBC 2009, TABLE 1704.4

TASK	CONTINUOUS	PERIODIC
INSPECTION OF REINFORCING STEEL, INCLUDING PRESTRESSING TENDONS AND PLACEMENT.	-	X
INSPECTION OF REINFORCING STEEL, WELDING IN ACCORDANCE WITH IBC 2009, TABLE 1704.3, ITEM 5b.	X	-
INSPECT BOLTS TO BE INSTALLED IN CONCRETE PRIOR TO AND DURING PLACEMENT OF CONCRETE.	X	-
VERIFYING USE OF REQUIRED DESIGN MIX.	-	X
AT THE TIME FRESH CONCRETE IS STAMPED TO FABRICATE SPECIMENS FOR STRENGTH TESTS, PERFORM SLUMP AND CONTENT TESTS, AND DETERMINE THE TEMPERATURE OF THE CONCRETE.	X	-
INSPECTION OF CONCRETE AND SHOTCRETE PLACEMENT FOR PROPER APPLICATION TECHNIQUES.	X	-
INSPECTION FOR MAINTENANCE OF SPECIFIED CURING TEMPERATURES AND TECHNIQUES.	-	X
INSPECT STUD RAILS FOR IDENTIFICATION CONDITION, POSITIONING, CLEARANCES AND CONCRETE COVER.	X	-
INSPECTION OF PRESTRESSED CONCRETE:		
- APPLICATION OF PRESTRESSING FORCES.	X	-
- GROUTING OF BONDED PRESTRESSING TENDONS IN THE SEISMIC FORCE RESISTING SYSTEM.	X	-
ERECTION OF PRECAST CONCRETE MEMBERS.	-	X
VERIFICATION OF IN-SITU CONCRETE STRENGTH, PRIOR TO STRESSING OF TENDONS IN POST-TENSIONED CONCRETE PRIOR TO REMOVAL OF SHORES AND FORMS FROM BEAMS AND STRUCTURAL SLABS.	-	X
INSPECT FORM WORK FOR SHAPE, LOCATION AND DIMENSIONS OF THE CONCRETE MEMBER BEING FORMED.	-	X
DURING APPLICATION OF FRP STRENGTHENING	X	-

CONCRETE MIX SCHEDULE

CONCRETE MIX TYPE	INTENDED USE	28 DAY STRENGTH, fc (KSI)	CONCRETE WEIGHT	MAX W/C RATIO, INCLUDING FLY ASH	MIN CEMENT MATERIAL (#/CY), INCLUDING FLY ASH	MAX AGGREGATE SIZE (IN), NOTE a	SLUMP LIMITS (IN), TOLERANCE = +1-1/2 ", -1-1/2"	TOTAL AIR CONTENT (%), NOTE b	CEMENT TYPE	REQUIRES ADMIXTURES, NOTE c	OTHER REQUIREMENTS, NOTE d
1	DRILLED PIERS	4	NWC	-	470	1	7	6	I / II	NOTE e	HRNP
2	GRADE BMS, TIE BMS, BSMT WALLS, PIER CAPS	4	NWC	-	470	3/4	4	5	I / II	AE	-
3	WALLS, COLUMNS	4	NWC	0.50	517	3/8	4	-	I / II	MRWRA	-
4	STRUCTURAL SLABS AND BEAMS	4	NWC	0.50	517	3/4	4	NP	I / II	-	-
5	ALL CONC. EXPOSED TO WEATHER OR DEICERS: BEAMS, SLABS, WALLS, COLUMNS [PARKING STRUCTURES, LOADING DOCKS, SITE WALLS]	4	NWC	0.40	564	3/4	4	6	I / II	AE, WRA	-
6	INT TOPPING SLABS, SLABS ON DECK	4	LWC	0.50	517	3/4	4	NP	I / II	-	-
7	INT SLAB ON GRADE	4	NWC	-	517	1	4	NP	I / II	-	-
8	SLAB ON GRADE WITH MOISTURE SENSITIVE FLOORING	4	NWC	0.45	517	1	4	NP	I / II	WRA	-
9	ALL CONC OTHERWISE NOT SPECIFIED	4	NWC [LWC]	0.50	517	3/4	4	6	I / II	AE	-

CONCRETE MIX TABLE NOTES:
a. FOR THE MAXIMUM COURSE AGGREGATE SIZE INDICATED, USE THE FOLLOWING AGGREGATE SIZE NUMBERS PER ASTM C33.
3/8": #8 AGGREGATE
3/4": #67 AGGREGATE
1": #57 AGGREGATE

b. TOTAL AIR CONTENT LIMITS INCLUDE BOTH ENTRAINED AND ENTRAPPED AIR +/- 1-1/2%. 'NP' IN COLUMN INDICATES ADDITION OF ENTRAINED AIR IS NOT PERMITTED.

c. ABBREVIATIONS FOR THE REQUIRED ADMIXTURES AS FOLLOWS:
AE = AIR-ENTRAINING ADMIXTURE. DO NOT USE ENTRAINED AIR FOR STEEL TROWELED FINISHED FLOORS.
WRA = WATER REDUCED ADMIXTURE.
MRWRA = MID-RANGE WATER REDUCING ADMIXTURE, MAXIMUM SLUMP = 6".
HRWRA = HIGH-RANGE WATER REDUCING ADMIXTURE, MAXIMUM SLUMP = 8".

d. ABBREVIATIONS FOR OTHER REQUIREMENTS AS FOLLOWS:
FRC = FIBER REINFORCED CONCRETE.
MSS = MAXIMUM SHRINKAGE STRAIN LIMITED, RE: SPECS.
FA = FLY ASH NOT PERMITTED.
FAR = FLY ASH REQUIRED.
HRNP = HIGH RANGE WATER REDUCING ADMIXTURE SHALL NOT BE USED TO OBTAIN HIGH SLUMP UNLESS DATA ARE SUBMITTED DEMONSTRATING SLUMP IS NOT LOST UNTIL CONCRETE IS OVER 90 MINUTES OLD.

e. FOR DRILLED PIERS CASED DURING CONSTRUCTION PROVIDE CONCRETE MIX WITH FLOWABILITY TO PREVENT ARCHING WHEN CASING IS PULLED.

f. FOR CONCRETE PLACED BY PUMPING PROVIDE CONCRETE MIX FLOWABILITY TO FACILITATE PUMPING. ENTRAINED AIR AMY BE USED IF IT CAN BE SHOWN THAT THE FLOOR WILL HAVE A FINISH ACCEPTABLE TO THE ARCHITECT WITHOUT BLISTERS.

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GENERAL NOTES SHEET 2

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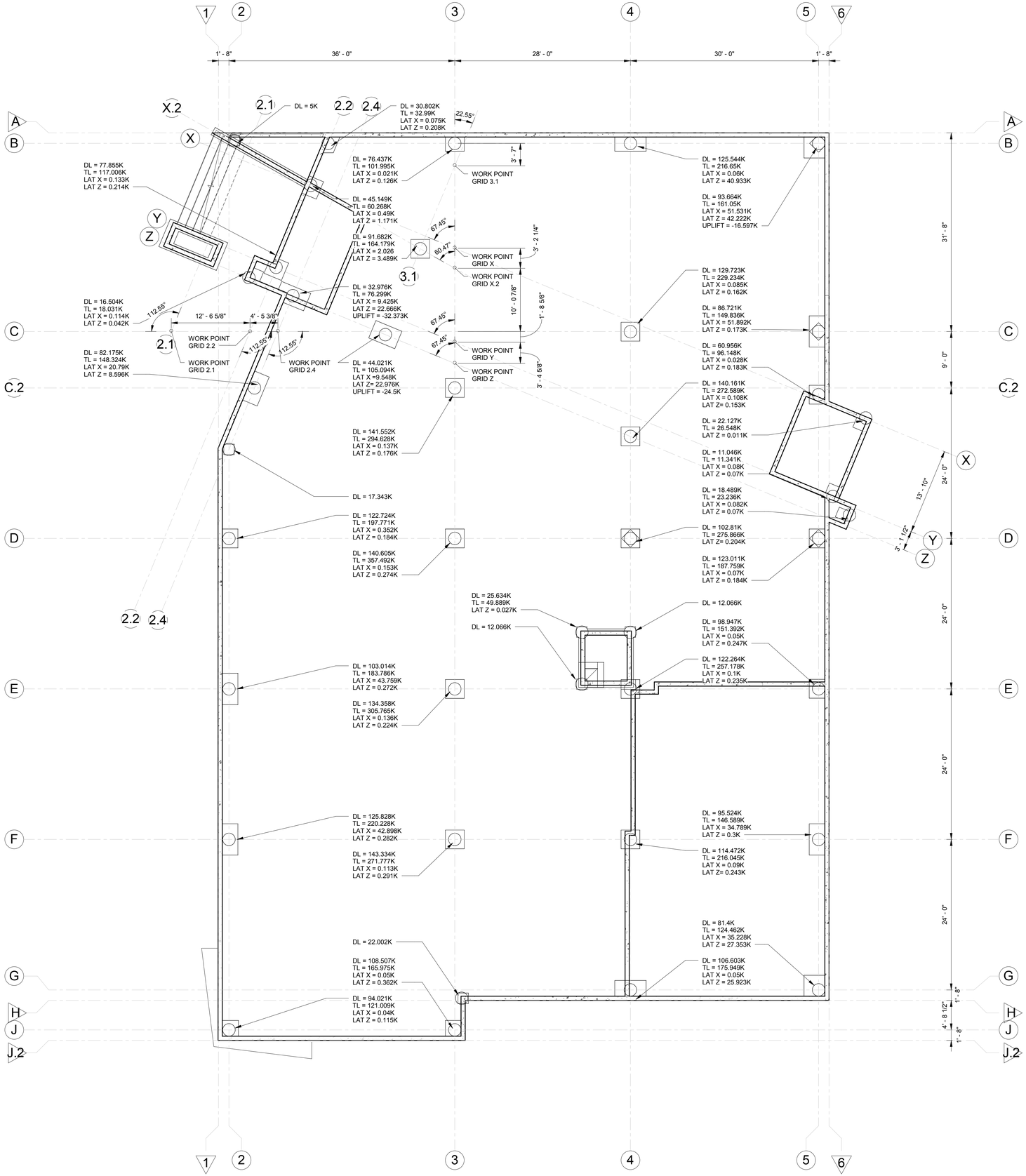

SCREW PILE NOTES

SCREW PILE NOTES:

A. ALPINE SITE SERVICES SCREW PIERS (OR EQUIVALENT APPROVED SCREW PILES OR HELICAL PIERS) SHALL BE INSTALLED BY AN AUTHORIZED CONTRACTOR TO MANUFACTURER'S DETAILS AND RECOMMENDATIONS FOLLOWING THE DESIGN LOADS SHOWN ON THE DRAWINGS.

B. A GEOTECHNICAL ENGINEER, REGISTERED IN THE STATE OF COLORADO, SHALL BE PRESENT DURING ALL DRILLING OPERATIONS, AND SHALL RECORD AND SUBMIT A PIER DRILLING LOG, SIGNED AND SEALED BY THE SUPERVISING GEOTECHNICAL ENGINEER.

C. SCREW PILES SHALL BE TORQUED PER THE MANUFACTURER TO ACHIEVE A FACTOR OF SAFETY OF 2.0 ABOVE THE DESIGN LOADS SHOWN ON THE PLANS. ALL SCREW PILES SHALL BE INSTALLED TO A MINIMUM OF 3,000 FT-LBS TORQUE.

D. ALL PIERS MUST BE CORROSION PROTECTED BY HOT DIP GALVANIZATION, U.O.N.

E. INSTALLATION TORQUE SHALL BE MONITORED THROUGHOUT THE INSTALLATION PROCESS.

LEDGEND:

◯ = PROPOSED LOCATION OF SINGLE/MULTIPLE SCREW PILES. REFER TO SCREW PILE DRAWINGS FOR LOCATION/SPACING (AND IF SCREW PILES ARE BATTER) OF SCREW PILES.

DL = DEAD LOAD AT BOTTOM OF CONCRETE PILASTER (ASD LOAD)

TL = TOTAL DESIGN LOAD (INCLUDING DEAD LOAD) AT BOTTOM OF CONCRETE PILASTER (ASD LOAD)

LAT = TOTAL LATERAL DESIGN LOAD (IN X OR Z DIRECTION) AT BOTTOM OF CONCRETE PILASTER (ASD LOAD)

X Z

UPLIFT = TOTAL UPLIFT DESIGN LOAD AT BOTTOM ON CONCRETE PILASTER (ASD LOAD)

K = KIPS

1 SCREW PILE LOAD PLAN
1/8" = 1'-0"

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SCREW PILE LOAD PLAN

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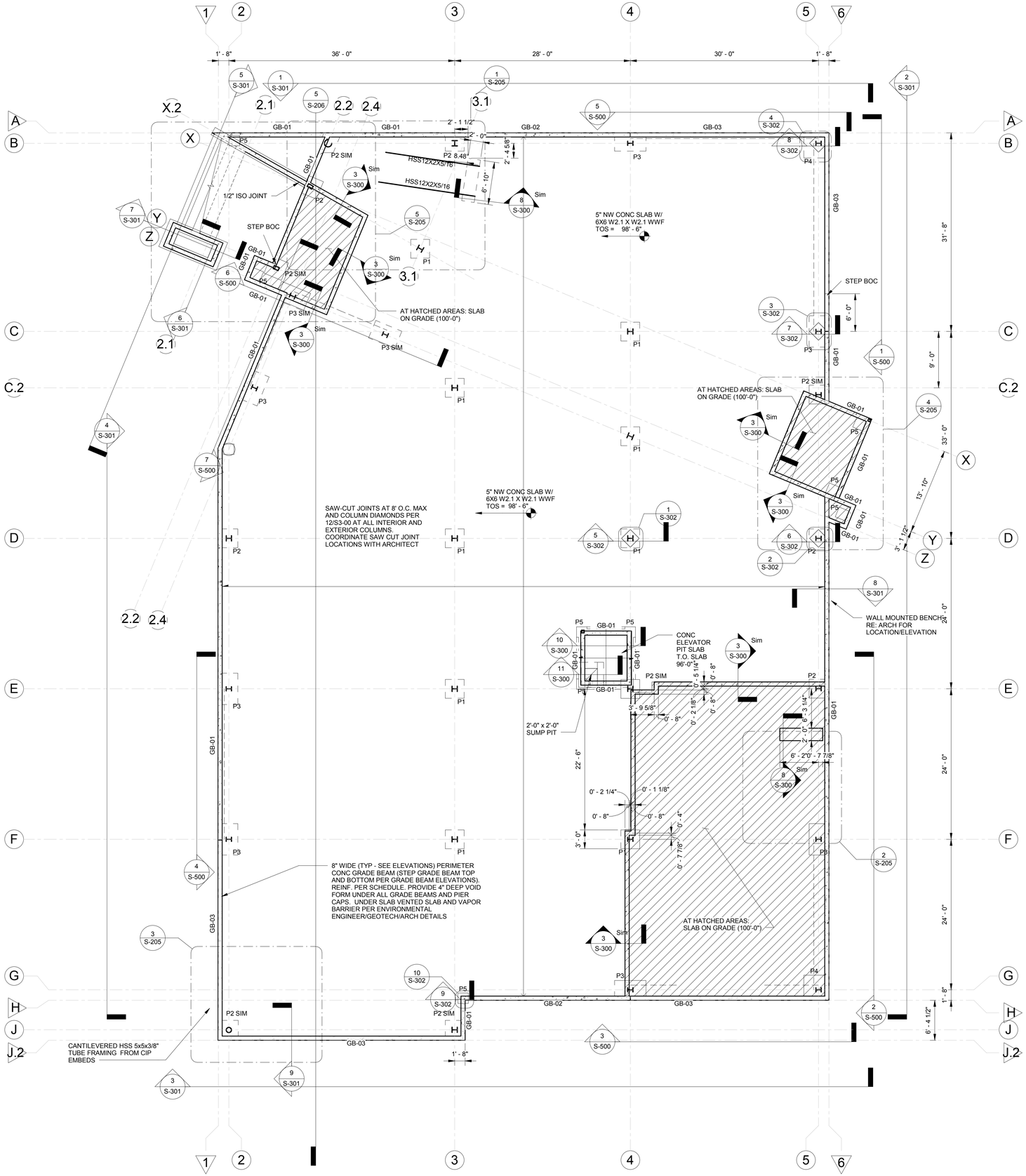

GRADE BEAM SCHEDULE					
WALL ID	WIDTH	TOP	MID	BOTTOM	VERTICAL
GB-01	0' - 8"	(2) #6	#5 @ 18"	(2) #6	#4 TIES @ 18" OC
GB-02	0' - 8"	(2) #7	#5 @ 18"	(2) #7	#4 TIES @ 18" OC
GB-03	0' - 8"	(4) #6	#5 @ 18"	(4) #6	#4 TIES @ 18" OC

PILASTER SCHEDULE		
LABEL	TYPE	DETAIL
P1	TYPE 1	1/S302,5/S302
P2	TYPE 2	2/S302,6S302
P2 SIM		
P2 SIM	TYPE 2	2/S302,6S302
P2 SIM		
P3	TYPE 3	3/S302,7/S302
P3 SIM		
P4	TYPE 4	4/S302,8/S302
P5	TYPE 5	9/S302,10/S302

FOUNDATION NOTES:

1. REFER TO GENERAL STRUCTURAL NOTES DRAWING.
2. VERIFY ALL DIMENSIONS WITH ARCHITECTURAL DRAWINGS.
3. VERIFY SITE DATUM WITH ARCHITECTS DRAWINGS.
4. CONTRACTOR SHALL VERIFY ALL FIELD DIMENSIONS PRIOR TO CONSTRUCTION.
5. TYPICAL DETAILS ARE NOT CUT AT EVERY LOCATION THEY OCCUR. IF A CONDITION IS UNCLEAR, CONTACT ARCHITECT IMMEDIATELY BEFORE PROCEEDING.
6. SLAB ON GRADE SHALL BE 5" CONCRETE REINFORCED WITH 6x6-W2.1xW2.1 WWF, REFER TO ARCHITECTURAL PLANS.
7. P1, P2, ETC – AS SHOWN ON PLANS INDICATES CONCRETE PILASTER, SEE SCHEDULE THIS SHEET.
8. COORDINATE ALL OPENINGS THROUGH FLOORS AND WALLS WITH ARCHITECTURAL, MECHANICAL, ELECTRICAL, PLUMBING AND CIVIL DRAWINGS. TRIM OPENINGS AS SHOWN ON PLANS.
9. SEE MECH, ELECT, AND CIVIL DRAWINGS FOR SLEEVE LOCATIONS. PIPES, CONDUITS AND OTHER PENETRATIONS NOT SHOWN SHALL NOT PASS THROUGH MASONRY OR CONCRETE WALLS OR STEEL BEAMS OR COLUMNS WITHOUT PRIOR APPROVAL FROM STRUCTURAL ENGINEER OF RECORD.
10. VERIFY EXACT LOCATION OF STEPS, RAMPS, DEPRESSED AND/OR RAISED AREAS OF SLAB-ON-GRADE WITH ARCHITECTURAL DRAWINGS.
11. PERIMETER SCREW PILES SHALL BE RATED FOR LOAD INDICATED ON S-200. INTERIOR SCREW PILES SHALL BE RATED FOR LOAD INDICATED. AT ALL BRACED FRAMES (AT LARGER PIER CAPS) PROVIDE (2) BATTERED SCREW PILES RATED FOR LATERAL LOAD INDICATED ON S-200.
12. FOR TOW, BOC, AND BOW ELEVATIONS SEE GRADE BEAM ELEVATIONS SHEET S301.

1 LEVEL 01
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FIRST FLOOR PLAN

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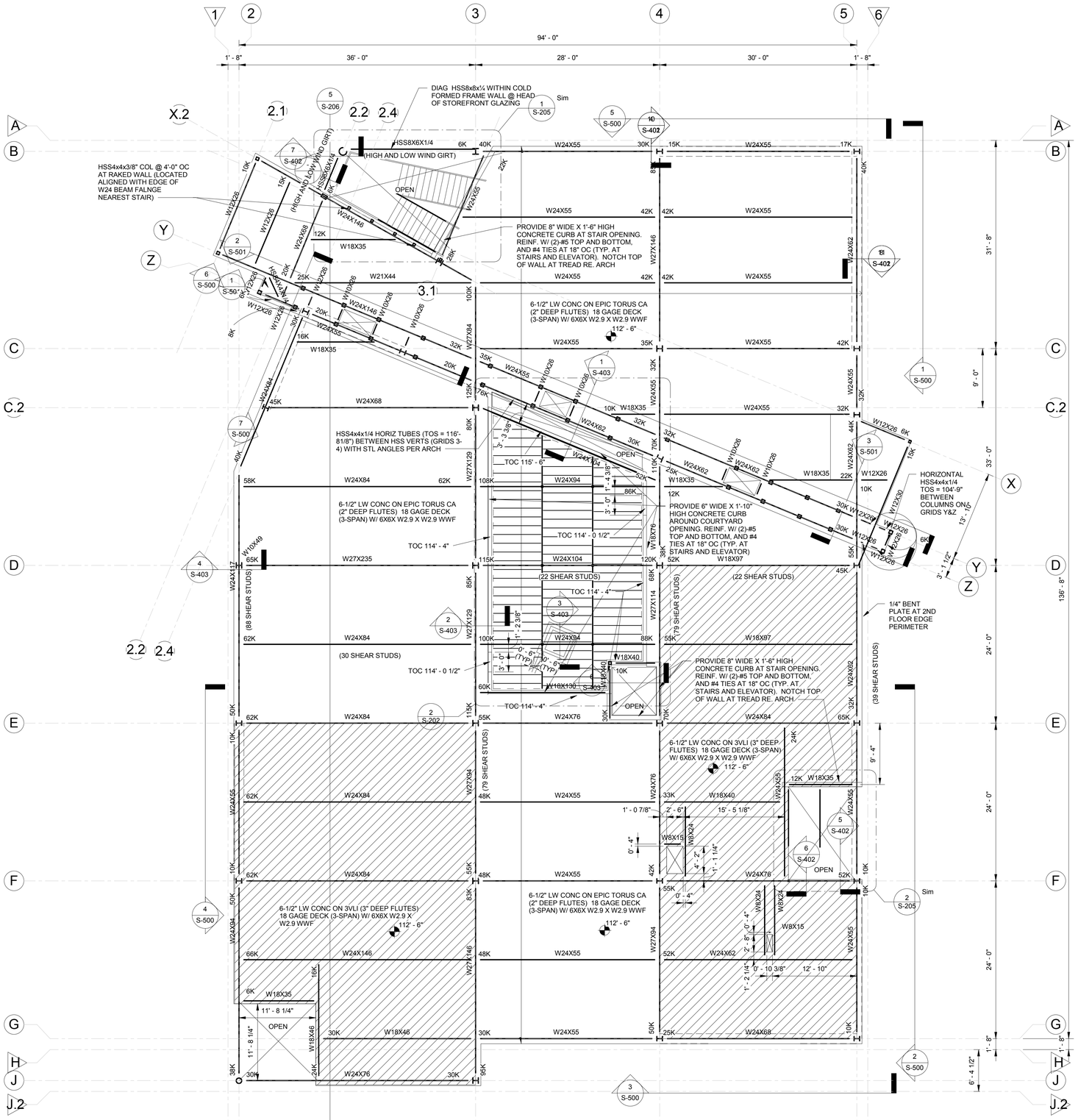

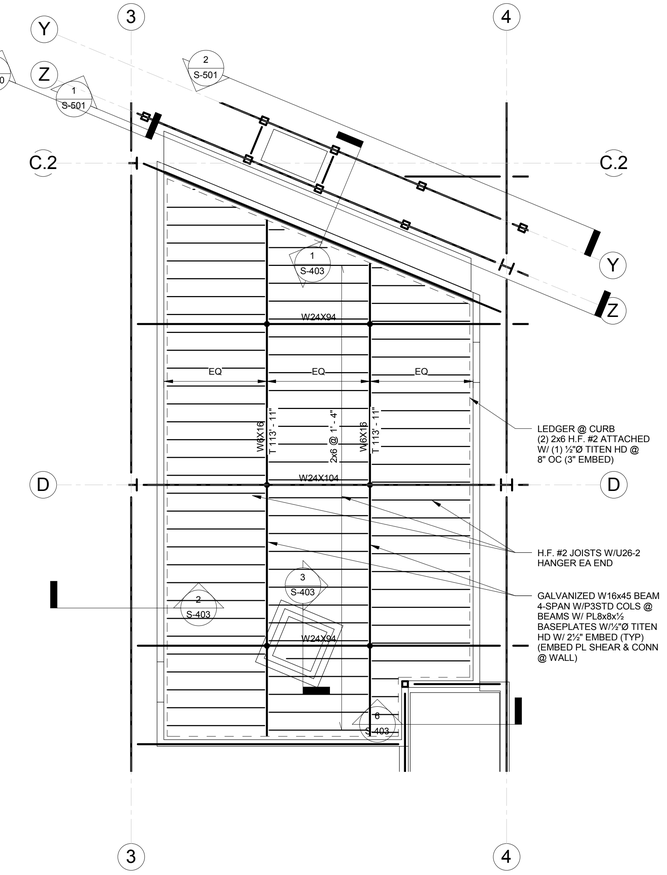

2 Callout of LEVEL 02
3/16" = 1'-0"

1 LEVEL 02
1/8" = 1'-0"

FRAMING NOTES:

1. REFER TO GENERAL STRUCTURAL NOTES DRAWING.
2. VERIFY ALL DIMENSIONS WITH ARCHITECTURALDRAWINGS.
3. VERIFY SITE DATUM WITH ARCHITECTS DRAWINGS.
4. CONTRACTOR SHALL VERIFY ALL FIELD DIMENSIONS PRIOR TO CONSTRUCTION.
5. TYPICAL DETAILS ARE NOT CUT AT EVERY LOCATION THEY OCCUR. IF A CONDITION IS UNCLEAR, CONTACT ARCHITECT IMMEDIATELY BEFORE PROCEEDING.
6. TOP OF CONCRETE SLAB IS AS NOTED ON PLAN.
7. TOP OF STEEL IS NOTED THUS (-#' -#") AND IS 111'-11 1/2" THIS LEVEL UNO.
8. ALL COMPOSITE STEEL BEAMS ARE DESIGNED FOR UNSHORED CONSTRUCTION. DO NOT SHORE COMPOSITE BEAMS WITHOUT PERMISSION OF ENGINEER.
9. CONCRETE SLAB IS LIGHTWEIGHT (115 PCF) COMPOSITE 6 1/2" EPIC TORIS CA 18 GAGE DECK (EXCEPT HATCHED AREAS WHICH ARE 6 1/2" LIGHTWEIGHT CONCRETE ON 3LV18.) IT SHALL BE CONNECTED W/ BEAM SHEAR STUDS AS SHOWN IN ON THE PLAN AND PER MANUFACTURER'S RECOMMENDATIONS (DIAPHRAGM LOAD = 957 PLF). ALL DECKING SHALL BE CONTINUOUS OVER THREE SPANS (MINIMUM) OTHERWISE SHORING WILL BE REQUIRED TO SUPPORT THE DECK AT MIDSPAN UNO.
10. COMPOSITE BEAM SHEAR STUDS SHALL BE NELSON ASTM 108 ¾" DIAMETER, 4" L.A.W. (LENGTH AFTER WELDING) AT SPACING SHOWN ON PLANS (MAX. 12"O.C. ALONG BEAM LENGTH).
11. COORDINATE ALL OPENINGS THROUGH ROOF, FLOORS AND WALLS WITH ARCHITECTURAL, MECHANICAL, ELECTRICAL, PLUMBING AND CIVIL DRAWINGS. TRIM OPENINGS AS SHOWN ON PLANS.
12. SEE MECH, ELECT, AND CIVIL DRAWINGS FOR SLEEVE LOCATIONS. PIPES, CONDUITS AND OTHER PENETRATIONS NOT SHOWN SHALL NOT PASS THROUGH MASONRY OR CONCRETE WALLS OR STEEL BEAMS OR COLUMNS WITHOUT PRIOR APPROVAL FROM STRUCTURAL ENGINEER OF RECORD.
13. REFER TO ARCHITECTURAL DRAWINGS FOR FIRE RATING AND UL DESIGN NUMBER.
14. CAMBER ALL STEEL BEAMS GREATER THAN 22'-0" IN LENGTH 3/4" UNLESS OTHERWISE NOTED.

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SECOND FLOOR PLAN

S-202

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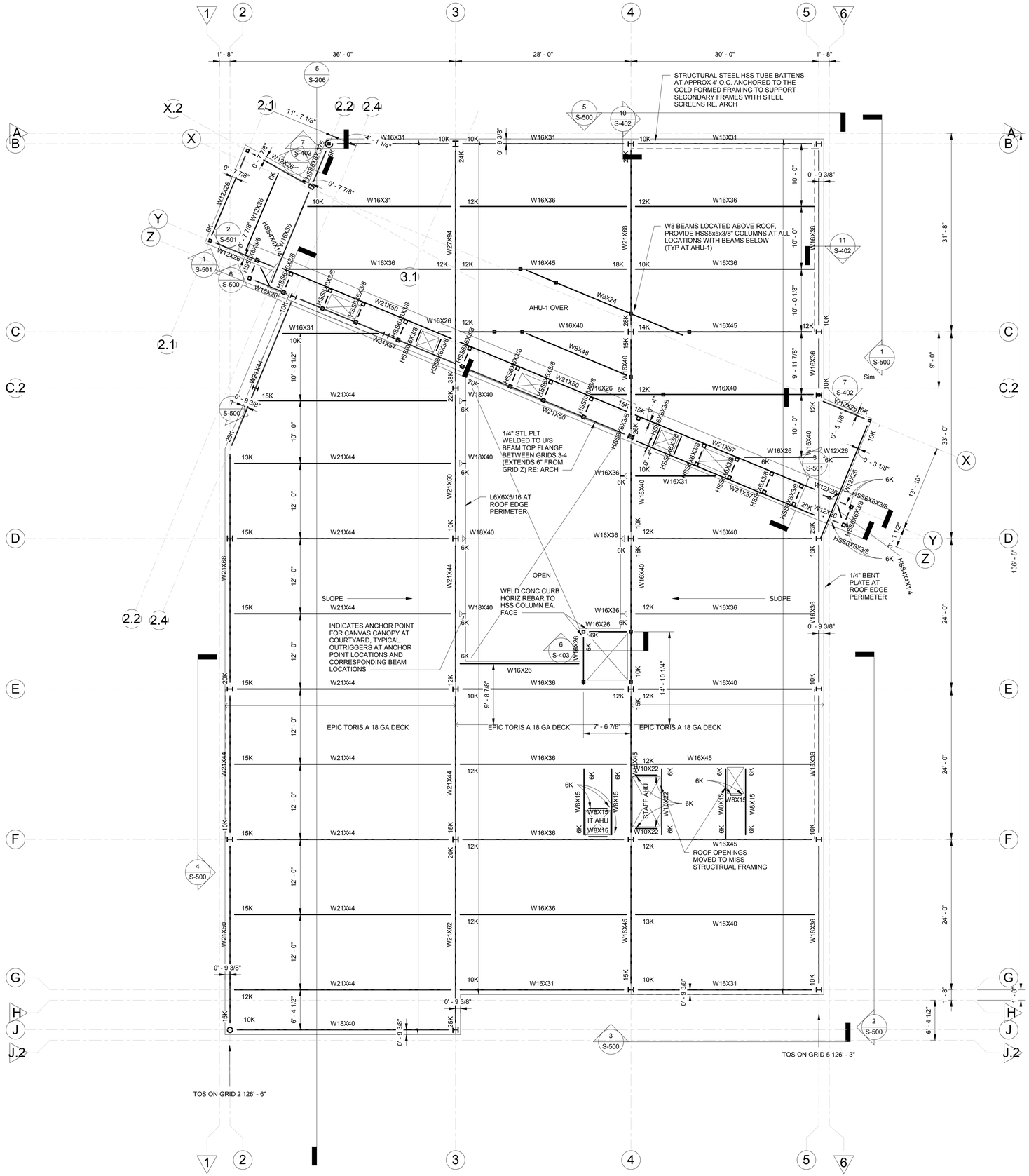

FRAMING NOTES:

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2. VERIFY ALL DIMENSIONS WITH ARCHITECTURAL DRAWINGS.
3. VERIFY SITE DATUM WITH ARCHITECTS DRAWINGS.
4. CONTRACTOR SHALL VERIFY ALL FIELD DIMENSIONS PRIOR TO CONSTRUCTION.
5. TYPICAL DETAILS ARE NOT CUT AT EVERY LOCATION THEY OCCUR. IF A CONDITION IS UNCLEAR, CONTACT ARCHITECT IMMEDIATELY BEFORE PROCEEDING.
6. TOP OF STEEL IS NOTED THUS (-# '-#") AND IS 125'-0" THIS LEVEL ON GRIDS 3 AND 4 AT THE ROOF LOW POINT. 126'-3" AT GRID 5 AND 126'-6" AT GRID 2.
7. ROOF DECK IS EPIC TORIS A (18 GAGE). THE DECK SHALL BE CONNECTED TO SUPPORT FRAMING WITH 3/4" WELD @ 24/3 PATTERN AND #12 TEK SIDELAPS @ 24" OC PER MANUFACTURERS RECOMMENDATIONS (DIAPHRAGM LOAD = 422 PLF). ALL DECKING SHALL BE CONTINUOUS OVER TWO SPANS (MINIMUM).
8. COORDINATE ALL OPENINGS THROUGH ROOF AND WALLS WITH ARCHITECTURAL, MECHANICAL, ELECTRICAL, PLUMBING AND CIVIL DRAWINGS. TRIM OPENINGS AS SHOWN ON PLANS.
9. SEE MECH, ELECT, AND CIVIL DRAWINGS FOR SLEEVE LOCATIONS. PIPES, CONDUITS AND OTHER PENETRATIONS NOT SHOWN SHALL NOT PASS THROUGH MASONRY OR CONCRETE WALLS OR STEEL BEAMS OR COLUMNS WITHOUT PRIOR APPROVAL FROM STRUCTURAL ENGINEER OF RECORD.
10. REFER TO ARCHITECTURAL DRAWINGS FOR FIRE RATING AND UL DESIGN NUMBER.

1 ROOF FRAMING
1/8" = 1'-0"

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ROOF PLAN

S-203

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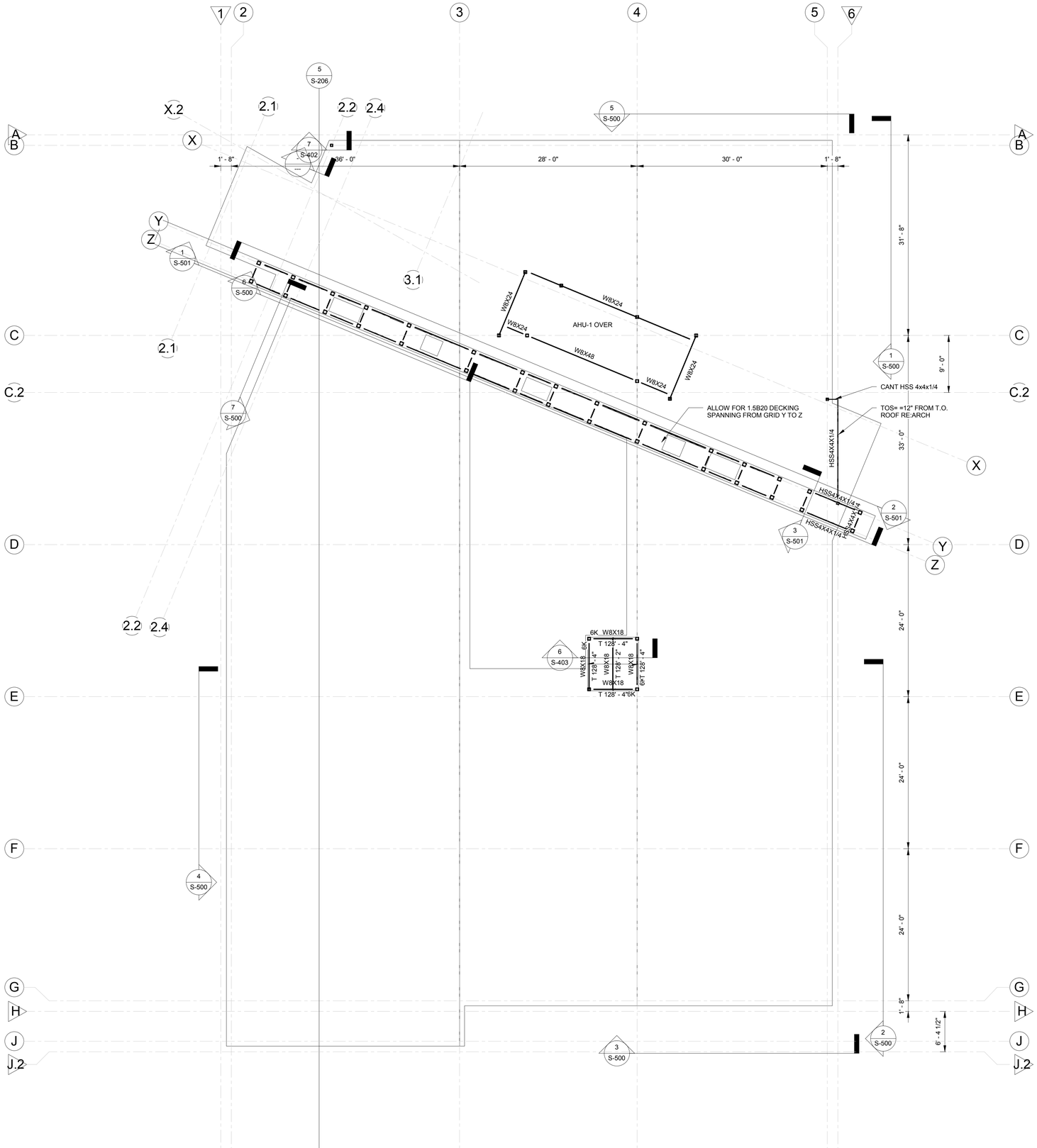

1 UPPER ROOF
1/8" = 1'-0"

FRAMING NOTES:

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4. CONTRACTOR SHALL VERIFY ALL FIELD DIMENSIONS PRIOR TO CONSTRUCTION.
5. TYPICAL DETAILS ARE NOT CUT AT EVERY LOCATION THEY OCCUR. IF A CONDITION IS UNCLEAR, CONTACT ARCHITECT IMMEDIATELY BEFORE PROCEEDING.
6. TOP OF STEEL IS NOTED THUS (-#' -#") AND IS 138'-0" THIS LEVEL UON.
7. ROOF DECK IS VULCRAFT 1.5B20. THE DECK SHALL BE CONNECTED TO SUPPORT FRAMING WITH 5/8" WELDS @ 36/5 PATTERN AND (5) # 10 TEK SCREWS @ SIDELAPS (DIAPHRAGM LOAD = 667 PLF).
8. COORDINATE ALL OPENINGS THROUGH ROOF AND WALLS WITH ARCHITECTURAL, MECHANICAL, ELECTRICAL, PLUMBING AND CIVIL DRAWINGS. TRIM OPENINGS AS SHOWN ON PLANS.
9. SEE MECH, ELECT, AND CIVIL DRAWINGS FOR SLEEVE LOCATIONS. PIPES, CONDUITS AND OTHER PENETRATIONS NOT SHOWN SHALL NOT PASS THROUGH MASONRY OR CONCRETE WALLS OR STEEL BEAMS OR COLUMNS WITHOUT PRIOR APPROVAL FROM STRUCTURAL ENGINEER OF RECORD.
10. REFER TO ARCHITECTURAL DRAWINGS FOR FIRE RATING AND UL DESIGN NUMBER.

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UPPER ROOF PLAN

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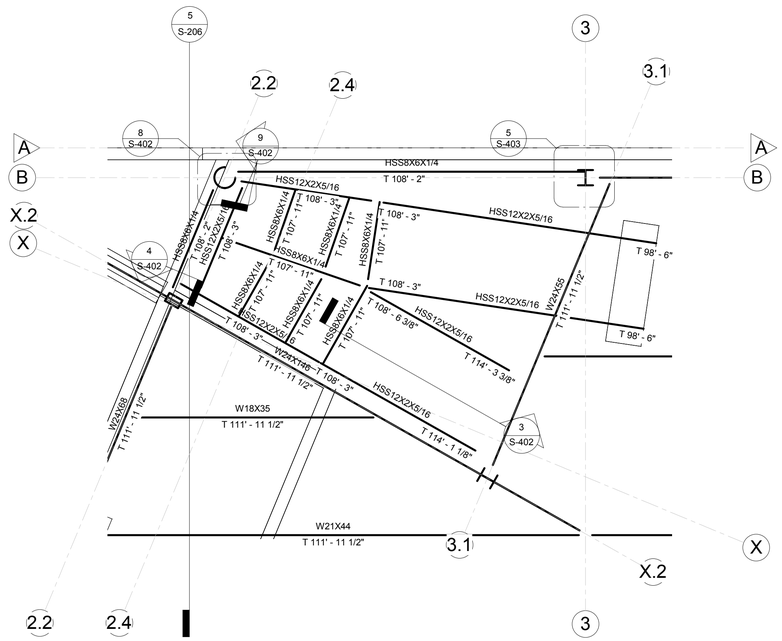
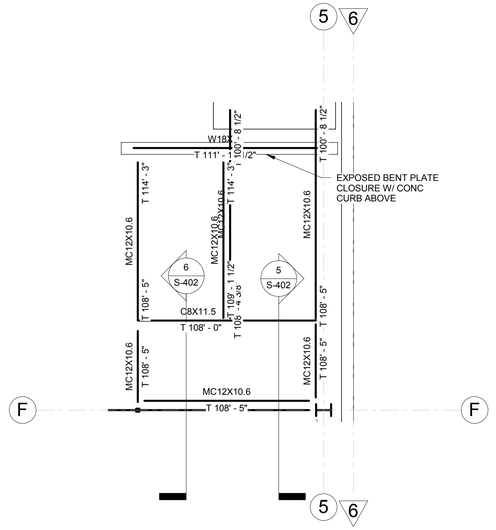
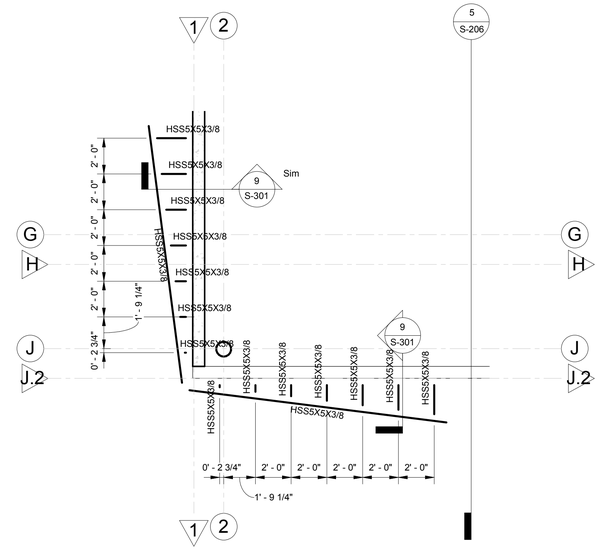


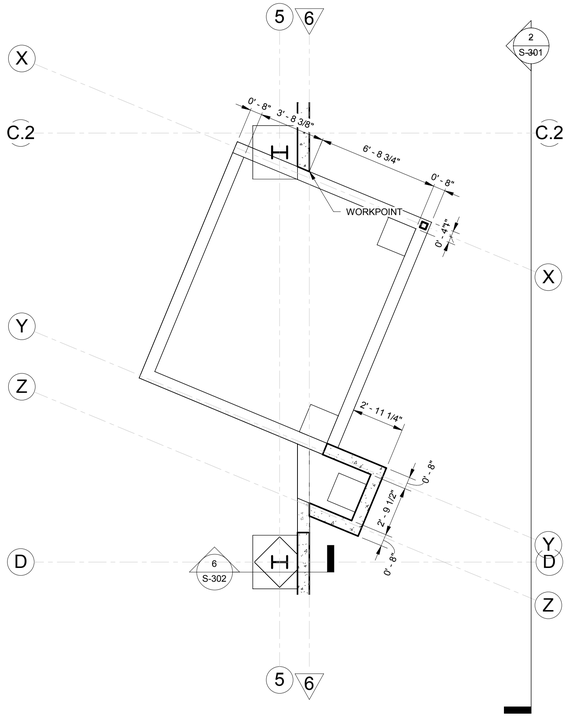
1 MAIN STAIR FRAMING PLAN
1/4" = 1'-0"



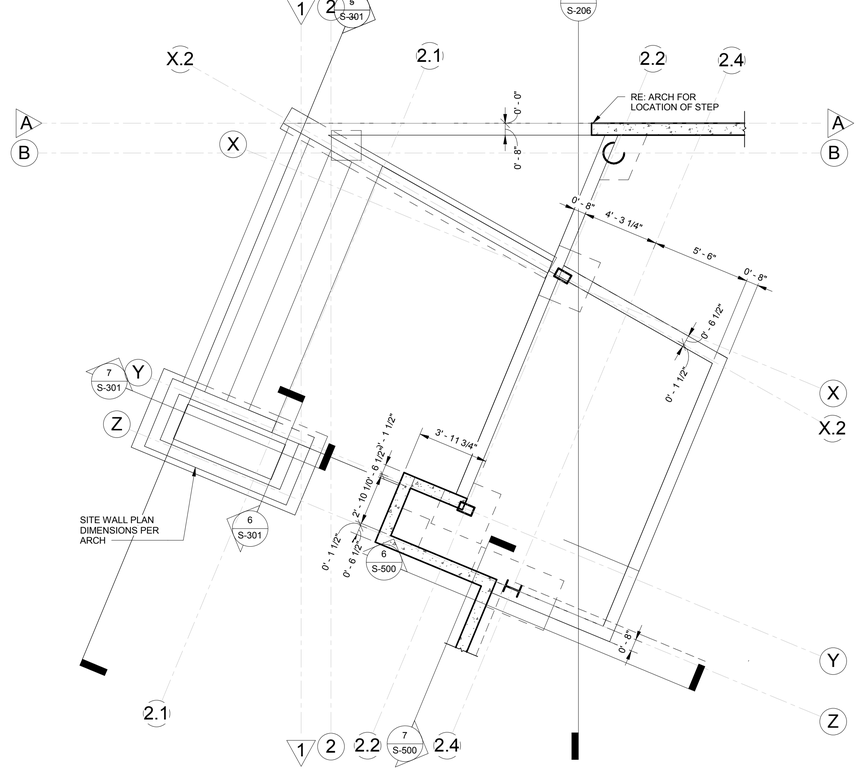
2 STAIR B FRAMING PLAN
1/4" = 1'-0"



3 STORYTIME SEAT FRAMING PLAN
1/4" = 1'-0"



4 VESTIBULE PLAN (EAST)
1/4" = 1'-0"



5 VESTIBULE PLAN (WEST)
1/4" = 1'-0"

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JOHN R. WEHAN
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PROFESSIONAL
ARCHITECT

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ENLARGED PLANS

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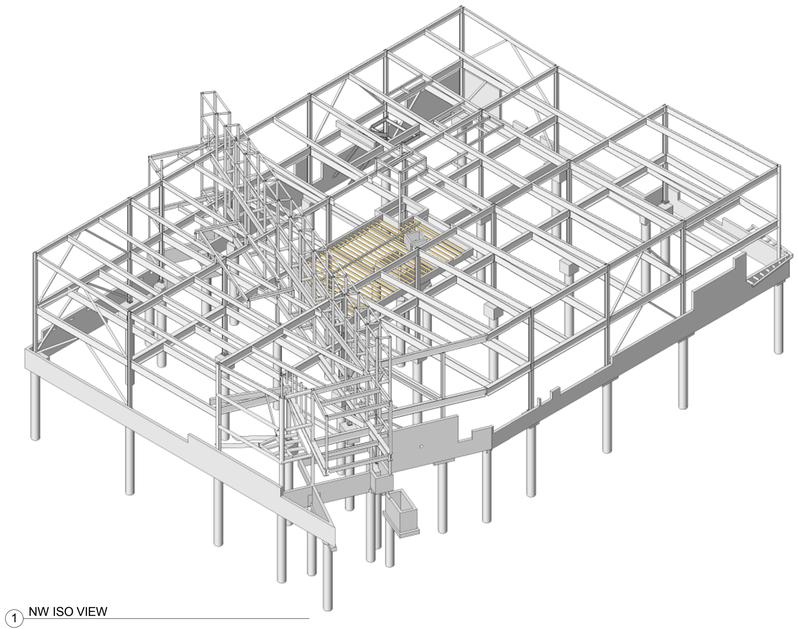
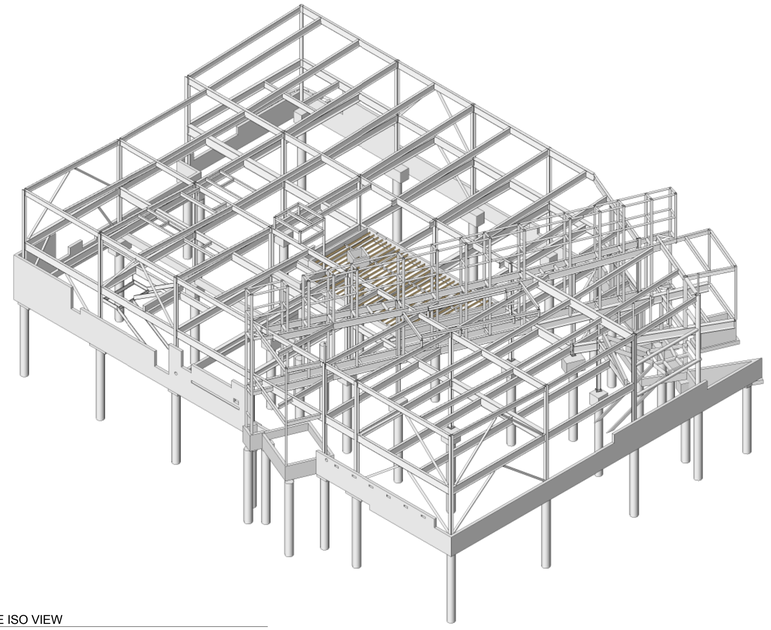
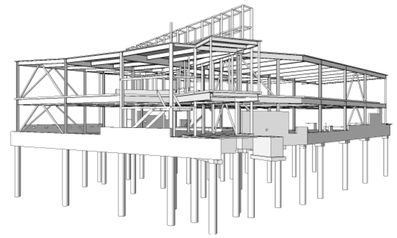


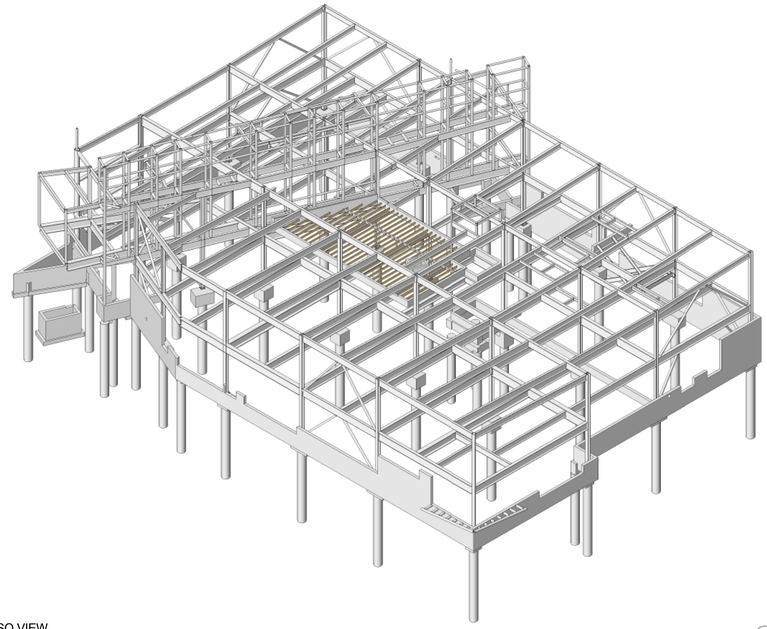
1 NW ISO VIEW



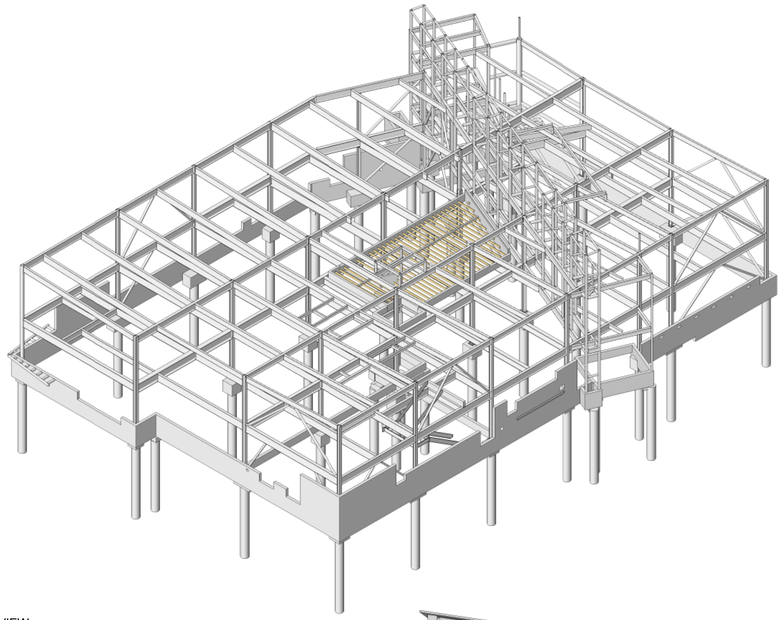
3 NE ISO VIEW



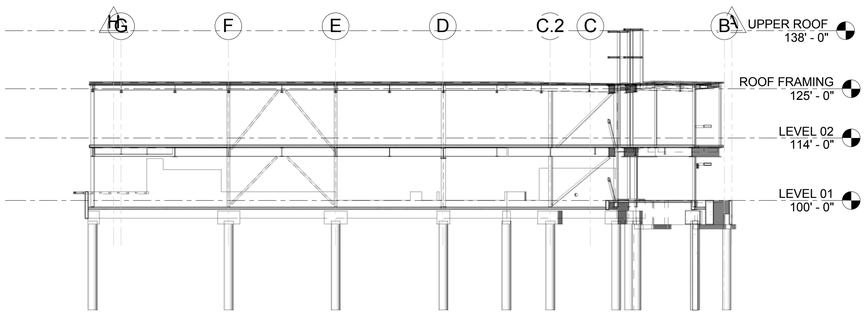
6 3D View 1



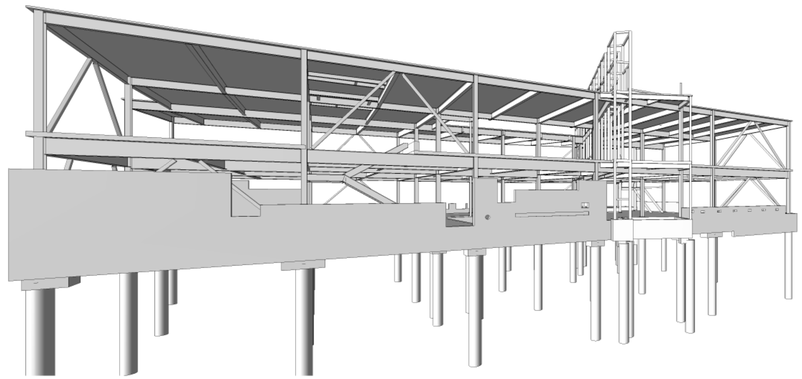
2 SW ISO VIEW



4 SE ISO VIEW



5 LONGITUDINAL SECTION
1/16" = 1'-0"



7 3D View 2

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ISO VIEWS

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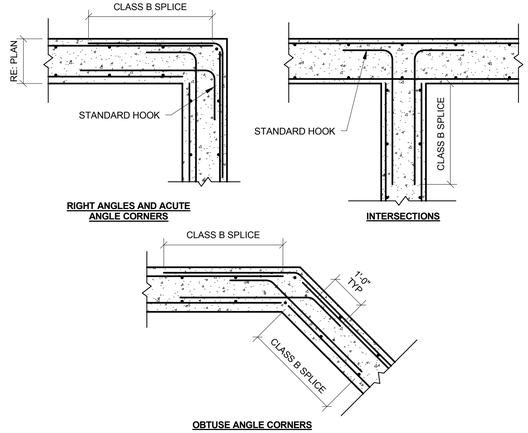
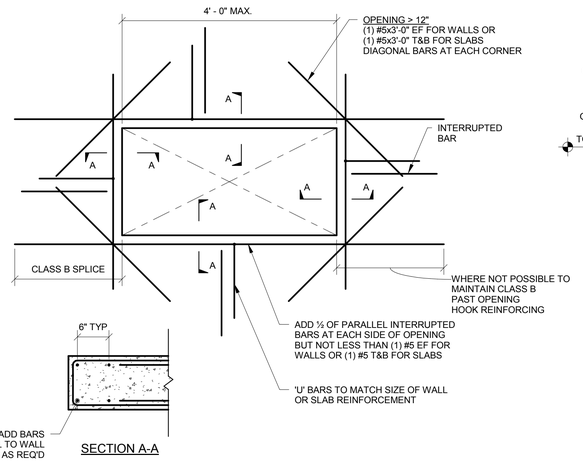
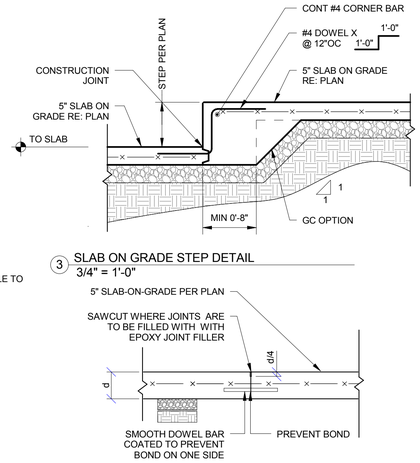


NOTES:
1. SEE WALL ELEVATIONS OR PLANS FOR REINFORCEMENT AT LARGER OPENINGS.
2. CLUSTERS OF SMALL HOLES WHOSE OVERALL MEASUREMENT EXCEEDS 1'-0" SHOULD BE REINFORCED AS ONE OPENING.
3. NO OPENING IN SLAB IS TO BE LOCATED CLOSER THAN 30" FROM COLUMN FACE UNLESS APPROVED BY THE STRUCTURAL ENGINEER.

1 TYPICAL REINF DETAILS @ CORNERS (DOUBLE LAYER SHOWN)
NTS

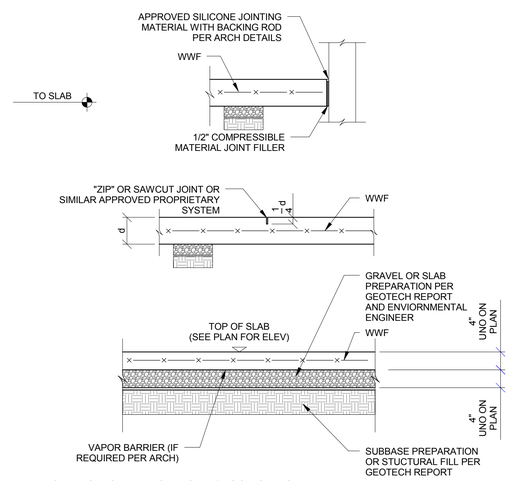


2 CONCRETE CUTOUT REINFORCING
3/4" = 1'-0"

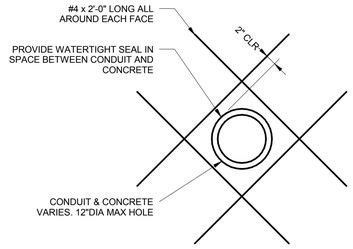


3 SLAB ON GRADE STEP DETAIL
3/4" = 1'-0"

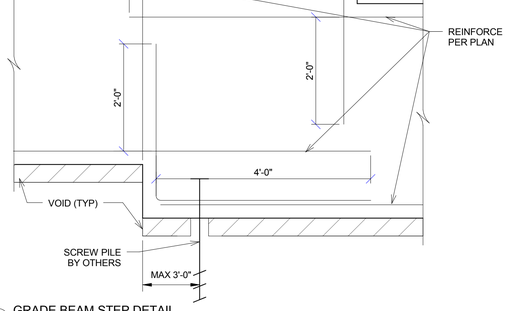
4 TYPICAL CONSTRUCTION JOINT (S.O.G.)
3/4" = 1'-0"



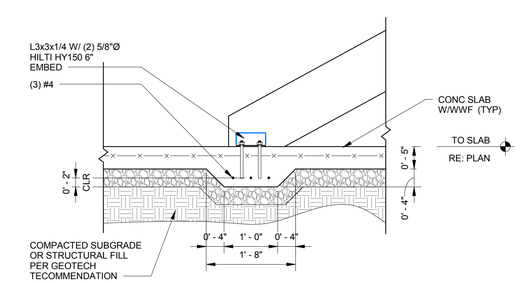
5 SLAB ON GRADE, SAWCUT & ISO JOINTS
3/4" = 1'-0"



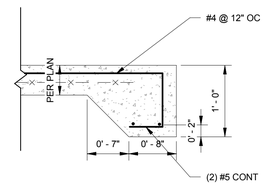
6 TYPICAL BLOCKOUT DETAIL
3/4" = 1'-0"



7 GRADE BEAM STEP DETAIL
3/4" = 1'-0"

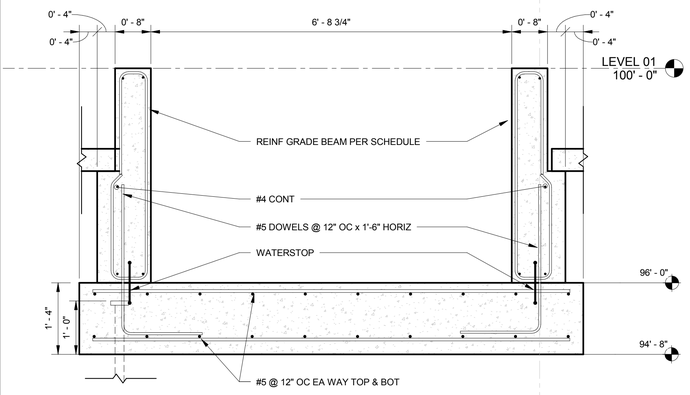


8 THICKENED SLAB STAIR DETAIL
3/4" = 1'-0"

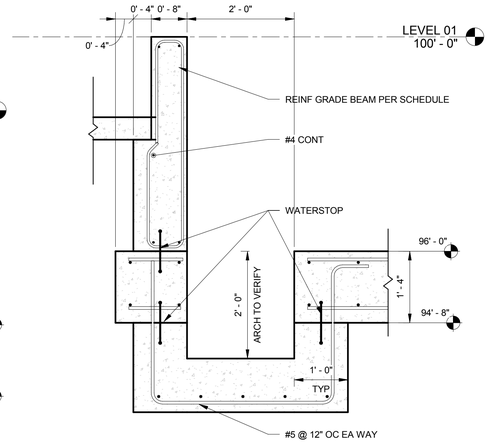


9 TYPICAL THICKENED SLAB EDGE
1" = 1'-0"

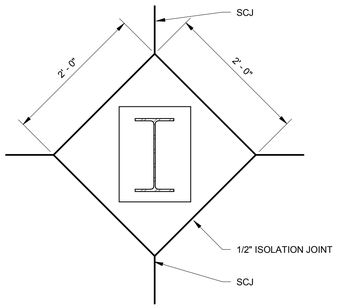
4



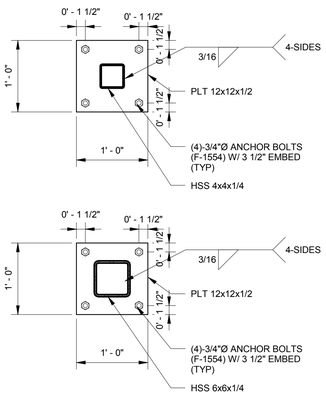
10 ELEVATOR PIT SECTION
3/4" = 1'-0"



11 ELEVATOR SUM PIT SECTION
3/4" = 1'-0"



12 COLUMN ISOLATION JOINT DETAIL
1" = 1'-0"



13 BASE PLATE (AT TRASH GATE)
1" = 1'-0"

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FOUNDATION DETAILS

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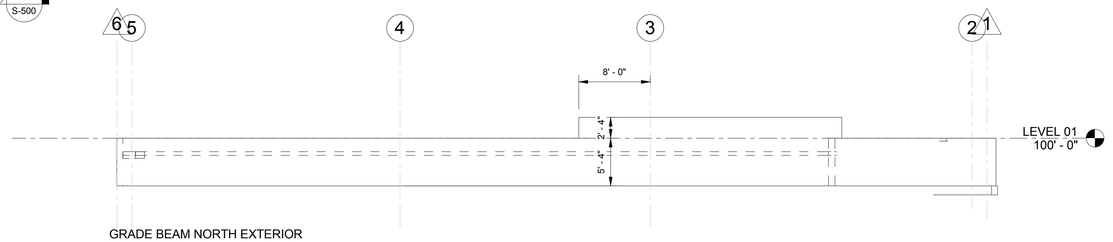
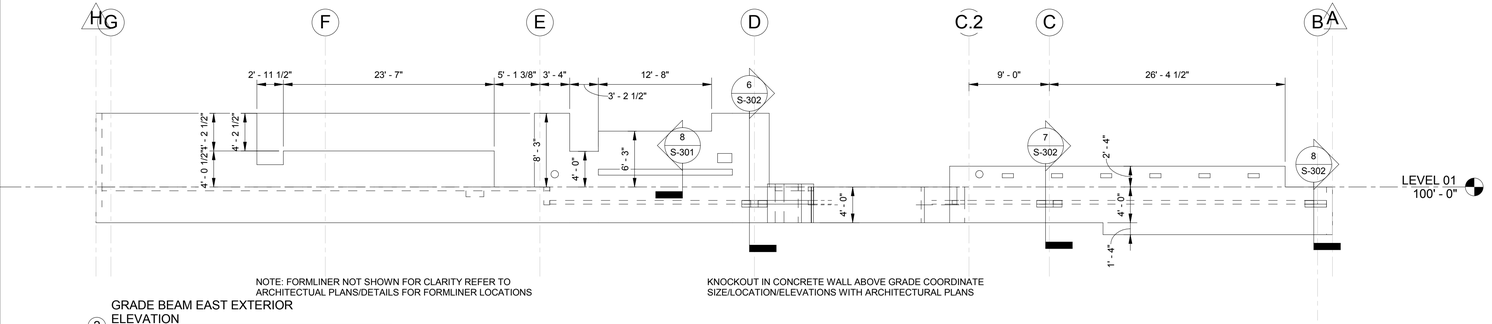


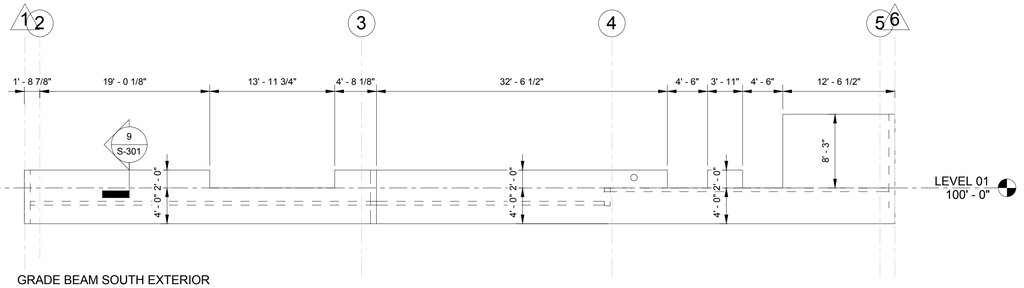
GRADE BEAM NORTH EXTERIOR ELEVATION
1/8" = 1'-0"



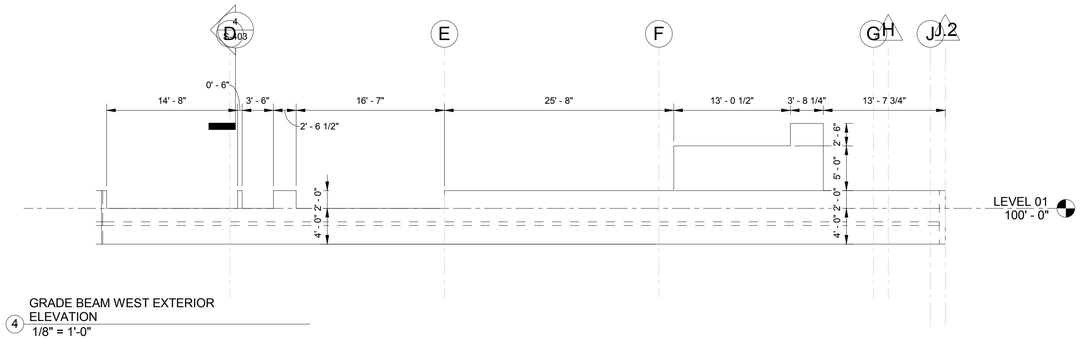
NOTE: FORMLINER NOT SHOWN FOR CLARITY REFER TO ARCHITECTUAL PLANS/DETAILS FOR FORMLINER LOCATIONS

KNOCKOUT IN CONCRETE WALL ABOVE GRADE COORDINATE SIZE/LOCATION/ELEVATIONS WITH ARCHITECTURAL PLANS

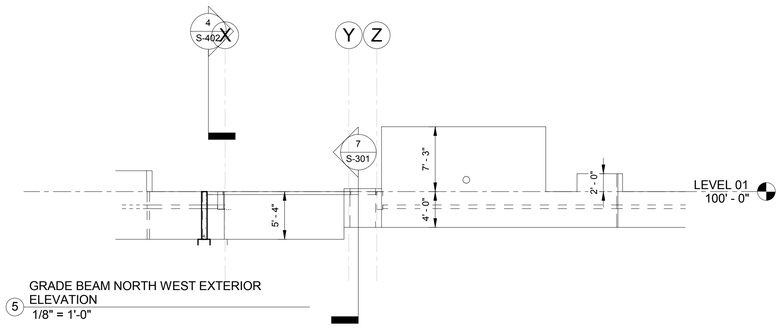
GRADE BEAM EAST EXTERIOR ELEVATION
1/8" = 1'-0"



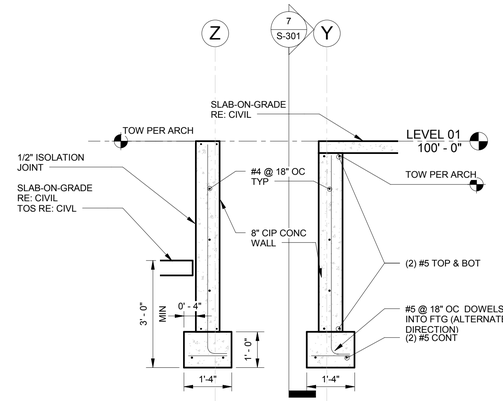
GRADE BEAM SOUTH EXTERIOR ELEVATION
1/8" = 1'-0"



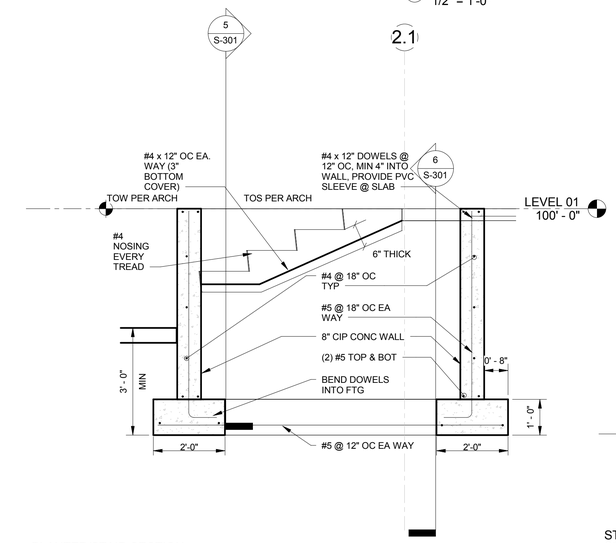
GRADE BEAM WEST EXTERIOR ELEVATION
1/8" = 1'-0"



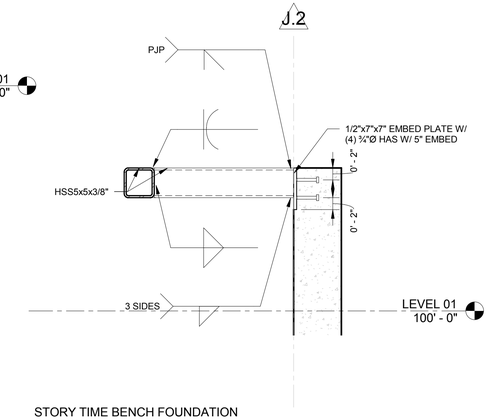
GRADE BEAM NORTH WEST EXTERIOR ELEVATION
1/8" = 1'-0"



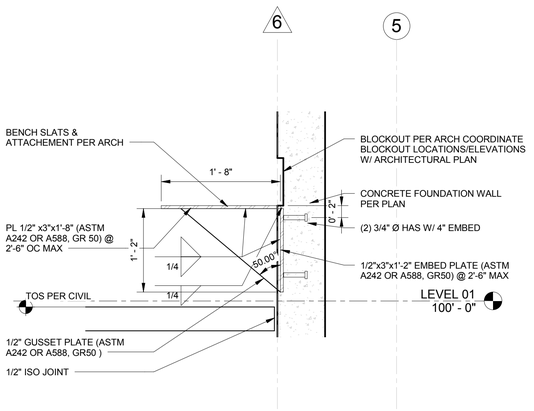
PLANTER SECTION
1/2" = 1'-0"



PLANTER/STAIR SECTION
1/2" = 1'-0"



STORY TIME BENCH FOUNDATION SECTION
1" = 1'-0"



WALL MOUNTED BENCH
1" = 1'-0"

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GRADE BEAM ELEVATIONS & FOUNDATION DETAILS

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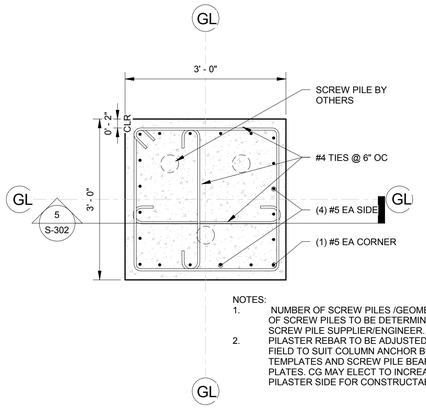
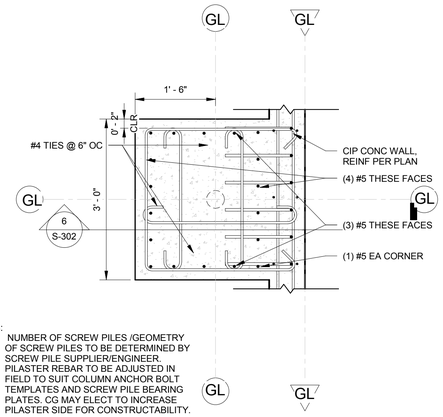


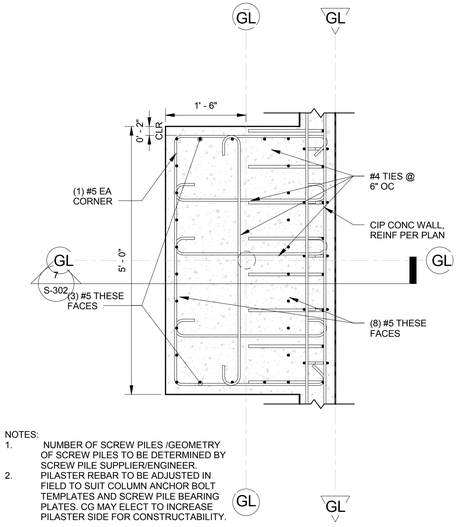
NOTES:
1. NUMBER OF SCREW PILES /GEOMETRY OF SCREW PILES TO BE DETERMINED BY SCREW PILE SUPPLIER/ENGINEER.
2. PILASTER REBAR TO BE ADJUSTED IN FIELD TO SUIT COLUMN ANCHOR BOLT TEMPLATES AND SCREW PILE BEARING PLATES. CG MAY ELECT TO INCREASE PILASTER SIDE FOR CONSTRUCTABILITY.

1 PILASTER TYPE 1 PLAN
3/4" = 1'-0"



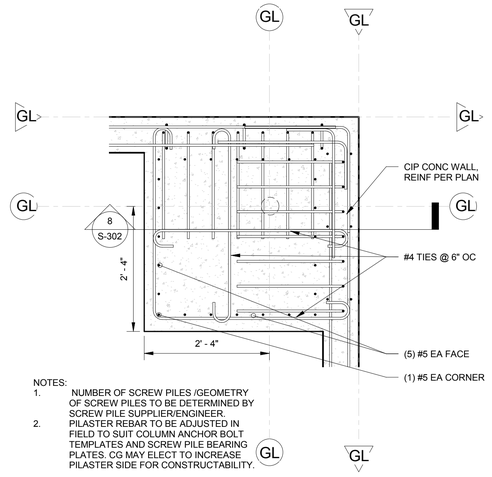
NOTES:
1. NUMBER OF SCREW PILES /GEOMETRY OF SCREW PILES TO BE DETERMINED BY SCREW PILE SUPPLIER/ENGINEER.
2. PILASTER REBAR TO BE ADJUSTED IN FIELD TO SUIT COLUMN ANCHOR BOLT TEMPLATES AND SCREW PILE BEARING PLATES. CG MAY ELECT TO INCREASE PILASTER SIDE FOR CONSTRUCTABILITY.

2 PILASTER TYPE 2 PLAN
3/4" = 1'-0"



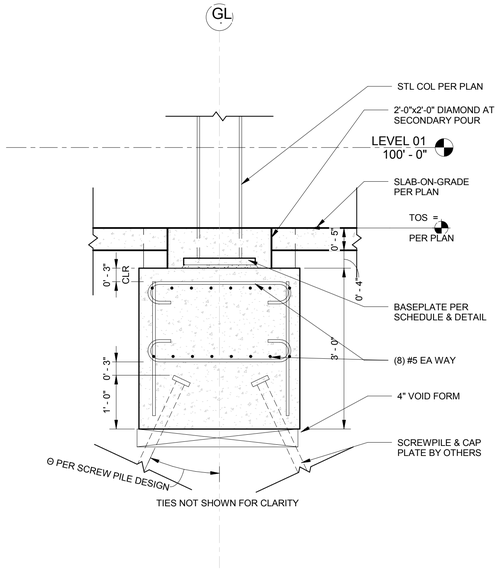
NOTES:
1. NUMBER OF SCREW PILES /GEOMETRY OF SCREW PILES TO BE DETERMINED BY SCREW PILE SUPPLIER/ENGINEER.
2. PILASTER REBAR TO BE ADJUSTED IN FIELD TO SUIT COLUMN ANCHOR BOLT TEMPLATES AND SCREW PILE BEARING PLATES. CG MAY ELECT TO INCREASE PILASTER SIDE FOR CONSTRUCTABILITY.

3 PILASTER TYPE 3 PLAN
3/4" = 1'-0"

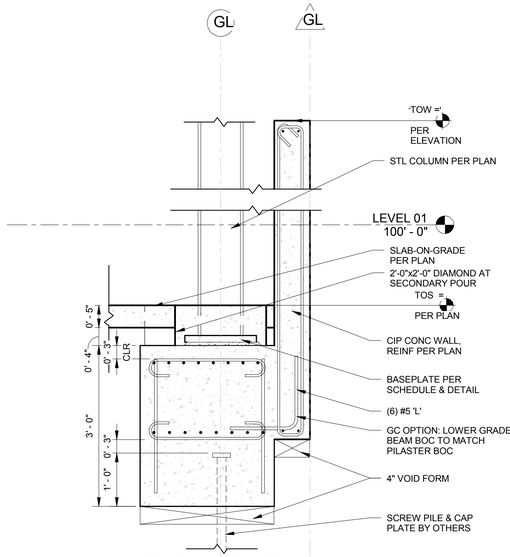


NOTES:
1. NUMBER OF SCREW PILES /GEOMETRY OF SCREW PILES TO BE DETERMINED BY SCREW PILE SUPPLIER/ENGINEER.
2. PILASTER REBAR TO BE ADJUSTED IN FIELD TO SUIT COLUMN ANCHOR BOLT TEMPLATES AND SCREW PILE BEARING PLATES. CG MAY ELECT TO INCREASE PILASTER SIDE FOR CONSTRUCTABILITY.

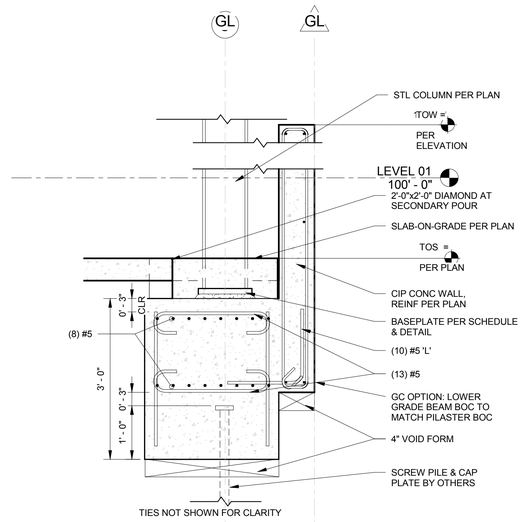
4 PILASTER TYPE 4 PLAN
3/4" = 1'-0"



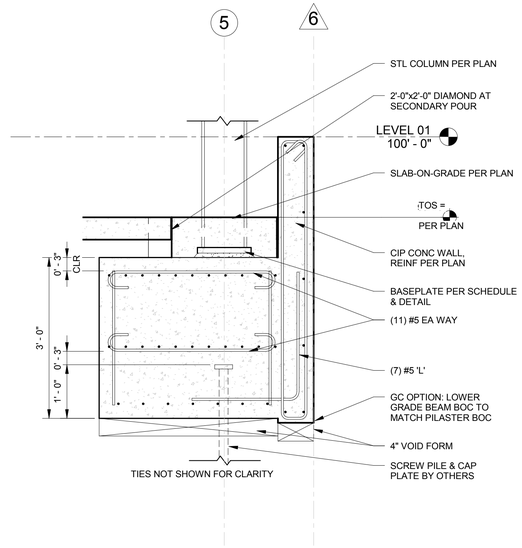
5 PILASTER TYPE 1 SECTION
3/4" = 1'-0"



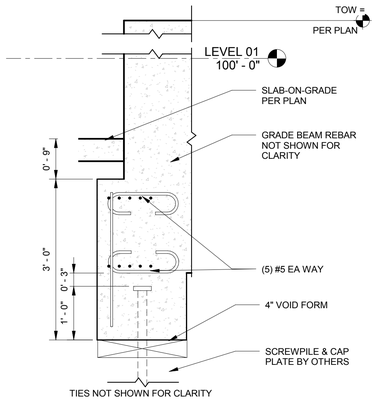
6 PILASTER TYPE 2 SECTION
3/4" = 1'-0"



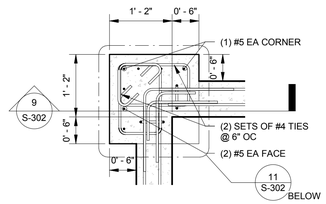
7 PILASTER TYPE 3 SECTION
3/4" = 1'-0"



8 PILASTER TYPE 4 SECTION
3/4" = 1'-0"



9 PILASTER TYPE 5 SECTION
3/4" = 1'-0"



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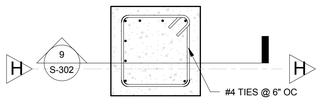
1. NUMBER OF SCREW PILES /GEOMETRY OF SCREW PILES TO BE DETERMINED BY SCREW PILE SUPPLIER/ENGINEER.
2. PILASTER REBAR TO BE ADJUSTED IN FIELD TO SUIT COLUMN ANCHOR BOLT TEMPLATES AND SCREW PILE BEARING PLATES. CG MAY ELECT TO INCREASE PILASTER SIDE FOR CONSTRUCTABILITY.

10 PILASTER TYPE 5 PLAN
3/4" = 1'-0"



11 PILASTER TYPE 5 PLAN LOW
3/4" = 1'-0"

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PILASTER PLANS & DETAILS

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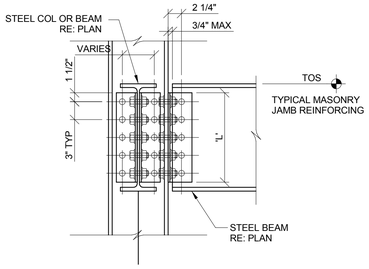
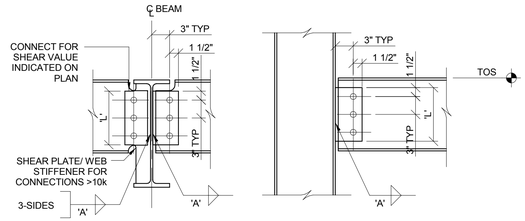


LOAD	NUMBER OF BOLTS	ANGLE THICKNESS	PERMISSIBLE MEMBER SIZES	LENGTH 'L'
40.8k	2	5/16"	W8	6"
63.6k	3	5/16"	W10, 12	9"
83.9k	4	5/16"	W16	12"
104k	5	5/16"	W18, W24	15"

NOTE:
1. ALL BOLTS 3/4" DIA A325N BOLTS IN STD OR SSLT HOLE, SNUG TIGHT.
2. ALL BOLTS AT BRACED FRAME GRIDS SHALL BE 7/8" DIA SLIP CRITICAL.
3. VALUES SHOWN DO NOT ACCOUNT FOR TOP OR BOTTOM FLANGE COPES, REFER TO AISC TABLE 10-1.

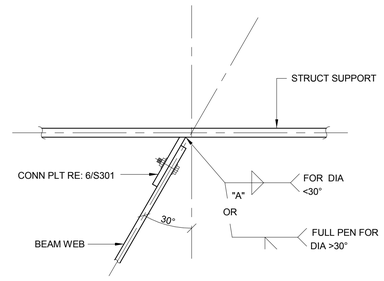
1 TYPICAL ALL-BOLTED DOUBLE-ANGLE CONN DETAIL
1" = 1'-0"



LOAD	NUMBER OF BOLTS	PLATE THICKNESS	PERMISSIBLE MEMBER SIZES	WELD 'A'	LENGTH 'L'
16.3k	2	1/4"	W8	3/16"	5 1/2"
25.6k	3	1/4"	W10	3/16"	8 1/2"
34.7k	4	1/4"	W16	3/16"	11 1/2"
42.8k	5	1/4"	W18	3/16"	14 1/2"
59.0k	7	1/4"	W24, W27	3/16"	20 1/2"

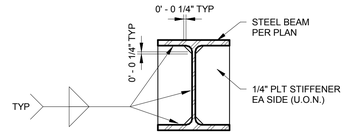
NOTE:
1. ALL BOLTS 3/4" DIA A325N BOLTS IN STD OR SSLT HOLE, SNUG TIGHT.
2. ALL BOLTS AT BRACED FRAME GRIDS SHALL BE 7/8" DIA SLIP CRITICAL.
3. NOT FOR USE AT COLLECTORS

2 TYPICAL SHEAR PLATE CONN DETAIL
1" = 1'-0"



PLAN

3 TYP SKEWED CONN PLT TO SUPPORT CONN
1" = 1'-0"

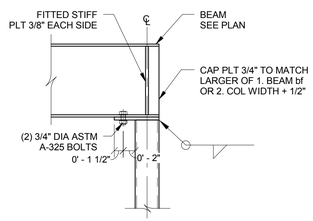


4 TYPICAL STIFFENER PLATE
1 1/2" = 1'-0"

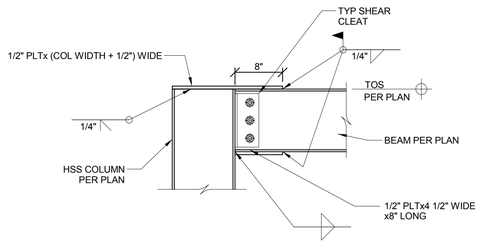
SCHEDULE OF WEB OPENINGS IN STEEL BEAMS		
MARK	"L"	"H"
1	2'-0"	10"
2		

8 TYPICAL WEB OPENING IN STEEL BEAM
3/4" = 1'-0"

5 COLUMN OR POST ABOVE & BELOW BM
1" = 1'-0"

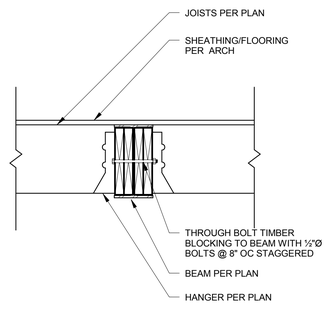


6 COLUMN AT END OF BEAM (TYP)
1" = 1'-0"



7 FRAME BEAM TO COLUMN CONN.
1" = 1'-0"

9 TYPICAL FRAME DETAILS
1" = 1'-0"



LUMBER CONNECTION TO FLUSH STEEL BEAM
10 1" = 1'-0"

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sDC PROJECT NO: 1020.00
COOD PROJECT NO: CE 02089

ISSUE DATE
01-12-2012

PHASE
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FRAMING DETAILS

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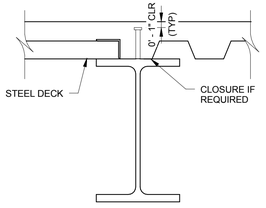
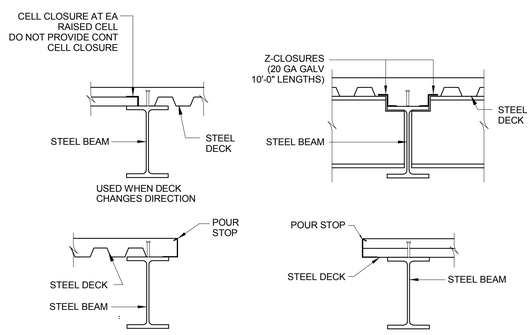


1 CHANGE IN DECK DIRECTION
1" = 1'-0"

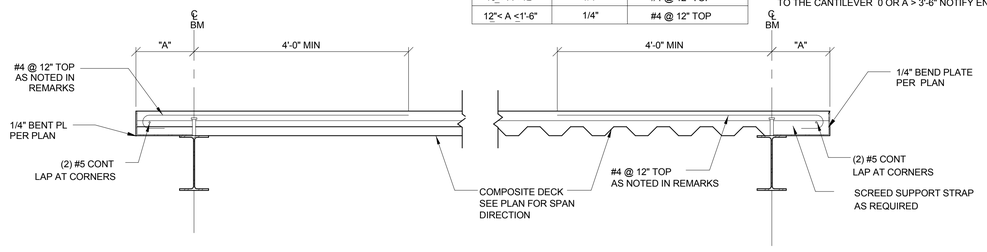


2 TYPICAL POUR STOPS
1/2" = 1'-0"

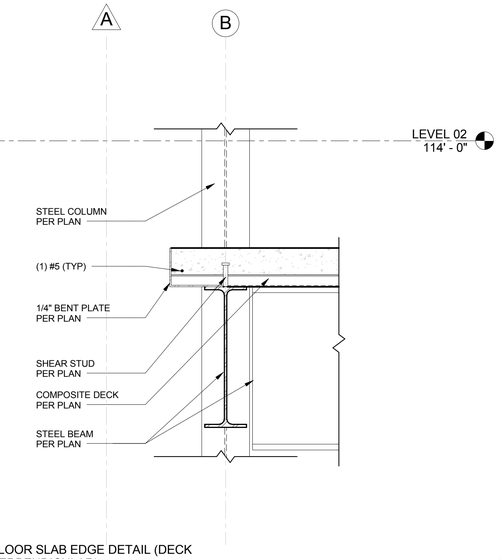
DECK TO CANTILEVER AND EXTENDING PAST BEAM	
"A"	REMARKS
A < 10"	
10" < A < 3'-6"	#4 @ 12" TOP

DECK || TO CANTILEVER OR STOPPING AT BEAM		
"A"	PLATE GAGE	REMARKS
A < 6"	1/4"	
6"< A <10"	1/4"	
10"< A <12"	1/4"	#4 @ 12" TOP
12"< A <1'-6"	1/4"	#4 @ 12" TOP

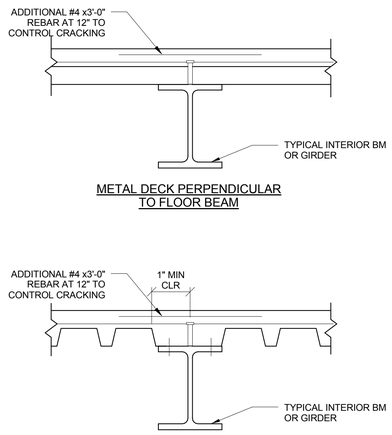
1. SEE PLANS AND ARCHITECT DRAWINGS FOR EDGE OF SLAB DISTANCES
2. FOR A > 1'-6" WHERE DECK SPAN IS PARALLEL TO THE CANTILEVER 0 OR A > 3'-6" NOTIFY ENGINEER



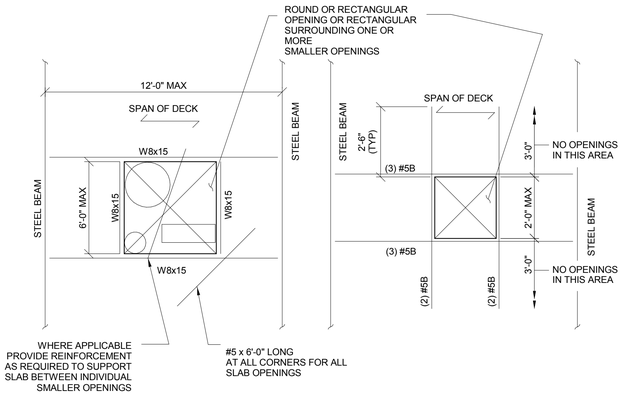
3 TYPICAL EDGE OF SLAB DETAIL
3/4" = 1'-0"



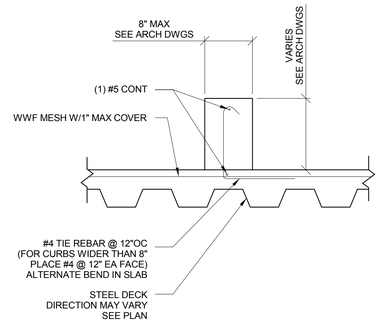
4 FLOOR SLAB EDGE DETAIL (DECK PERPENDICULAR)
1" = 1'-0"



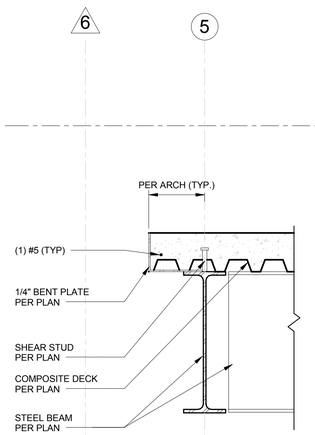
5 GIRDER SHEAR CONN COMPOSITE SLAB
1" = 1'-0"



6 REINF AT OPNGS IN SLABS W/COMPOSITE STL DECK
3/4" = 1'-0"



7 CURB AT COMPOSITE SLAB
1" = 1'-0"



8 FLOOR SLAB EDGE DETAIL (DECK PARELLEL)
1" = 1'-0"

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CCOD PROJECT NO: CE 02089

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DECK DETAILS

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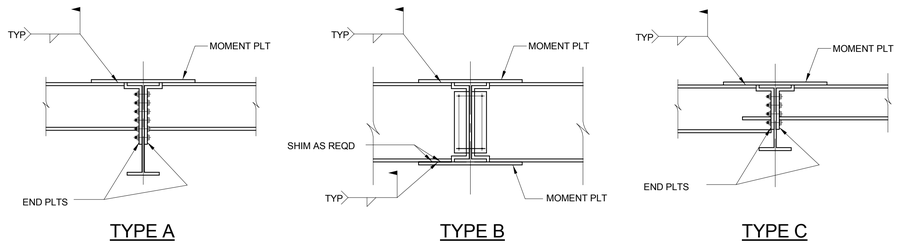
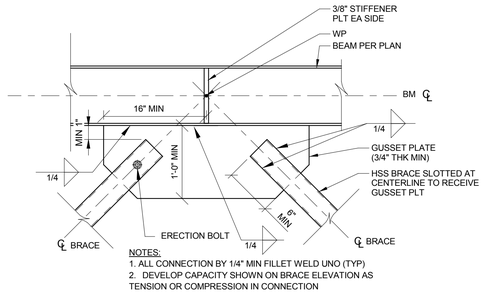


TYPE A TYPE B TYPE C

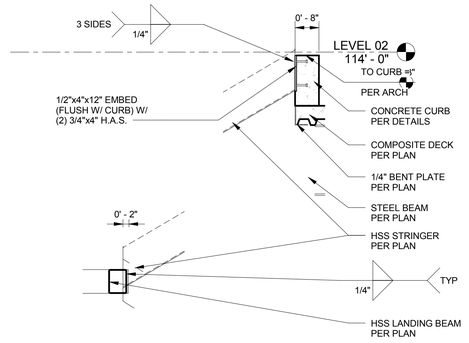
NOTES:
1. SHEAR CONNECTION SHALL BE DESIGNED FOR THE BEAM END REACTIONS GIVEN ON THE DRAWINGS
2. DESIGN MOMENT PLATES FOR THE FULL MOMENT CAPACITY OF THE SMALLER BEAM

1 BM TO BM MOMENT CONNECTION
3/4" = 1'-0"

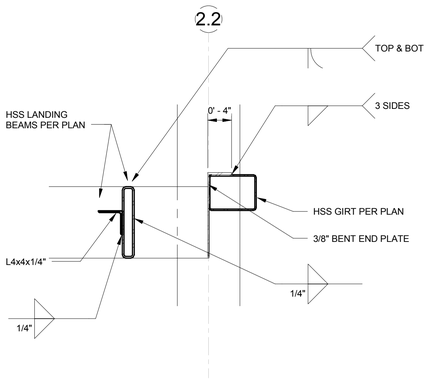


NOTES:
1. ALL CONNECTION BY 1/4" MIN FILLET WELD UNO (TYP)
2. DEVELOP CAPACITY SHOWN ON BRACE ELEVATION AS TENSION OR COMPRESSION IN CONNECTION

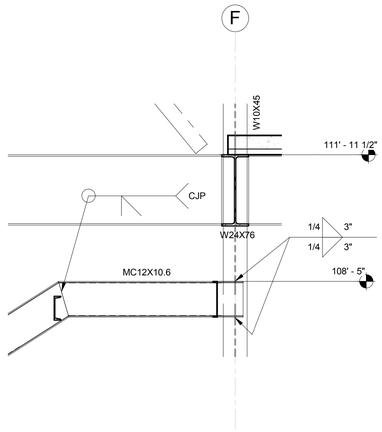
2 TYPICAL BRACED FRAMED CONNECTION
1" = 1'-0"



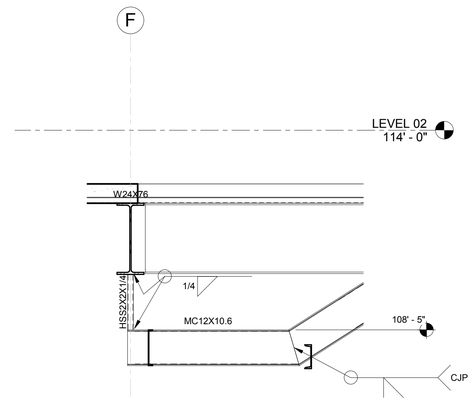
3 MAIN STAIR
1/2" = 1'-0"



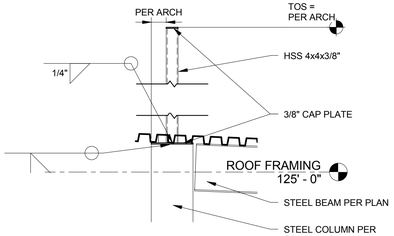
4 WIND GIRT TO MAIN STAIR DETAIL
1" = 1'-0"



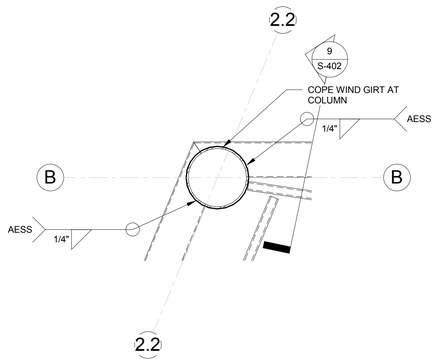
5 STAIR B DETAIL AT EXTERIOR COLUMN
1/2" = 1'-0"



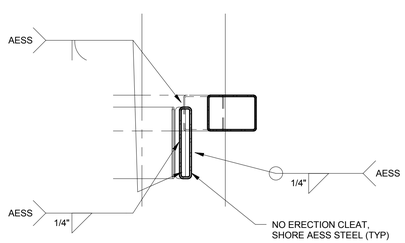
6 STAIR B DETAIL AT INTERIOR COLUMN
1/2" = 1'-0"



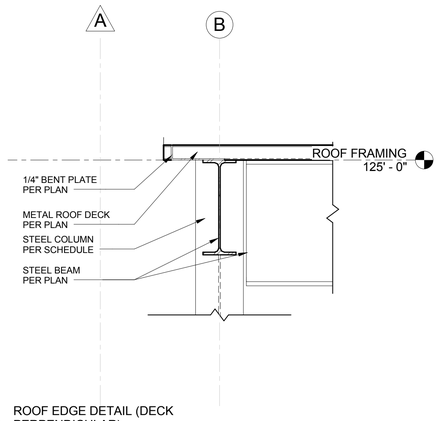
7 PARAPET DETAIL
1/2" = 1'-0"



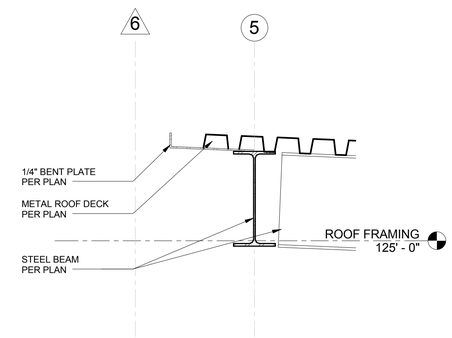
8 MAIN STAIR COLUMN PLAN
3/4" = 1'-0"



9 MAIN STAIR COLUMN DETAIL
1" = 1'-0"



10 ROOF EDGE DETAIL (DECK PERPENDICULAR)
1" = 1'-0"



11 ROOF EDGE DETAIL (DECK PARALLEL)
1" = 1'-0"

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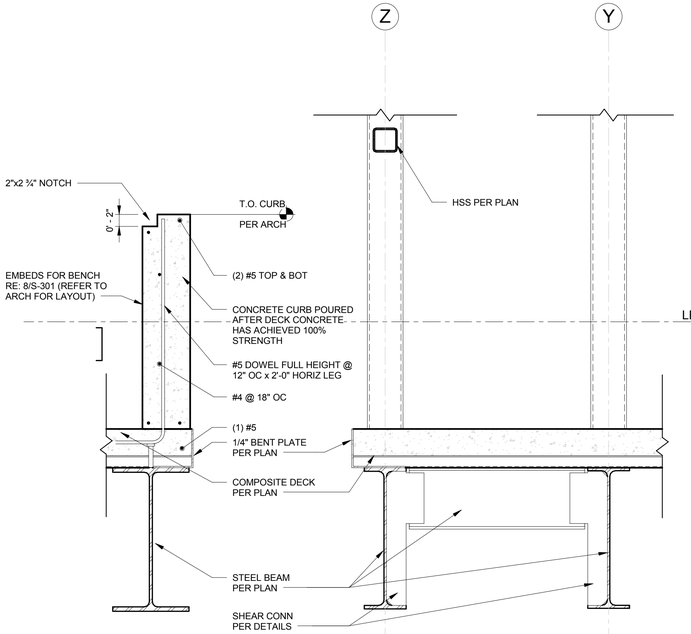
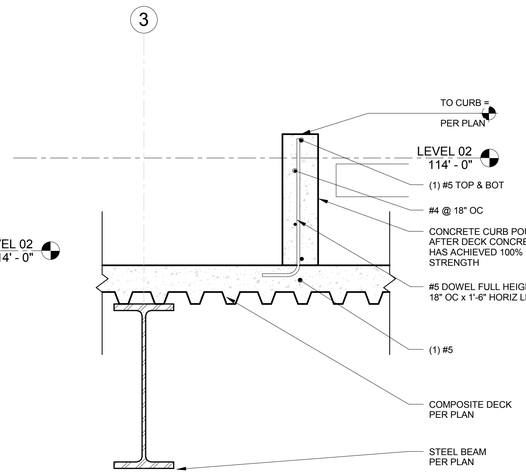
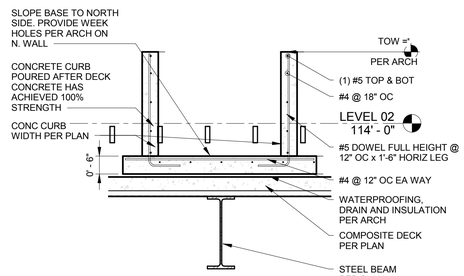


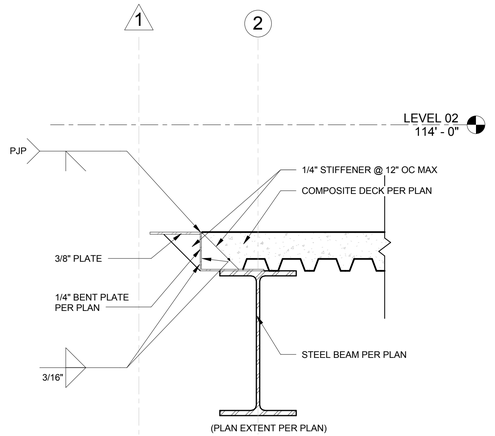
1 SKYLIGHT AT PATIO
1" = 1'-0"



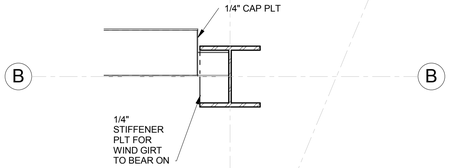
2 CURB AT PATIO
1" = 1'-0"



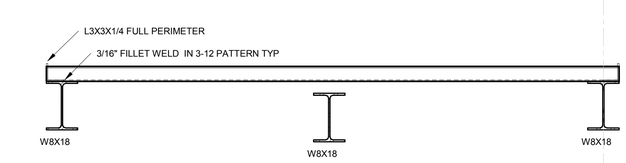
3 OUTDOOR READING ROOM PLANTER
DETAIL
1/2" = 1'-0"



4 STOREFRONT CAPTURE PLATE DETAIL
1" = 1'-0"



5 WIND GIRT TO COLUMN PLAN
1" = 1'-0"



6 ELEVATOR ROOF SECTION
1" = 1'-0"

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JOHN S. LILLYMAN
33333
PROFESSIONAL ENGINEER

sDC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02089

ISSUE DATE
01-12-2012

PHASE
100% CD

FRAMING DETAILS

S-403

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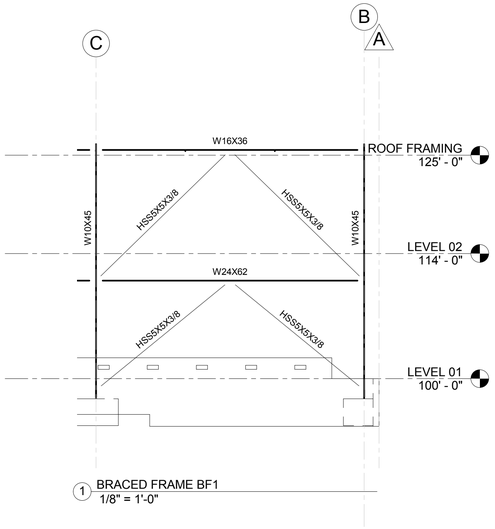
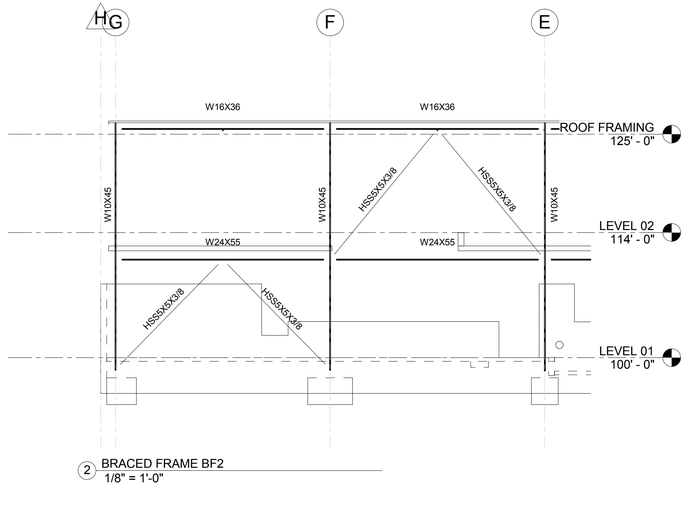
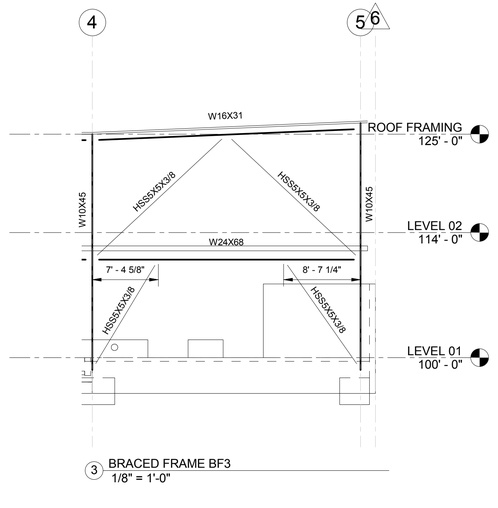


1 BRACED FRAME BF1
1/8" = 1'-0"



2 BRACED FRAME BF2
1/8" = 1'-0"



3 BRACED FRAME BF3
1/8" = 1'-0"

4 BRACED FRAME BF4
1/8" = 1'-0"

5 BRACED FRAME BF5
1/8" = 1'-0"

6 BRACED FRAME BF6
1/8" = 1'-0"

7 BRACED FRAME BF7
1/8" = 1'-0"

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COLORADO LICENSED
WILLIAM B. LINEHAN
33333
12 2nd
PROFESSIONAL ENGINEER

sDC PROJECT NO: 1020.00
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BRACED FRAME ELEVATION

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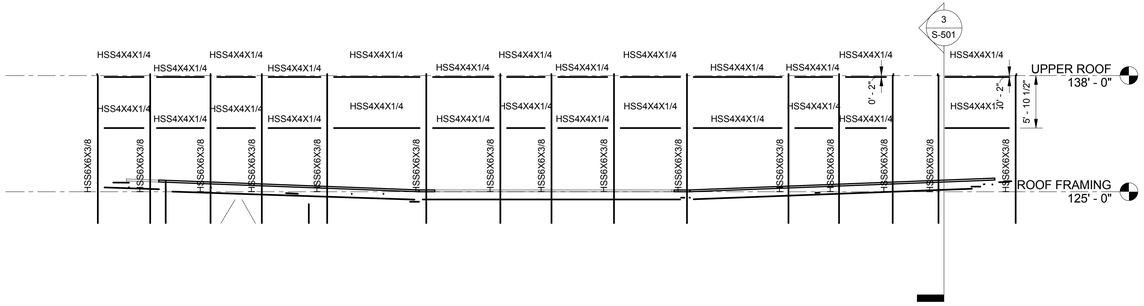
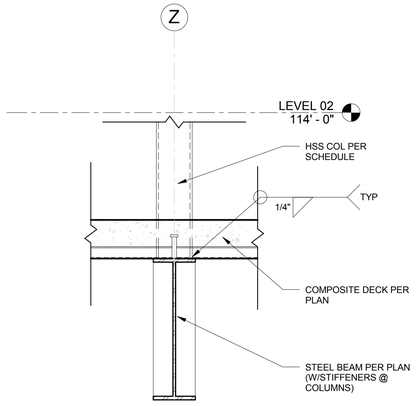
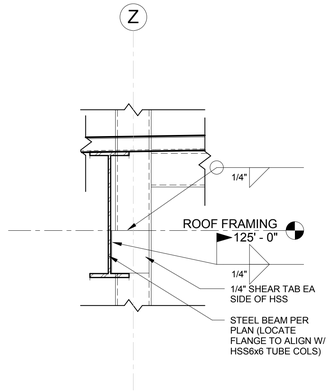


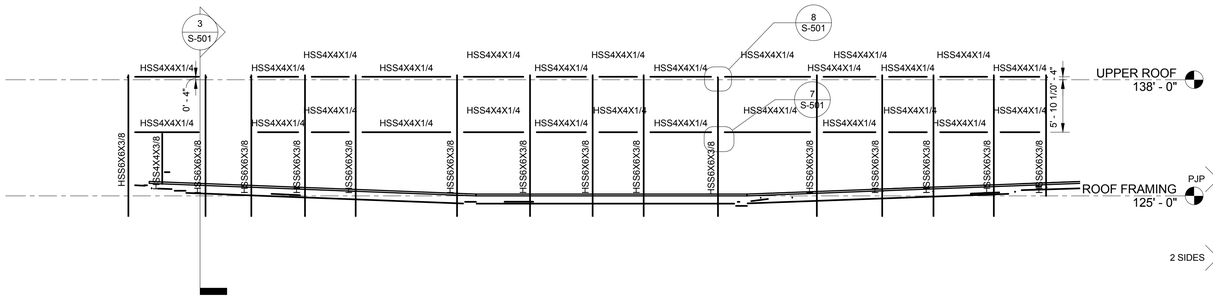
1 WONDER WALL SOUTH ELEVATION (GRID Z)
1/8" = 1'-0"



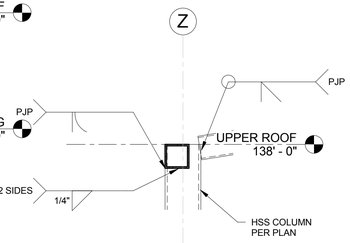
4 WONDER WALL @ LEVEL 2 SECTION
1" = 1'-0"



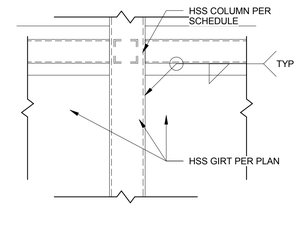
5 WONDER WALL @ ROOF SECTION
1" = 1'-0"



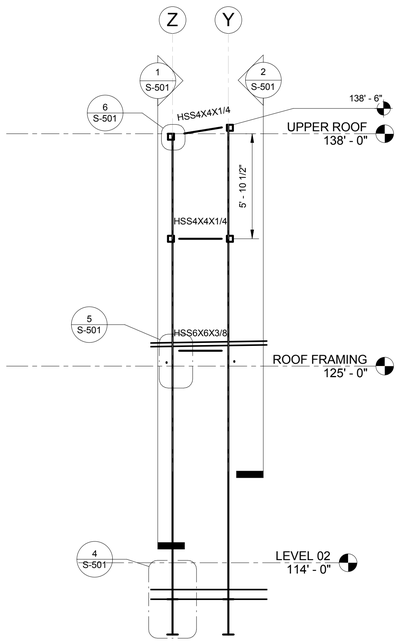
2 WONDER WALL NORTH ELEVATION (GRID Y)
1/8" = 1'-0"



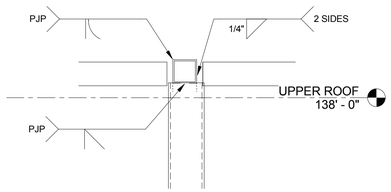
6 WONDER WALL @ UPPER ROOF SECTION
1" = 1'-0"



7 WONDER WALL @ MID ROOF DETAIL
1" = 1'-0"



3 WONDER WALL TYP SECTION
1/4" = 1'-0"



8 WONDER WALL @ UPPER ROOF DETAIL
1" = 1'-0"

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sDC PROJECT NO: 1020.00
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WONDER WALL
ELEVATIONS AND DETAILS

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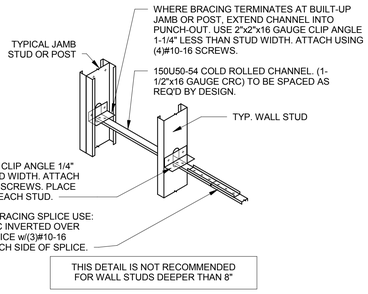
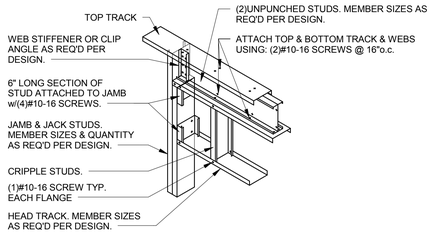
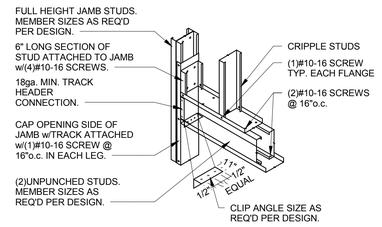
THESE ARE TYPICAL DETAILS ONLY TO SHOW CONSTRUCTION INTENT. ACTUAL DETAILS PLUS SUPPORTING CALCULATIONS SHALL BE SUBMITTED FOR ARCH./ENG. REVIEW.



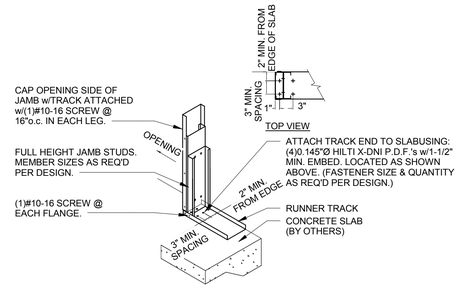
1 CRC LATERAL BRACING
3/4" = 1'-0"



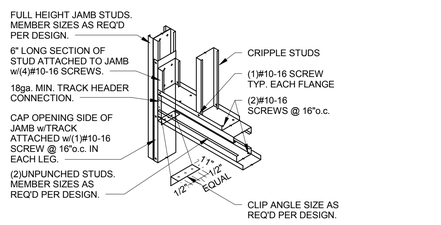
2 BACK TO BACK HEADER
3/4" = 1'-0"



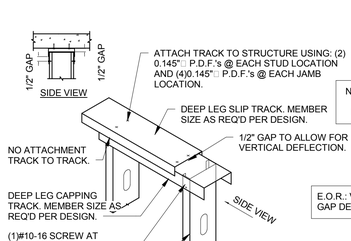
3 BOXED HEADER CONNECTION VERT
3/4" = 1'-0"



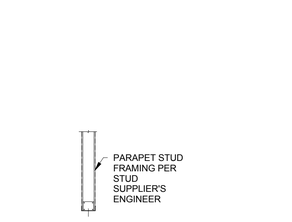
4 DOOR JAMB ANCHORAGE
3/4" = 1'-0"



5 LAY-IN HEADER CONNECTION
3/4" = 1'-0"

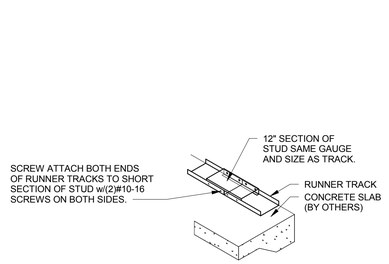


6 SILL/HEAD TRACK CONNECTION
3/4" = 1'-0"

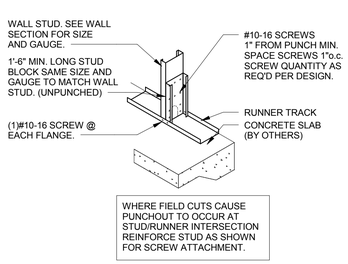


7 TIED JAMB STUDS
3/4" = 1'-0"

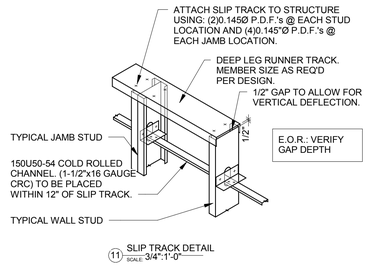
8 WINDOW JAMB ANCHORAGE
3/4" = 1'-0"



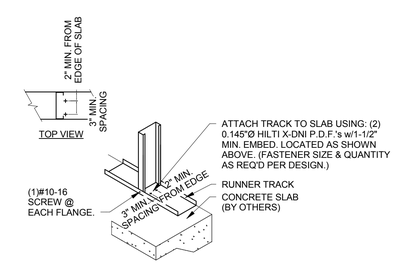
9 BOTTOM TRACK SPLICE
3/4" = 1'-0"



10 REINFORCEMENT AT STUD END
3/4" = 1'-0"



11 SLIP TRACK DETAIL
SCALE 3/4" = 1'-0"



12 STUD TO TRACK DETAIL
3/4" = 1'-0"

13 BOXED HEADER CONNECTION HORIZ
3/4" = 1'-0"

14 DEEP LEG SLIP TRACK DETAIL
3/4" = 1'-0"

15 BN STIFF CLIP RIDGID PARAPET CLIP
3/4" = 1'-0"

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LT GAGE DETAILS

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1/12/2012 8:15:46 PM

PROJECT NARRATIVE

SCOPE OF WORK

HVAC

AN ACTIVE HVAC DISTRIBUTION SYSTEM FOR THE BUILDING WILL BE ACHIEVED WITH TWO ROOFTOP UNIT SYSTEMS; ONE UNIT FOR THE PUBLIC ZONES IN THE BUILDING AND A SEPARATE, SECOND UNIT FOR THE BACK-OF-HOUSE SUPPORT ZONE.

THE ROOFTOP UNIT, RTU-1, SERVING THE PUBLIC ZONES WILL BE APPROXIMATELY 16,000 CFM, VARIABLE AIR VOLUME UNIT WITH EVAPORATIVE DIRECT/INDIRECT COOLING AND HOT WATER HEATING; MECHANICAL COOLING WILL NOT BE PROVIDED. BASIS OF DESIGN FOR THIS ROOFTOP UNIT IS ANNEXAIR. THIS UNIT WILL ALSO HAVE A HEAT-WHEEL TYPE HEAT EXCHANGER FOR ENERGY RECOVERY. THE HEAT-WHEEL WILL PRE-COOL THE OUTSIDE AIR IN THE WARM WEATHER MONTHS AND PRE-HEAT THE OUTSIDE AIR IN THE COLD WEATHER MONTHS. THE UNIT WILL BE 100% OUTSIDE AIR IN WARM WEATHER MONTHS. TO IMPROVE COLD WEATHER HEAT RECOVERY, IT WILL OPERATE IN RETURN AIR MODE, BY-PASSING THE HEAT-WHEEL, DURING THE COLD WEATHER MONTHS. THE SUPPLY AIR AND RETURN/EXHAUST AIR FANS WILL HAVE VARIABLE FREQUENCY DRIVES (VFD). THIS UNIT WILL UTILIZE INCREASED FILTRATION WITH MERV 8 PRE-FILTERS AND MERV 13 FINAL FILTERS.

SUPPLY AIR WILL BE DISTRIBUTED THROUGH AN UNDERFLOOR SYSTEM. HOT WATER FAN COIL UNITS WILL BE LOCATED AT THE PERIMETER OF THE UNDERFLOOR SYSTEM TO OFFSET BUILDING ENVELOPE HEAT LOSS DURING COLD WEATHER MONTHS. THE SUPPLY AIR SHAFTS WILL BE DUCTED FROM THE CEILING SPACE AND DOWN BELOW THE FLOOR. DUCTWORK WILL BE DISTRIBUTED BELOW THE RAISED FLOOR VIA FABRIC DUCT AND TERMINATE WITH A MAXIMUM DISTANCE OF 50 FEET TO THE MOST REMOTE AIR TERMINAL. THE SUPPLY AIR WILL PRESSURIZE THE UNDERFLOOR PLENUM SPACE AND ULTIMATELY SERVE THE PUBLIC ZONES THROUGH ADJUSTABLE FLOOR DIFFUSERS. THE BASIS OF DESIGN WILL BE PRICE INDUSTRIES FOR THE UNDERFLOOR DISTRIBUTION AND TERMINAL EQUIPMENT. RETURN AIR WILL BE ACHIEVED AT THE CEILING LEVEL AND WILL BE ROUTED BACK THROUGH A RETURN AIR DUCT INSIDE THE WONDERWALL TO ROOFTOP UNIT; RTU-1. THIS STRATEGY IS TYPICAL FOR BOTH FLOOR LEVELS OF THE BUILDING.

AS DISCUSSED WITH THE DENVER PUBLIC LIBRARY STAFF, PHYSICAL WORK ACTIVITIES WILL OCCUR IN THE SUPPORT ZONE REQUIRING A MORE CONSISTENT COOLING SYSTEM THAN AN EVAPORATIVE COOLING SYSTEM CAN PROVIDE. A SECOND ROOFTOP UNIT, RTU-2, WILL BE PROVIDED TO MEET THE REQUIREMENT TO BE A CONSISTENT AND COMFORTABLE WORKING ENVIRONMENT FOR THE STAFF. THIS UNIT WILL BE APPROXIMATELY A 2,500 CFM, VARIABLE VOLUME UNIT WITH DX COOLING AND HOT WATER HEATING. THE SUPPLY AIR AND RELIEF/EXHAUST AIR FANS WILL HAVE VFD'S. THIS UNIT WILL ALSO UTILIZE INCREASED FILTRATION WITH MERV 13 FINAL FILTERS. THIS UNIT WILL UTILIZE AN UNDERFLOOR DISTRIBUTION SYSTEM, SIMILAR TO RTU-1, WITH ADJUSTABLE FLOOR DIFFUSERS. HOT WATER FAN COIL UNITS WILL BE LOCATED AT THE PERIMETER OF THE UNDERFLOOR SYSTEM TO OFFSET BUILDING ENVELOPE HEAT LOSS DURING COLD WEATHER MONTHS. RETURN AIR GRILLES WILL BE LOCATED AT THE CEILING RETURNING AIR THROUGH A PLENUM BACK TO ROOFTOP UNIT; RTU-2.

TWO (2) 85% EFFICIENT, NON-CONDENSING, PATTERSON-KELLEY (P-K), THERMIFIC BOILERS WILL BE PROVIDED - NO ALTERNATES. PROVIDING TWO BOILERS WILL ALLOW FOR SOME REDUNDANCY AND FREEZE PROTECTION OF THE BUILDING IF ONE BOILER IS OFF-LINE. EACH BOILER WILL BE PROVIDED WITH AN ASSOCIATED CONSTANT VOLUME CIRCULATION PUMP. TWO HOT WATER HEATING SYSTEM DISTRIBUTION PUMPS WILL BE PROVIDED AS WELL. PUMPS WILL HAVE 100% REDUNDANCY WITH ONE OF THE TWO PUMPS IN STAND-BY FOR FAILURE OR SERVICING. EACH SYSTEM DISTRIBUTION PUMP MOTOR WILL BE PROVIDED WITH PREMIUM EFFICIENCY. THE HEATING WATER DISTRIBUTION PIPING WILL BE ROUTED BELOW THE RAISED FLOOR TO PERIMETER FAN COIL UNITS AND IN THE CEILING SPACE TO ROOFTOP UNITS IN A REVERSE/RETURN CONFIGURATION. A 30% PROPYLENE GLYCOL SOLUTION AND COIL CIRCULATION PUMPS WILL BE PROVIDED FOR FREEZE PROTECTION OF THE HEATING WATER SYSTEM AT THE ROOFTOP UNIT HEATING COILS.

HOT WATER CABINET UNIT HEATERS WILL BE LOCATED IN ENTRY VESTIBULE LOCATIONS.

A DUCTLESS SPLIT-SYSTEM COOLING UNIT WILL BE PROVIDED FOR THE IT EQUIPMENT ROOM AND ELEVATOR MACHINE ROOM.

GENERAL EXHAUST WILL BE PROVIDED FOR TOILET ROOMS, CUSTODIAN WORKROOM AND STAFF LOUNGE.

TEMPERATURE CONTROL SYSTEM

A BUILDING AUTOMATION SYSTEM (BAS) WILL BE PROVIDED. THE TEMPERATURE CONTROLS WILL BE MANUFACTURED BY ANDOVER IN ACCORDANCE WITH DENVER PUBLIC LIBRARY STANDARDS.

METERING OF WATER, GAS AND ELECTRIC UTILITIES WILL BE ACHIEVED THROUGH THE BAS TO SERVE AS AN INFORMATIONAL/EDUCATIONAL TOOL FOR THE COMMUNITY AS WELL AS A TROUBLE SHOOTING TOOL FOR THE OWNER.

SUSTAINABLE DESIGN CONCEPTS (BASE LINE)

- EVAPORATIVE COOLING (NO MECHANICAL COOLING AND REDUCTION OF REFRIGERANT) FOR THE PUBLIC ZONES OF THE BUILDING SPACES.
- UNDERFLOOR VENTILATION SYSTEM.
- PUBLIC ZONES: DEMAND CONTROLLED VENTILATION FOR COLD WEATHER MONTHS.
  SUPPORT ZONES: DEMAND CONTROLLED VENTILATION YEAR ROUND.
- ECM (VARIABLE SPEED) MOTORS ON PERIMETER FAN COIL UNITS FOR VAV OPERATION.
- VARIABLE SPEED HEATING WATER SYSTEM PUMPS WITH PREMIUM EFFICIENCY MOTORS.
- MEASUREMENT AND VERIFICATION OF UTILITIES.
- INCREASED VENTILATION RATES FOR PUBLIC ZONES.
- AIR-SIDE ECONOMIZER.

PLEASE REFER TO THE SUSTAINABILITY NARRATIVE FOR ADDITIONAL INFORMATION.

LOAD CALCULATION DESIGN DATA

LOCATION:	DENVER , CO ; 5,439 FT. ELEVATION, 39.6 DEGREES LATITUDE, 104.9 DEGREES LONGITUDE.	
OUTDOOR CONDITIONS:	SUMMER	= 94 DEGREES F DB/61 DEGREES WB (REFERENCE: ASHRAE 2009; 0.4 DESIGN WEATHER)
	WINTER	= -10 DEGREES F
INDOOR CONDITIONS:	COOLING	= 75 DEGREES F
	HEATING	= 68 DEGREES F
ENVELOPE CHARACTERISTICS:	GLASS AT VIEWING LEVEL	
	• SHADING COEF.:	= (0.32)
	• "U" FACTOR:	= (0.28)
	• LOW-E:	= (Y)
	• INTERIOR SHADING:	= (N)
	GLASS AT CLEARSTORY LEVEL	
	• SHADING COEF.:	= (0.44)
	• "U" FACTOR:	= (0.28)
	• LOW-E:	= (Y)
	• INTERIOR SHADING:	= (N)
	WALL INSULATION "R":	= (21.0)
	ROOF INSULATION "R":	= (30.0)
	PERIMETER FOUNDATION WALL INSULATION "R":	= (10)
INTERNAL LOADS:	AVERAGE LIGHTING:	= (0.75) WATTS/S.F.
	AVERAGE MISC. ELECTRICAL:	= (0.5) WATTS/S.F.
	AVERAGE OCCUPANT LOAD:	= 19.5 FTE, 170 VISITORS
OUTDOOR AIR VENTILATION RATE:		= ASHRAE 62.1 - 2007; TABLE 6-A

MECHANICAL LEGEND

ALL SYMBOLS IN LEGEND MAY NOT NECESSARILY BE USED ON THIS PROJECT

LINE DESIGNATIONS

- HWS — HEATING WATER SUPPLY
- HWR — HEATING WATER RETURN
- HRS — HEAT RECOVERY SUPPLY
- HRR — HEAT RECOVERY RETURN
- CWS — CHILLED WATER SUPPLY
- CWR — CHILLED WATER RETURN
- CS — CONDENSER WATER SUPPLY
- CR — CONDENSER WATER RETURN
- LPS — LOW PRESSURE STEAM SUPPLY
- LPR — LOW PRESSURE - RETURN
- ARROW IN LINE INDICATES DIRECTION OF FLOW
- MPS — MEDIUM PRESSURE STEAM - SUPPLY
- MPR — MEDIUM PRESSURE STEAM - RETURN
- HPS — HIGH PRESSURE STEAM - SUPPLY
- HPR — HIGH PRESSURE STEAM - RETURN
- RL — REFRIGERANT LIQUID
- RS — REFRIGERANT SUCTION
- RHG — REFRIGERANT HOT GAS
- ARROW PARALLEL TO LINE INDICATES PITCH
- CD — CONDENSATE DRAIN

VALVES and FITTINGS

- PIPE CONNECTION
- ELBOW UP
- ELBOW DOWN
- TEE UP
- TEE DOWN
- RISE OR DROP
- BRANCH-TOP CONNECTION
- BRANCH-BOTTOM CONNECTION
- PIPE CAP OR PLUG
- UNION
- EXPANSION JOINT
- PIPE ANCHOR
- PIPE ALIGNMENT GUIDE
- PIPE HANGER
- FLEXIBLE CONNECTION
- STRAINER
- STRAINER W/BLOWOFF VALVE
- FLOOR SINK; (¼ GRATE SHOWN)
- FLOOR DRAIN
- STEAM TRAP (INDICATE TYPE)
- TEMPERATURE GAUGE
- BFP — BACKFLOW PREVENTER
- PRESSURE/ TEMPERATURE TAP
- WELL
- BALL VALVE
- GATE VALVE
- GATE VALVE (IN VERTICAL)
- VALVE IN YARD BOX
- VENTURI
- CALIBRATED BALANCE VALVE
- PLUG VALVE
- NEEDLE VALVE
- SOLENOID VALVE
- PRESSURE REDUCING VALVE
- 2-WAY CONTROL VALVE
- 3-WAY CONTROL VALVE
- CHECK VALVE
- GLOBE VALVE
- BUTTERFLY VALVE
- BALANCING VALVE
- CIRCUIT SETTER
- HOSE END BALL VALVE
- TEMPERATURE/PRESSURE RELIEF VALVE
- VACUUM BREAKER
- AUTOMATIC AIR VENT
- MANUAL AIR VENT
- METER (GAS OR WATER)
- PRESSURE GAUGE W/ COCK
- GAUGE W/ PIGTAIL

MISCELLANEOUS

- POINT OF CONNECTION NEW TO EXISTING
- EXIST. 4" / NEW 4" — LIGHT LINE WEIGHT FOR EQUIPMENT, PIPING, SYMBOLS, TEXT, ETC. INDICATES EXISTING CONDITIONS WITH NEW WORK SHOWN AS DARK
- SCREENING INDICATES EXISTING TO BE REMOVED
- EXISTING TO BE REMOVED
- DIRECTION OF VIEW / PICTURE DESIGNATION (A)
- SECTION DESIGNATION (1 / M-7)
- DRAWN ON THIS SHEET
- INDICATES SUPPLY AND RETURN PIPING TO UNIT
- HEATING COIL
- CONTROL ENCLOSURE
- CONTROL/VALVE ACCESS
- EQUIPMENT TERMINAL OR VAV BOX
- EQUIP. TYPE — TB-103 CFM/GPM
- FLOOR # IF MULTIPLE
- BOX #
- IF APPLICABLE

DUCTWORK

- ROUND 90° CONICAL TAKEOFF FROM RECTANGULAR TRUNK
- DUCT RISE (IN ELEVATION) (R)
- DUCT DROP (IN ELEVATION) (D)
- RECTANGULAR 90° TAKEOFF
- BURIED OR UNDERFLOOR
- FLEXIBLE DUCT CONNECTION
- RADIUS ELBOW
- VANED ELBOW
- FLEXIBLE DUCT
- ROUND DUCT DOWN
- ROUND DUCT UP
- RETURN DUCT DOWN
- RETURN DUCT UP
- EXHAUST DUCT DOWN
- EXHAUST DUCT UP
- SUPPLY DUCT UP
- SUPPLY DUCT DOWN
- RETURN OR EXHAUST REGISTER/GRILLE
- SUPPLY AIR DIFFUSER W/ ROUND CONNECTION
- UNSHADED AREAS INDICATE DIRECTION OF AIR FLOW (IF NO SHADING, 4-WAY OR ADJUSTABLE)
- CEILING FIRE DAMPER/ AIR DEVICE (F)
- LINEAR SLOT DIFFUSER
- RECTANGULAR 90° TAKEOFF FROM RECTANGULAR TRUNK
- RECTANGULAR 90° TAKEOFF ON END OF MAIN W/MIN. 12" AIR CUSHION DOWNSTREAM
- VANED ELBOW
- DOUBLE VANED ELBOW
- RADIUS ELBOW; 1 DIAMETER
- ROUND 90° CONICAL TAKEOFF FROM RECTANGULAR TRUNK W/MANUAL VOLUME DAMPER
- ROUND 90° SPIN-IN TAKEOFF FROM RECTANGULAR TRUNK W/MANUAL VOLUME DAMPER
- DUCT TRANSITION CONCENTRIC
- DUCT TRANSITION ECENTRIC
- SIDE TAKEOFF AT REGISTER
- BOTTOM TAKEOFF AT DIFFUSER
- SIDE TAKEOFF AT DIFFUSER
- TRANSFER DUCT & GRILLES
- UC — DOOR UNDERCUT
- AIR FLOW - SUPPLY
- AIR FLOW - RETURN OR EXHAUST
- AIR FLOW
- DUCT UP TO ROOFTOP EXHAUST UNIT
- ACCESS PANEL
- MANUAL VOLUME DAMPER
- M — MOTORIZED DAMPER MOTOR
- BD — BACK DRAFT DAMPER
- FS — FIRE/SMOKE DAMPER; (# REFERS TO SCHEDULE)
- F — FIRE DAMPER (# REFERS TO SCHEDULE)
- S — SMOKE DAMPER (# REFERS TO SCHEDULE)

CONTROL DEVICES

- FS — FLOW SWITCH
- FT — FLOW TRANSMITTER
- H — HUMIDITY SENSOR
- P — PRESSURE SENSOR
- PDS — PRESSURE DIFFERENTIAL SWITCH
- PDT — PRESSURE DIFFERENTIAL TRANSMITTER
- PI — POSITION INDICATOR
- PSH — PRESSURE SWITCH HIGH
- PSL — PRESSURE SWITCH LOW
- T — TEMPERATURE SENSOR
- TSH — TEMPERATURE SWITCH HIGH
- TSL — TEMPERATURE SWITCH LOW
- S — SENSOR
- SP — STATIC PRESSURE SENSOR
- AIR FLOW DIRECTION ARROW
- H — HUMIDIFIER
- PARALLEL BLADE DAMPER
- OPPOSED BLADE DAMPER
- CS — CURRENT SENSOR
- DM — DAMPER ACTUATOR
- MS — MOTOR STARTER
- VFD — VARIABLE FREQUENCY DRIVE
- H — HORN
- S — DUCT SMOKE DETECTOR
- FS — FLOW SWITCH
- PS — PRESSURE SWITCH
- PI — PRESSURE INDICATOR
- T — AQUASTAT
- $ — MANUAL SWITCH
- D/N — WALL MOUNTED THERMOSTAT N - INDICATES NIGHT
- H — HUMIDISTAT
- S — SENSOR (SPECIFY)
- INDICATOR LIGHT
- UNIT MOUNTED THERMOSTAT
- INSTRUMENT AIR SIGNAL
- INTERNAL SYSTEM SOFTWARE OR DATA LINK

ABBREVIATIONS

AFF	ABOVE FINISHED FLOOR
AP	ACCESS PANEL
C	COMMON
CI	CAST IRON
℄ EL.	CENTER LINE ELEVATION
DIA, D	DIAMETER
EA	EXHAUST AIR
FDC	FIRE DEPARTMENT CONNECTION
I.E.	INVERT ELEVATION
MA	MIXED AIR
MD	MOTORIZED DAMPER
MVD	MANUAL VOLUME DAMPER
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
OA	OUTSIDE AIR
RA	RETURN AIR
SA	SUPPLY AIR
TCEAD	TEMP. CONTROL EXH DAMPER
TCOAD	TEMP. CONTROL OA DAMPER
TCRAD	TEMP. CONTROL RA DAMPER
TYP	TYPICAL
VCP	VITRIFIED CLAY PIPE
VTR	VENT THROUGH ROOF
(N)	NEW
(E)	EXISTING
(R)	RELOCATED
(F)	FUTURE

EQUIPMENT ABBREVIATIONS

AB	AIR BLENDER
AC-L	AIR COMPRESSOR - LABORATORY
AC-M	AIR COMPRESSOR - MEDICAL
AC-SH	AIR COMPRESSOR - SHOP
AC-TC	AIR COMPRESSOR - TEMP. CONTROL
ACCU	AIR COOLED CONDENSING UNIT
AK-E	AIR CURTAIN - ELECTRIC
AK-G	AIR CURTAIN - GAS
AK-HW	AIR CURTAIN - HOT WATER
AHU	AIR HANDLING UNIT
BFP	BACKFLOW PREVENTER
EBB	BASEBOARD RADIATION - ELECTRIC
B	BOILER
CUH-E	CABINET HEATER - ELECTRIC
CUH	CABINET UNIT HEATER
CH-ABS	CHILLER - ABSORPTION
CH-AC	CHILLER - AIR COOLED
CH	CHILLER - CENTRIFUGAL
CH	CHILLER - RECIPROCATING
CWC	COIL COOLING
DHC	COIL - DUCT HEATING
HRC	COIL - HEAT RECOVERY
HWC	COIL - HEATING
PHC	COIL - PRE-HEAT
CRAC	COMPUTER ROOM PACKAGED AIR CONDITIONING UNIT
CRP	CONDENSATE RETURN - PUMP
CR-SP	CONDENSATE RETURN - STEAM POWERED PUMP
CONV	CONVERTER
CT	COOLING TOWER
DWH	DOMESTIC WATER HEATER
DWS	DOMESTIC WATER SOFTENER
EDHC	ELECTRIC DUCT HEATER
ECCU	EVAPORATIVE CONDENSING CHILLER / CONDENSER
EV-CV	EXHAUST VALVE - CONSTANT VOLUME
EV-VV	EXHAUST VALVE - VARIABLE VOLUME
ET-CW	EXPANSION TANK - CHILLED WATER
ET-DWH	EXPANSION TANK - DOMESTIC WATER
ET-HW	EXPANSION TANK - HOT WATER
EF	FAN - EXHAUST
RAF	FAN - RETURN/ AIR
REF	FAN - RETURN EXHAUST
SAF	FAN - SUPPLY
FCU	FAN COIL UNIT
ESF	FILTER - ELECTROSTATIC
FF	FILTER - FINAL
HF	FILTER - HEPA
IF	FILTER - INTERMEDIATE
PF	FILTER - PRE
FTR	FINNED TUBE RADIATION - HOT WATER/STEAM
FS	FIRE/SMOKE DAMPER
FURN	FURNACE
HX	HEAT EXCHANGER
PF	HEAT EXCHANGER - PLATE & FRAME
HUM	HUMIDIFIER
IND	INDUCTION AIR TERMINAL
IRH	INFRARED HEATER
L	LOUVER
MAU	MAKE-UP AIR UNIT
CWP	PUMP - CHILLED WATER
CSP	PUMP - CONDENSER
DWP	PUMP - DOMESTIC CIRCULATING
HRP	PUMP - HEAT RECOVERY
HTHWP	PUMP - HIGH TEMPERATURE
HWP	PUMP - HOT WATER
RP	RADIANT HEATING PANEL
RPBFP	REDUCED PRESSURE BACKFLOW PREVENTER
RH	ROOF HOOD
RTU	ROOFTOP UNIT
SEP	SEWAGE EJECTOR PUMP
SAU	SOUND ATTENUATOR
SP	SUMP PUMP
TB	TERMINAL BOX
EUH	UNIT HEATER - ELECTRIC
UH	UNIT HEATER - HOT WATER
UV	UNIT VENTILATOR
VP-H	VACUUM PUMP - HOUSE
VP-L	VACUUM PUMP - LABORATORY
VP-M	VACUUM PUMP - MEDICAL
FVAV	VARIABLE AIR VOLUME BOX - FAN POWERED
HVAV	VARIABLE AIR VOLUME BOX - FAN POWERED W/ HEATING

HVAC GENERAL NOTES:

1. DUCT AND PIPE SIZE DIMENSIONS ARE IN INCHES UNLESS NOTED OTHERWISE.
2. THE EQUIPMENT SPECIFIED ON THE DRAWINGS HAVE BEEN SELECTED AS THE BASIS OF DESIGN. THE USE OF REVIEWED OR SPECIFIED EQUALS SHALL BE COORDINATED BY THE CONTRACTOR AS TO SPACE REQUIREMENTS, EQUIPMENT DIMENSIONS AND PERFORMANCE. ANY ADDITIONAL COSTS EITHER DIRECTLY OR INDIRECTLY CAUSED BY EQUALS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
3. COORDINATE ALL DIFFUSER AND GRILLE LOCATIONS WITH ARCHITECTURAL REFLECTED CEILING PLAN, FIRE PROTECTION, AND ELECTRICAL DRAWINGS.
4. DRAWINGS ARE DIAGRAMMATIC AND SHOW THE GENERAL DESIGN INTENT, ARRANGEMENT AND EXTENT OF SYSTEMS. DO NOT SCALE DRAWINGS NOR USE AS SHOP DRAWINGS. WHERE ALTERNATE ROUTING, OFFSETS AND TRANSITIONS ARE REQUIRED FOR FIELD COORDINATION OF ALL TRADES, THIS CONTRACTOR SHALL MAKE CHANGES WITHOUT ADDITIONAL COSTS.
5. ALL EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY DIRECTED OTHERWISE.
6. CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATION AND INSTALLING SLEEVES, INSERTS AND SUPPORTS AS REQUIRED FOR THIS SCOPE OF WORK AND/OR CORE DRILL REQUIREMENTS. COORDINATE WITH G.C. AND STRUCTURAL ENGINEER AS REQUIRED.
7. CONTRACTOR SHALL CLOSELY COORDINATE NEW MECHANICAL WITH PLUMBING, ELECTRICAL, FIRE PROTECTION, ARCHITECTURAL AND STRUCTURAL MEMBERS. REFER TO DIVISION 23 FOR CEILING SPACE ALLOCATION PRIORITIES.
8. ALL MECHANICAL SYSTEMS SHALL BE INSTALLED IN ACCORDANCE WITH THE CURRENT VERSION OF INTERNATIONAL BUILDING CODE, INTERNATIONAL FIRE CODE OR NFPA, INTERNATIONAL MECHANICAL CODE, AND INTERNATIONAL PLUMBING CODE; INCLUDING LOCAL AMENDMENTS. REFER TO ARCHITECTURAL CODE PLAN.
9. CONTRACTOR SHALL PROVIDE SUBMITTALS ON ITEMS LISTED IN THE MECHANICAL SCHEDULES AND AS REQUIRED IN EACH SECTION OF SPECIFICATION TO THE ENGINEER FOR REVIEW PRIOR TO THE ORDER, PURCHASE OR INSTALLATION OF THESE SAME ITEMS.
10. CONVENTIONS USED IN THE PRESENTATION OF THE CONTRACT DOCUMENTS:
    A. CFM IS AT ALTITUDE OF PROJECT.
    B. STATIC PRESSURES AND AIR PRESSURE DROPS ARE AT SEA LEVEL.
    C. HEATING AND COOLING CAPACITIES ARE AT ALTITUDE OF PROJECT.
    D. HORSEPOWERS ARE CORRECTED FOR ALTITUDE.
    E. NATURAL GAS INPUTS ARE AT SEA LEVEL.
11. PROVIDE MANUAL AIR VENTS ON CLOSED SYSTEM WATER PIPING AT ALL CHANGES IN ELEVATION DOWNWARD IN DIRECTION OF WATER FLOW.
12. CONTRACTOR SHALL CONSTRUCT AND INSTALL DUCTWORK ACCORDING TO SMACNA STANDARDS AS A MINIMUM REQUIREMENT. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.
13. ALL DUCT DIMENSIONS ARE OUTSIDE DIMENSIONS. WHERE DUCT LINER IS USED, THE THICKNESS OF THE LINER TO MAINTAIN THE CLEAR INSIDE DIMENSION HAS BEEN INCLUDED. REFER TO DUCT DIVISION 23 OF THE SPECIFICATIONS.
14. SPIN-IN FITTINGS TO TERMINAL BOXES AND DIFFUSERS SHALL BE CONICAL TYPE (EXCEPT LOCATIONS WHERE LISTED DUCT HEIGHT DOES NOT ACCOMMODATE). SPIN-IN FITTINGS TO DIFFUSERS SHALL INCLUDE AN INTEGRAL MANUAL VOLUME DAMPER.
15. RIGID INLET DUCTS TO TERMINAL BOXES SHALL BE THE SAME SIZE AS THE BOX INLET CONNECTION UNLESS NOTED OTHERWISE FOR A MINIMUM OF THREE DIAMETERS OF STRAIGHT DUCT.
16. ALL OPENINGS FROM EXHAUST DUCTS, EXHAUST FANS, GRAVITY ROOF VENTS, INTAKE LOUVERS AND GOOSENECKS SHALL BE A MINIMUM OF 12" ABOVE THE TOP OF THE FINISHED ROOFING SURFACE.
17. MOUNT THERMOSTAT SENSORS AND CO2 SENSORS AT 60" ON CENTER ABOVE FINISHED FLOOR AND OVERRIDE SWITCHES AT 48" ON CENTER ABOVE FINISHED FLOOR.
18. PROVIDE REDLINE MARK-UPS FOR ANY FIELD CHANGES OR MODIFICATIONS ON THE CONSTRUCTION DOCUMENTS. REDLINE DRAWINGS SHALL BE PROVIDED WHETHER COORDINATION DRAWINGS ARE REQUIRED OR NOT.
19. EQUIPMENT E.E.R. AND/OR C.O.P. SHALL COMPLY ASHRAE 90.1 - 2007.
20. PRIOR TO BALANCING MECHANICAL CONTRACTOR SHALL PROVIDE A CLEAN SET OF FILTERS FOR AIR HANDLING UNITS. THIS CONTRACTOR SHALL PROVIDE A MEANS TO SIMULATE 50% LOADED FILTERS. SYSTEM BALANCE SHALL BE VERIFIED IN THIS MODE.

BCER CONTACT LIST

010.06
1/10/12

303-422-7400 FAX 303-422-7900

PROJECT ENGINEER	WENDY MERCHANT	EXT 244	wmerchant@bcer.com
PROJECT MANAGER	PAUL MISKOWICZ	EXT 275	pmiskowicz@bcer.com
CONSTRUCTION ADMINISTRATION	BROOK CORNING	EXT 216	bcorning@bcer.com

MECHANICAL DRAWING LIST

Sheet Number	Sheet Title
M-000	MECHANICAL LEGEND AND GENERAL INFORMATION
M-001	MECHANICAL SCHEDULES
M-002	MECHANICAL SCHEDULES
M-100	MECHANICAL SITE PLAN
M-101	LEVEL 1 UNDER FLOOR MECHANICAL PLAN
M-102	LEVEL 1 MECHANICAL PLAN
M-103	LEVEL 2 UNDER FLOOR MECHANICAL PLAN
M-104	LEVEL 2 MECHANICAL PLAN
M-105	ROOF LEVEL MECHANICAL PLAN
M-201	ENLARGED MECHANICAL PLAN AND ELEVATIONS
M-301	MECHANICAL CONTROL DIAGRAMS
M-302	MECHANICAL CONTROL DIAGRAMS
M-303	MECHANICAL CONTROL DIAGRAMS
M-304	MECHANICAL CONTROL DIAGRAMS
M-401	MECHANICAL DETAILS
M-402	MECHANICAL DETAILS
M-403	MECHANICAL DETAILS

OWNERSHIP OF DOCUMENTS:
ALL DRAWINGS, SPECIFICATIONS AND OTHER WORK PRODUCT OF THE ENGINEER FOR THIS PROJECT ARE INSTRUMENTS OF SERVICE FOR THIS PROJECT ONLY AND SHALL REMAIN THE PROPERTY OF THE ENGINEER WHETHER THE PROJECT IS COMPLETED OR NOT. REUSE OF ANY OF THE INSTRUMENTS OF SERVICE OF THE ENGINEER BY THE OWNER OR EXTENSIONS OF THIS PROJECT WITHOUT WRITTEN PERMISSION OF THE ENGINEER SHALL BE AT THE OWNER'S RISK AND THE OWNER AGREES TO DEFEND, INDEMNIFY AND HOLD HARMLESS THE ENGINEER FROM ALL CLAIMS, DAMAGES, AND EXPENSES INCLUDING ATTORNEY'S FEES ARISING OUT OF UNAUTHORIZED REUSE OF THE ENGINEER'S INSTRUMENTS OF SERVICE BY THE OWNER OR BY OTHERS ACTING THROUGH THE OWNER.

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sDO PROJECT NO: 1020.00
COOD PROJECT NO: CE 02089

ISSUE DATE 01-12-2012
PHASE 100% CD

MECHANICAL LEGEND AND GENERAL INFORMATION

M-000

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ROOFTOP UNIT WITH ENERGY RECOVERY SCHEDULE

S855.02 (10/22/0 01/13/12 13:08:47

| PLAN CODE | MFR. / MODEL NO. | INSTALLED MFR. | INSTALLED MODEL | ARRANGEMENT | SUPPLY FAN DATA: CFM; UNIT TOTAL @ 5439' | MIN. O.A. | E.S.P. IN. W.C. @ S.L. | T.S.P. IN. W.C. @ S.L. | WHEEL TYPE & DIA. (IN.) | FAN RPM (APPROX) | H.P. (EA) | FAN BHP @ ALT. | RETURN/EXHAUST FAN DATA: CFM TOTAL @ 5439' | E.S.P. IN W.C. @ S.L. | T.S.P. IN W.C. @ S.L. | WHEEL TYPE & DIA. (IN.) | FAN RPM (APPROX) | H.P. (EA) | FAN BHP @ ALT. | QTY. | MAX. FACE VELOCITY (FPM) | COIL CFM @ 5439' | AIR P.D. IN W.C. @ S.L. (10) | HEATING COIL DATA: ENTERING AIR TEMP. °F DB | °F WB | LEAVING AIR TEMP. °F DB | °F WB | EWT °F | LWT °F | % GLYCOL (PROP) | TOTAL MBH | GPM | WATER P.D. F.T. W.C. (MAX.) | ROWS (MIN.) | FINS/ INCH (MAX.) | HEAT RECOVERY WHEEL: QTY / SIZE | CFM SUPPLY | CFM RETURN | SERVICE | SUPPLY AIR: OUTSIDE AIR EAT °F DB | OUTSIDE AIR EAT °F WB | SUPPLY AIR EAT °F DB | SUPPLY AIR EAT °F WB | SUPPLY AIR LAT °F DB | SUPPLY AIR LAT °F WB | EXHAUST AIR: EAT °F DB | EXHAUST AIR EAT °F WB | EXHAUST AIR LAT °F DB | EXHAUST AIR LAT °F WB | SENS. REC. (MBH) | EFF % | AIR P.D. IN W.C. @ S.L. | FILL | MEDIA EFF. % | PUMP HP (?) | DIRECT EVAP COOLER DATA: SUPPLY AIR EAT °F DB | SUPPLY AIR EAT °F WB | SUPPLY AIR LAT °F DB | SUPPLY AIR LAT °F WB | EXHAUST AIR EAT °F DB | EXHAUST AIR EAT °F WB | EXHAUST AIR LAT °F DB | EXHAUST AIR LAT °F WB | SUPPLY AIR FILTER DATA: TYPE | FACE AREA S.F. | PRE-FILTER | FINAL FILTER | ELECTRICAL DATA: VOLT/PH | FLA | MCA | MOP | APPROX. UPPER WEIGHT (LBS.) | REMARKS |
|---|---|---

UNIT HEATER SCHEDULE (HOT WATER)

S835.08 (02/28/0 10/24/11 14:46:23

PLAN CODE	MFR.	MODEL	INSTALLED MFR.	INSTALLED MODEL	DISCHARGE	MBH	GPM	°F EWT	WATER P.D. FT. W.C.	CFM @ S.L.	RPM (APPROX.)	H.P.	MOUNTING HEIGHT (FT.)	ELEC. VOLT/PH	REMARKS
UH-1	TRANE	S-A08			HORIZONTAL	8.0	0.8	190	0.8	245	1550	1/4	10'-0"	120/1	LINE VOLTAGE THERMOSTAT
UH-2	TRANE	S-A08			HORIZONTAL	8.0	0.8	190	0.8	245	1550	1/4	10'-0"	120/1	LINE VOLTAGE THERMOSTAT

CABINET UNIT HEATER SCHEDULE (HOT WATER)

S835.03\n(7/24/01) 07/12/12 13:12:01

PLAN CODE	MFR.	MODEL	INSTALLED MFR.	INSTALLED MODEL	ARRANGEMENT (3)	INLET (1)	DISCHARGE (2)	°F ENTERING WATER TEMP.	MBH	GPM	WATER P.D. FT. W.C.	% GLYCOL	CFM @ 5439'	EAT (°F)	MOTOR POWER (WATTS)	ELEC. VOLT/PH.	REMARKS
CUH-1	TRANE	D 03			F	B	B	190	25.0	2.0	3.5	30	290	60	42	120/1	(4)
CUH-2	TRANE	D 03			F	B	B	190	25.0	2.0	3.5	30	290	60	42	120/1	(4)
CUH-3	TRANE	H 02			C	B	B	190	14.5	1.0	1.5	30	200	60	30	120/1	(4)

REMARKS:
(1) INLET CONFIGURATION: (A) DUCTED FLANGE CONNECTION, (B) FACE PLATE RETURN GRILLE, (C) BOTTOM CABINET RETURN.
(2) OUTLET CONFIGURATION: (A) DUCTED FLANGE CONNECTION, (B) FACE PLATE SUPPLY GRILLE, (C) TOP CABINET SUPPLY.
(3) ARRANGEMENT: (A) CEILING FLUSH MOUNTED, (B) WALL FLUSH, (C) WALL RECESSED, (D) CONCEALED OVERHEAD, (E) CEILING SURFACE MOUNTED (F) CEILING RECESSED.
(4) PROVIDE THE FOLLOWING: 1) INTEGRAL DISCONNECT SWITCH, 2) UNIT MOUNTED FAN SPEED SWITCH, 3) UNIT MOUNTED LINE VOLTAGE THERMOSTAT.

COIL SCHEDULE

238200.02 (07/06/10) 12/07/11 13:53:28

PLAN CODE	CFM	SIZE L x H (IN.)	SYSTEM	FACE VEL. (FPM)	EAT °F DB	EAT °F WB	LAT °F DB	LAT °F WB	EWT (°F)	LWT (°F)	GLYCOL %	MBH TOTAL	TOTAL GPM	WATER P.D. FT. W.C.	ROWS	FINS PER FT. (MAX)	AIR P.D. IN W.C. @ S.L. (MAX)	REMARKS
DHC-1	1400	22x14	RTU-2 / LEVEL 2		50	–	95	–	190	160	30%	56	3.9		2		.25	
DHC-2	1100	18x15	RTU-2 / LEVEL 1	600	50	–	92	–	190	160	30%	40.6	2.8	2.15	1	110	.25	

HOT WATER BOILER - SCHEDULE (NATURAL GAS)

S356.02 (07/29/0 10/24/11 14:47:26

PLAN CODE	MFR.	MODEL	INSTALLED MFR.	INSTALLED MODEL	BOILER H.P.	GPM MAX / MIN	MBH INPUT @ S.L.	MBH GROSS OUTPUT @ S.L.	MAX. FIRING RATE (CFH)	MIN. GAS PRESSURE (IN. W.C.)	MAX. GAS PRESSURE (IN. W.C.)	GLYCOL %	COMB. INLET DIAMETER	FLUE OUTLET DIAMETER	ELEC. VOLT/PH	OPERATING WEIGHT (LBS)	REMARKS
B-1	P-K MODU-FIRE	N750MFD			19.0	120 / 60	750	637	882	5	14	30	8"	6"	208/1 6A	800	
B-2	P-K MODU-FIRE	N750MFD			19.0	120 / 60	750	637	882	5	14	30	8"	6"	208/1 6A	800	

NOTES:
(1) COMBUSTION EFFICIENCY: 85%
(2) 125 PSIG RATED.
(3) GAS/ELECTRIC IGNITION ASSEMBLY INCLUDING; GAS PRESSURE REGULATOR; GAS COCK; GAS SOLENOID VALVE, DUAL; GAS/ELECTRIC IGNITION SWITCH.

PUMP SCHEDULE

S540.02\n(3/11/03) 12/07/11 11:17:09

PLAN CODE	SERVICE	LOCATION	PUMP TYPE	MFR.	MODEL	PUMP SIZE	GPM	HEAD FT.	EFF %	APPROX. IMP. DIA.	SUCTION DIA.	DISCHARGE DIA.	% OF PROPYLENE GLYCOL	H.P.	RPM	ELEC. VOLT/PH.	REMARKS
HWP-1	HEATING WATER	MECH ROOM	INLINE	ARMSTRONG	4380	2x2x8	82	50	64	7.25	2	2	30	3	1800	208/3	
HWP-2	HEATING WATER	MECH ROOM	INLINE	ARMSTRONG	4380	2x2x8	82	50	64	7.25	2	2	30	3	1800	208/3	STAND-BY
HWCP-1	HEATING WATER	MECH ROOM	INLINE	ARMSTRONG	SERIES S	S57	70	20	–	–	3"	3"	30	3/4	1800	208/3	
HWCP-2	HEATING WATER	MECH ROOM	INLINE	ARMSTRONG	SERIES S	S57	70	20	–	–	3"	3"	30	3/4	1800	208/3	
HWCP-3	RTU-1	RTU-1	INLINE	ARMSTRONG	SERIES H	H63	26	25	–	5.25	1 1/2"	1 1/2"	30	3/4	1800	208/3	

EXPANSION TANK SCHEDULE

S120.01\n(3/11/03) 12/13/11 09:54:09

PLAN CODE	MFR.	MODEL	INSTALLED MFR.	INSTALLED MODEL	SERVICE	CHARGE PRESSURE	% GLYCOL	CAPACITY ACCEPT. VOLUME	CAPACITY TOTAL VOLUME	OPERATING WEIGHT (LBS.)	SYSTEM WATER VOLUME (GAL.) APPROX	SYSTEM GLYCOL VOLUME (GAL.) APPROX	REMARKS
ET-HW-1	AMTROL	AX-100V			HEATING WATER	12	30	22.60	55.70	370	175	75	(1)

1. FLOOR MOUNTED TYPE.

AIR SEPARATOR SCHEDULE

S120.02 (7/2/01) 05/13/11 12:27:43

PLAN CODE	MFR.	MODEL	INSTALLED MFR.	INSTALLED MODEL	SERVICE	GPM	PRESSURE DROP (FT. OF HEAD)	PIPE SIZE	REMARKS
AS-1	B & G ROLAIRTROL	RL-3F			HEATING WATER	156	1.00	3	

GLYCOL FEED UNIT SCHEDULE

PLAN CODE	MFR.	MODEL	FLOW RATE @ 0 PSIG (GPM)	FLOW RATE @ 50 PSIG (GPM)	TANK VOL. (GAL)	GLYCOL CONCENTRATION (% BY VOL)	VOLT/ PHASE	FLA	REMARKS
GF-1	AXIOM	SF100	1.4	1.0	55	30	115/1	0.7	

RADIANT HEATING PANEL SCHEDULE (HOT WATER)

S835.11\n(0/28/02)\n\n 12/08/11 13:48:07

DESIGNATION	MFR.	MODEL	INSTALLED MFR.	INSTALLED MODEL	SIZE L x W (FT)	AREA SERVED	NO. OF PANELS	CAPACITY BTUH	CAPACITY WATER P.D. F.T. W.C.	CAPACITY GPM	REMARKS
RHP-1	SIGMA	MODULAR			4 x 1 (4 TUBE)	MEN'S 114	1	1080	.50	.10	(1)

(1) PROVIDE ALL NECESSARY HARDWARE AND ACCESSORIES TO MOUNT PANEL FLUSH WITH GYPSUM BOARD CEILING.

SOUND ATTENUATOR SCHEDULE

23.05500.01 (07/06/10) 01/16/12 15:13:53

PLAN CODE	SYSTEM	MFR.	MODEL	INSTALLED MFR.	INSTALLED MODEL	CFM @ ALT.	FACE VEL FPM	P.D. IN W.C. @ ALT.	HEIGHT (IN.)	WIDTH (IN.)	LENGTH (IN.)	INSERTION LOSSES (DB) 63 HZ.	125 HZ.	250 HZ.	500 HZ.	1000 HZ.	2000 HZ.	4000 HZ.	MAXIMUM REGENERATED NOISE (DB) 63 HZ.	125 HZ.	250 HZ.	500 HZ.	1000 HZ.	2000 HZ.	4000 HZ.	REMARKS
SAU-1	RTU-1 RETURN	IAC	3LFL			15,750	1400	.23	30	60	36	4	7	13	17	17	11	11	46	45	48	49	51	55	46	
SAU-2	RTU-2 SUPPLY	IAC	3LFM			2500	750	.13	18	32	36	4	7	15	20	17	13	11	46	35	37	37	41	39	29	

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COLORADO REGISTERED PROFESSIONAL ENGINEER PAUL BISHOWICZ 28801 1/13/12 J.D.S.L.

sDC PROJECT NO: 1020.00
CODD PROJECT NO: CE 02089

ISSUE DATE 01-12-2012
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MECHANICAL SCHEDULES

M-002

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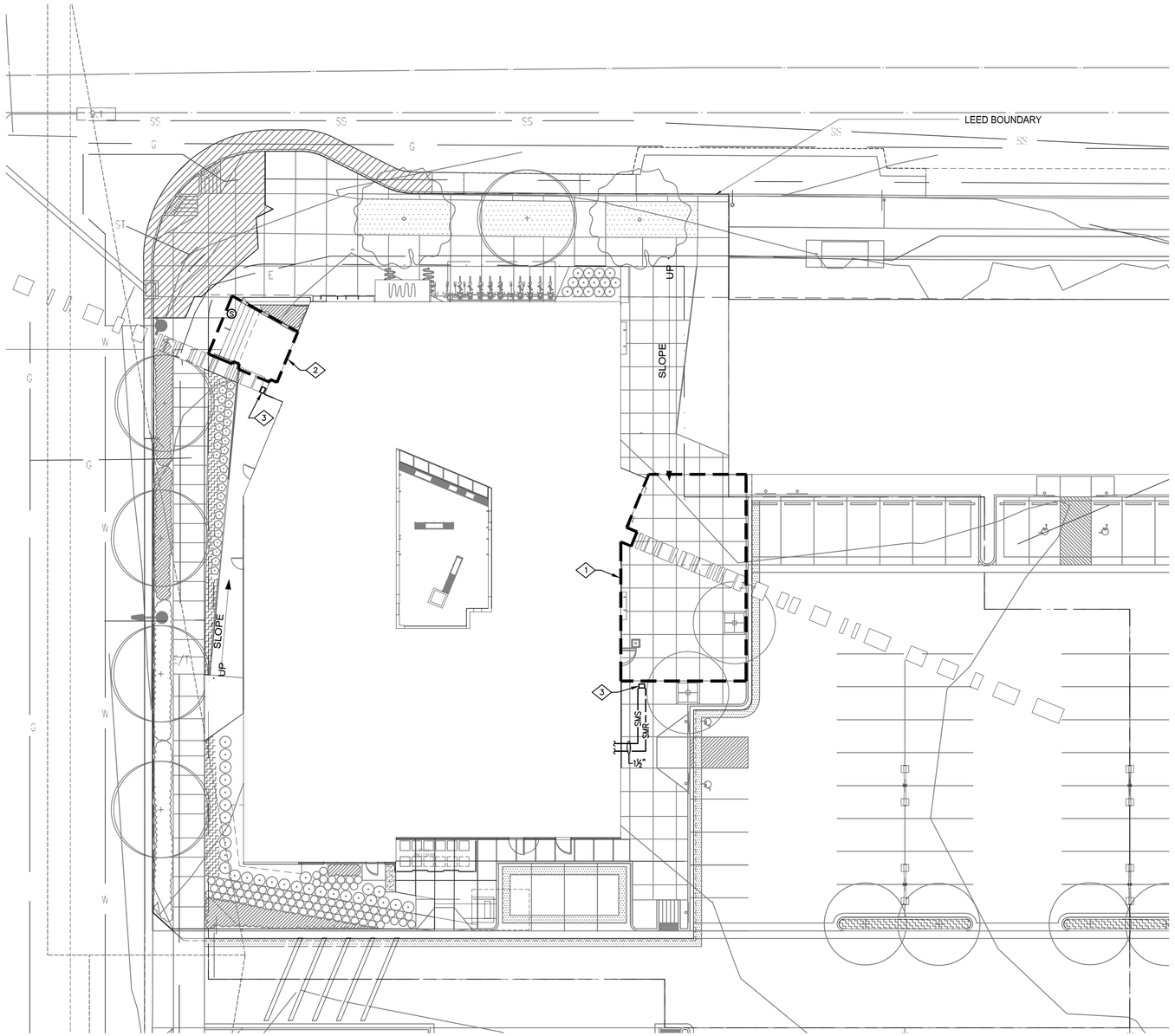

MECHANICAL SITE PLAN
SCALE: 1/16" = 1'-0"

8' 4' 0 8' 16' 32'

GENERAL NOTES:

1. ALL WORK SHOWN ON THIS DRAWING IS RELATED TO THE SNOW MELT SYSTEM; ADD ALTERNATE NO. 3.
2. SEE DETAILS FOR SNOW MELT INSTALLATION.

WORK NOTES:

1. ADD ALTERNATE 3a: PROVIDE (10) LOOPS, ¾" "PEX" TUBING FOR 1,500 SQUARE FOOT WALKWAY; 300 LINEAR FEET PER LOOP. CONTRACTOR TO DESIGN PIPE LAYOUT AND SUBMIT DRAWINGS FOR REVIEW. REFER TO SPECIFICATION AND PIPING SCHEMATIC/CONTROL DIAGRAM FOR ADDITIONAL INFORMATION.
2. ADD ALTERNATE 3b: PROVIDE (3) LOOPS (2 STAIR/1 LANDING), ¾" "PEX" TUBING FOR 300 SQUARE FOOT WALKWAY; 200 LINEAR FEET PER LOOP AT STAIR AND 300 LINEAR FEET FOR LOOP AT TOP LANDING. CONTRACTOR TO DESIGN PIPE LAYOUT AND SUBMIT DRAWINGS FOR REVIEW. REFER TO SPECIFICATION AND PIPING SCHEMATIC/CONTROL DIAGRAM FOR ADDITIONAL INFORMATION.
3. 48"x30" CONCRETE PIT/SNOW MELT MANIFOLD; SEE DETAIL.

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MECHANICAL SITE PLAN

M-100

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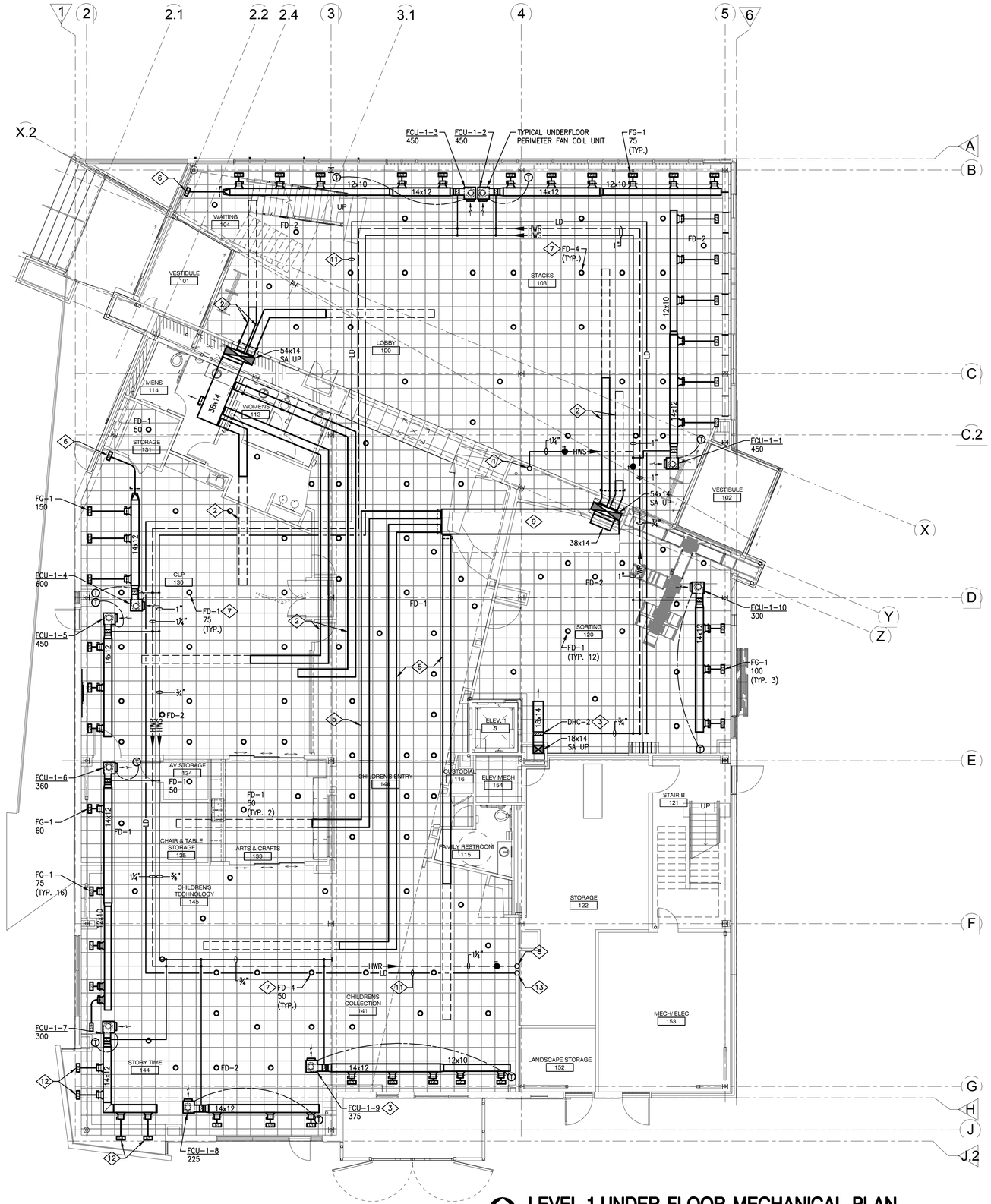

GENERAL NOTES:

1. ALL FCU HWS/R PIPING RUNOUTS ARE ¾" UNLESS NOTED OTHERWISE.
2. SEE ARCHITECTURAL INTERIOR FLOOR PATTERN PLAN FOR EXACT LOCATION OF FLOOR GRILLES AND FLOOR DIFFUSERS.
3. ALL FLOOR DIFFUSERS TO BE 60 CFM EACH UNLESS NOTED OTHERWISE ON PLAN.
4. ALL HWS/HWR BRANCH PIPING TO HEATING COILS SHALL BE ¾" UNLESS NOTED OTHERWISE.
5. PROVIDE ALL FAN COIL UNITS AND TERMINAL BOXES WITH 2-WAY MODULATING CONTROL VALVES UNLESS NOTED OTHERWISE.
6. DUCT SOCK TO BE LOCATED BELOW CABLE TRAYS; FIELD COORDINATE.
7. FLOOR DIFFUSER QUANTITIES AND SPACING ARE PRELIMINARY; FLOOR DIFFUSERS MAY INCREASE/DECREASE IN DENSITY AS DESIGN MOVES FORWARD BASED ON FINAL BUILDING ENVELOPE INCLUDING GLAZING PERFORMANCE AND FINAL GLAZING QUANTITIES.
8. ALL TEMPERATURE SENSORS SHOWN ON THIS PLAN ARE TO BE LOCATED IN SPACE ABOVE RAISED FLOOR AT HEIGHT INDICATED ON M-000.
9. PRIOR TO FABRICATION AND INSTALLATION OF UNDER FLOOR DUCTWORK, COORDINATE DUCTWORK WITH CABLE TRAY SHOWN ON TC101. KEEP DUCTWORK TO EITHER SIDE OF CABLE TRAY; WHERE CABLE TRAY AND DUCTWORK CROSS EACH OTHER, FIELD COORDINATE ELEVATION OF TRAY TO ALLOW MAXIMUM SPACE FOR DUCTWORK.

WORK NOTES:

1. 1¼"HWS FROM ABOVE.
2. 14"ø FABRIC DUCT; DASHED LINES INDICATE 16 LF OF ACTIVE, PERFORATED DUCT WITH DISCHARGE ON BOTH SIDES FOR 900 CFM.
3. PROVIDE HEATING COIL WITH 3-WAY MODULATING VALVE.
4. DAISY CHAIN FD-3 DIFFUSERS TO MODULATE TOGETHER IN THIS SPACE.
5. 14"ø FABRIC DUCT; DASHED LINES INDICATE 20 LF OF ACTIVE, PERFORATED DUCT WITH DISCHARGE ON BOTH SIDES FOR 900 CFM.
6. FIELD CUT FLOOR GRILLE INTO RAISED ACCESS FLOOR TO BE PARALLEL TO WALL.
7. 60% OF ROUND FLOOR DIFFUSERS SHALL BE FD-1 AND 40% SHALL BE FD-4. LOCATE FD-1 DIFFUSERS IN SEATING AREAS AND FD-4 IN STACKS AND CIRCULATION AREAS; COORDINATE FLOOR DIFFUSERS WITH ARCHITECT.
8. 1¼"HWR UP INSIDE WALL.
9. 44"x14" UNDER FLOOR SHEET METAL PLENUM WITH ½" LINER.
10. ¾"HWS/R UP INSIDE WONDERWALL TO RHP-1 IN MENS 114.
11. LIEBERT LT500V LEAK DETECTION CABLE, INSTALL CABLE IN LOCATION SHOWN, ATTACH TO FLOOR PER MANUFACTURER'S INSTALLATION REQUIREMENTS. ROUTE CABLE TO LIEBERT LIQUI-TECT MONITORING SYSTEM LOCATED IN THE MECHANICAL ROOM. SEE SHEET M-201 FOR MONITORING SYSTEM PANEL LOCATION.
12. INSTALL FLOOR GRILLES INSIDE WALL OF BENCH; RE: ARCHITECTURAL DETAIL.
13. ROUTE LEAK DETECTION CABLE UP INSIDE WALL TO LEVEL 1 CEILING.

LEVEL 1 UNDER FLOOR MECHANICAL PLAN

SCALE: 1/8" = 1'-0"

4' 2' 0 4' 8' 16'

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LEVEL 1 UNDER FLOOR MECHANICAL PLAN

M-101

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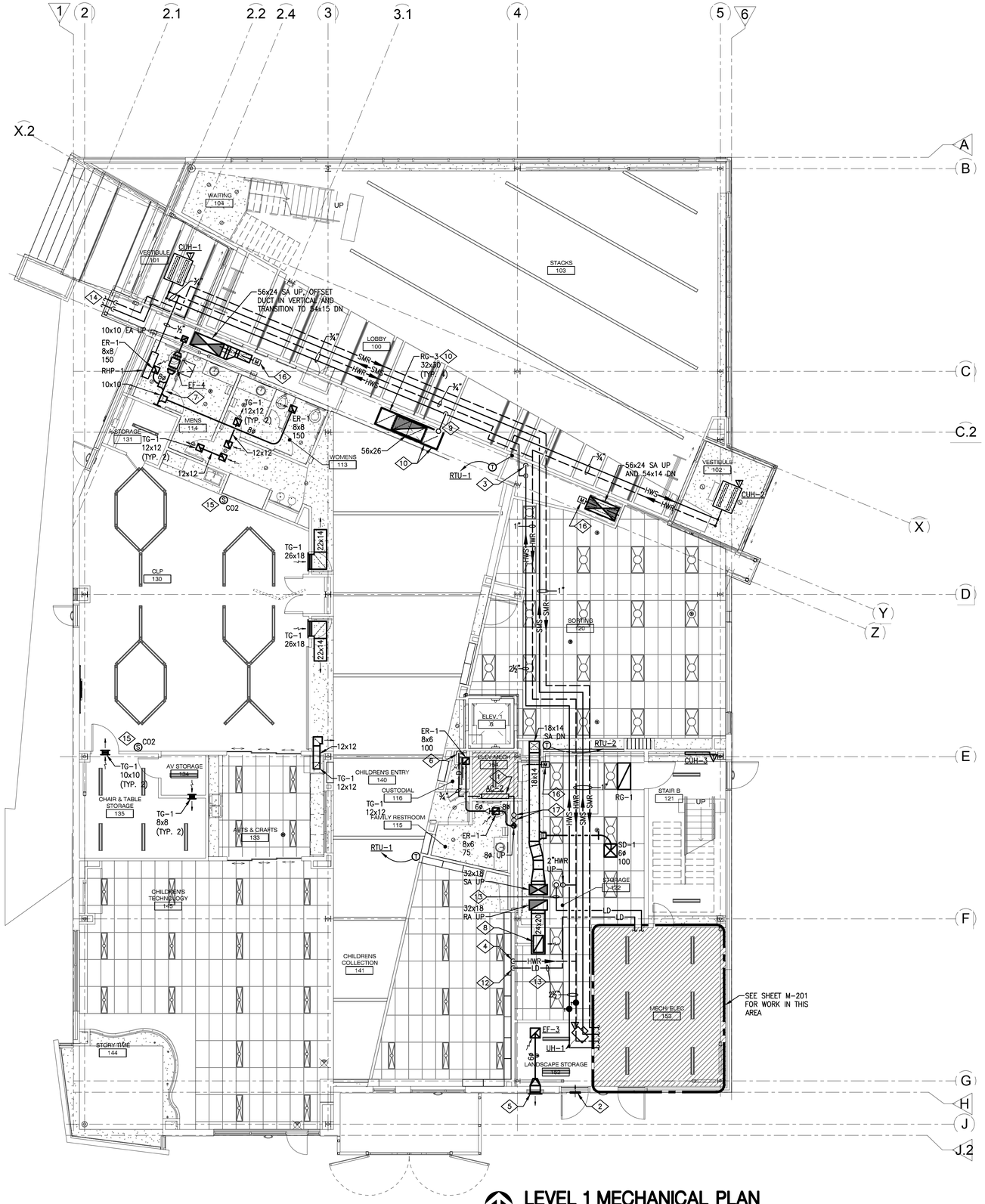

LEVEL 1 MECHANICAL PLAN

SCALE: 1/8" = 1'-0"

4' 2' 0 4' 8' 16'

GENERAL NOTES:

1. SNOW MELT PIPING, SMS/R, SHOWN ON THIS PLAN IS PART OF ADD ALTERNATE 3a.

WORK NOTES:

1. COORDINATE EXACT LOCATION OF AC-2 WITH ELEVATOR EQUIPMENT ROOM LAYOUT.
2. DOOR LOUVER FOR TRANSFER AIR; RE: ARCHITECTURAL.
3. 1¼"HWS DOWN TO LEVEL 1 UNDER FLOOR.
4. 1¼"HWR FROM LEVEL 1 UNDER FLOOR BELOW.
5. WALL LOUVER DISCHARGE FOR EF-3.
6. TERMINATE ¾" CONDENSATE DRAIN FROM AC-2 AT MOP SERVICE BASIN; 3" ABOVE FLOOD RIM.
7. OFFSET EXHAUST DUCT BRANCHES AT MAIN TO MINIMIZE NOISE TRANSFER.
8. 18"x30" OPENING IN TOP OF DUCT FOR RETURN AIR; RE: DETAIL.
9. 2"HWS UP TO LEVEL 2 UNDER FLOOR.
10. 30"x118"x20" TALL PLENUM ABOVE RETURN GRILLES; STUB 56"x26" RETURN AIR DUCT INTO TOP OF PLENUM.
11. CUSTOM COLOR SELECTION BY ARCHITECT FOR FOUR (4), RG-3, RETURN GRILLES.
12. LEAK DETECTION CABLE FROM LEVEL 1 UNDER FLOOR BELOW.
13. ROUTE LEAK DETECTION BACK TO MONITORING PANEL IN MECHANICAL/ELECTRICAL ROOM.
14. 1"SMS/R PIPING TO SNOW MELT MANIFOLD FOR ZONE 1.
15. CO2 (MONITOR) SENSOR; MOUNT AT 60" A.F.F.
16. UNDER FLOOR PRESSURE CONTROL DAMPER; RE: SEQUENCE OF OPERATION.
17. ½"RS AND ¼"RL LINES UP INSIDE CHASE.

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LEVEL 1 MECHANICAL PLAN

M-102

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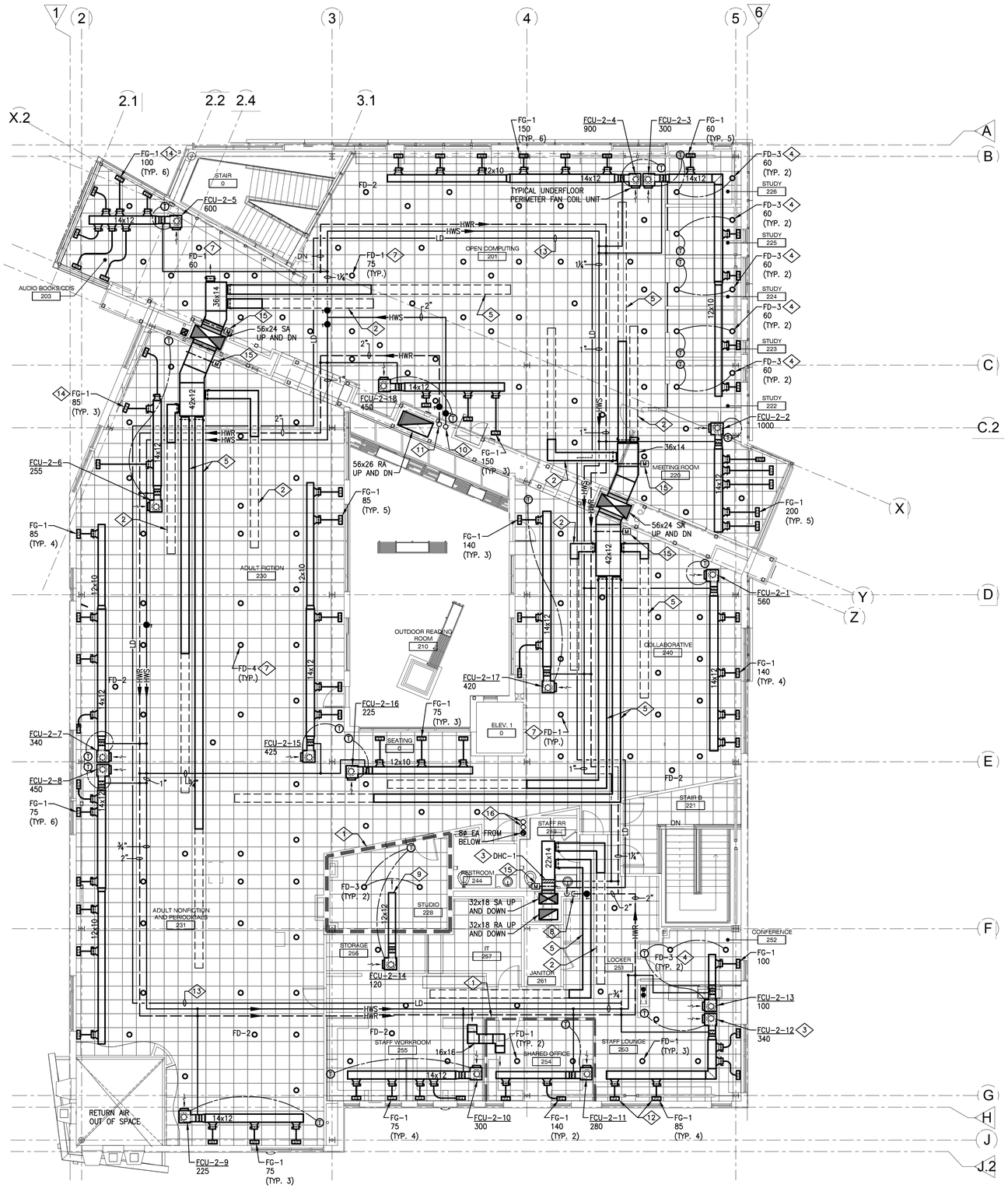

LEVEL 2 UNDER FLOOR MECHANICAL PLAN

SCALE: 1/8" = 1'-0"

4' 2' 0 4' 8' 16'

GENERAL NOTES:

1. ALL FCU HWS/R PIPING RUNOUTS ARE ¾" UNLESS NOTED OTHERWISE.
2. SEE ARCHITECTURAL INTERIOR FLOOR PATTERN PLAN FOR EXACT LOCATION OF FLOOR GRILLES AND FLOOR DIFFUSERS.
3. ALL FLOOR DIFFUSERS TO BE 60 CFM EACH UNLESS NOTED OTHERWISE ON PLAN.
4. ALL HWS/HWR BRANCH PIPING TO HEATING COILS SHALL BE ¾" UNLESS NOTED OTHERWISE.
5. PROVIDE ALL FAN COIL UNITS AND TERMINAL BOXES WITH 2-WAY MODULATING CONTROL VALVES UNLESS NOTED OTHERWISE.
6. DUCT SOCK TO BE LOCATED BELOW CABLE TRAYS; FIELD COORDINATE.
7. FLOOR DIFFUSER QUANTITIES AND SPACING ARE PRELIMINARY; FLOOR DIFFUSERS MAY INCREASE/DECREASE IN DENSITY AS DESIGN MOVES FORWARD BASED ON FINAL BUILDING ENVELOPE INCLUDING GLAZING PERFORMANCE AND FINAL GLAZING QUANTITIES.
8. ALL TEMPERATURE SENSORS SHOWN ON THIS PLAN ARE TO BE LOCATED IN SPACE ABOVE RAISED FLOOR AT HEIGHT INDICATED ON M-000.
9. PRIOR TO FABRICATION AND INSTALLATION OF UNDER FLOOR DUCTWORK, COORDINATE DUCTWORK WITH CABLE TRAY SHOWN ON TC102. KEEP DUCTWORK TO EITHER SIDE OF CABLE TRAY; WHERE CABLE TRAY AND DUCTWORK CROSS EACH OTHER, FIELD COORDINATE ELEVATION OF TRAY TO ALLOW MAXIMUM SPACE FOR DUCTWORK.

WORK NOTES:

1. SOUND ISOLATION WALL; RE: ARCHITECTURAL.
2. 14"ø FABRIC DUCT; DASHED LINES INDICATE 16 LF OF ACTIVE, PERFORATED DUCT WITH DISCHARGE ON BOTH SIDES FOR 900 CFM.
3. PROVIDE HEATING COIL WITH 3-WAY MODULATING VALVE.
4. DAISY CHAIN FD-3 DIFFUSERS TO MODULATE TOGETHER IN THIS SPACE.
5. 14"ø FABRIC DUCT; DASHED LINES INDICATE 20 LF OF ACTIVE, PERFORATED DUCT WITH DISCHARGE ON BOTH SIDES FOR 900 CFM.
6. PROVIDE ½" LINER FOR UNDER FLOOR BRANCH DUCTWORK.
7. 60% OF ROUND FLOOR DIFFUSERS SHALL BE FD-1 AND 40% SHALL BE FD-4. LOCATE FD-1 DIFFUSERS IN SEATING AREAS AND FD-4 IN STACKS AND CIRCULATION AREAS; COORDINATE FLOOR DIFFUSERS WITH ARCHITECT.
8. 2"HWR DOWN INSIDE SHAFT.
9. OPEN END DUCT TO DISCHARGE AIR TO STUDIO FLOOR PLENUM.
10. 2"HWS FROM BELOW AND 1½"HWS UP TO RTU-1.
11. 2"HWR FROM RTU-1 ABOVE.
12. INSTALL FLOOR GRILLES AT TOP OF BENCH; RE: ARCHITECTURAL DETAIL.
13. LIEBERT LT500V LEAK DETECTION CABLE. INSTALL CABLES IN LOCATION SHOWN, ATTACH TO FLOOR PER MANUFACTURER'S INSTALLATION REQUIREMENTS. ROUTE CABLE TO LIEBERT LIQUI-TECT MONITORING SYSTEM LOCATED IN THE MECHANICAL ROOM. SEE SHEET M-201 FOR MONITORING SYSTEM PANEL LOCATION.
14. FIELD CUT FLOOR GRILLE INTO RAISED ACCESS FLOOR TO BE PARALLEL TO WALL.
15. UNDER FLOOR PRESSURE CONTROL DAMPER; RE: SEQUENCE OF OPERATION.
16. ½"RS AND ¼"RL LINES FROM AC-2 UP THROUGH ROOF TO ACCU-2.

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COOD PROJECT NO: CE 02089

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LEVEL 2 UNDER FLOOR MECHANICAL PLAN

M-103

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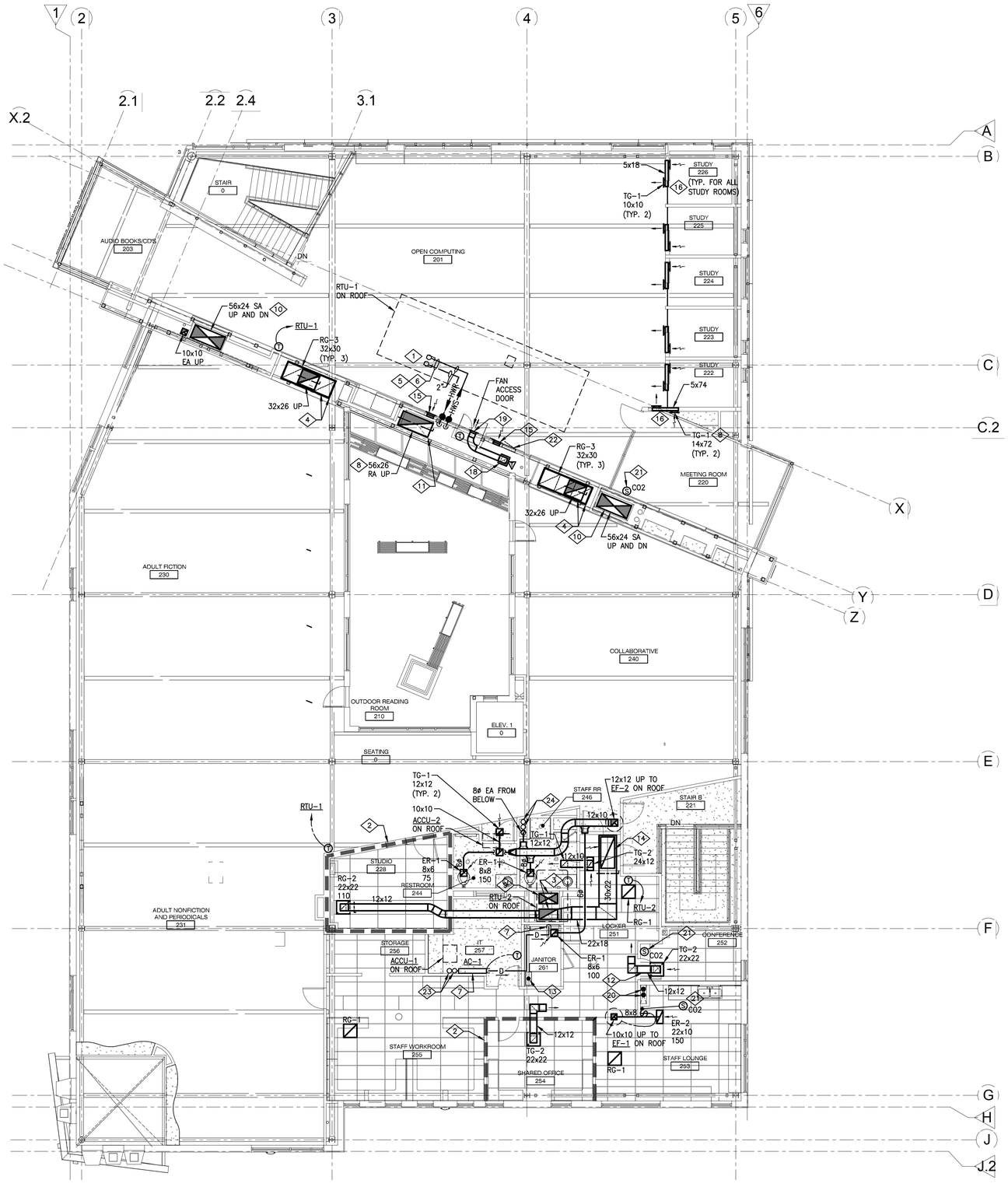

LEVEL 2 MECHANICAL PLAN

SCALE: 1/8" = 1'-0"

4' 2' 0 4' 8' 16'

GENERAL NOTES:

1. ALL DUCT DIMENSIONS ARE OUTSIDE DIMENSIONS. WHERE DUCT LINER IS USED, THE THICKNESS OF THE LINER TO MAINTAIN THE CLEAR INSIDE DIMENSION HAS BEEN INCLUDED. REFER TO DUCT DIVISION 23 OF THE SPECIFICATIONS.

WORK NOTES:

1. 2"HWS/R UP TO RTU-1 ON ROOF.
2. SOUND ISOLATION WALL; RE: ARCHITECTURAL.
3. 32"x18" SUPPLY AND RETURN AIR UP TO RTU-2; TRANSITION DUCTWORK AS REQUIRED FOR UNIT CONNECTIONS. ROUTE SUPPLY AND RETURN DUCTS FROM RTU-2 DOWN INSIDE SHAFT.
4. 30"x8"x20" TALL PLENUM ABOVE RETURN GRILLES; STUB 32"x26" RETURN AIR DUCT INTO TOP OF PLENUM.
5. PAINT PIPING; COLOR SELECTION BY ARCHITECT.
6. ROUTE 2"HWS/R PIPING CROSSING CEILING TIGHT TO STRUCTURE, FROM WONDER WALL TO RTU-1.
7. TERMINATE ¾" CONDENSATE DRAIN FROM AC-1 AT MOP SERVICE BASIN; 3" ABOVE FLOOD RIM.
8. CUSTOM COLOR SELECTION BY ARCHITECT FOR TRANSFER GRILLE INSIDE MEETING ROOM.
9. SAU-2 IN VERTICAL SUPPLY AIR DUCT JUST BELOW ROOF.
10. PROVIDE INTERIOR DUCTWORK CONSTRUCTION FOR ALL SUPPLY AIR DUCTWORK STARTING JUST BELOW ROOF; RE: SPECIFICATION.
11. PROVIDE EXTERIOR DUCTWORK CONSTRUCTION FOR ALL RETURN AIR DUCTWORK BELOW ROOF AND WITHIN THE WONDERWALL; RE: SPECIFICATION.
12. RETURN AIR BOOT; RE: DETAIL.
13. 6"ø DOMESTIC WATER HEATER FLUE.
14. 24"x54" OPENING IN TOP OF DUCT FOR RETURN AIR; RE: DETAIL.
15. 10"x10", TG-1 AT 12" A.F.F.; PROVIDE OBD.
16. STUDY/MEETING ROOM TRANSFER AIR; RE: DETAIL.
17. AC-1; MOUNT BOTTOM OF WALL UNIT AT 96" A.F.F.
18. TRANSFER FAN; TF-5, INSIDE WONDERWALL IN VERTICAL CONFIGURATION; MOUNT AT 48" A.F.F.
19. 10"x10", TG-1 AT 12" BELOW FINISHED CEILING.
20. 6"ø BOILER FLUES FROM BELOW AND UP THROUGH ROOF.
21. CO2 (MONITORING) SENSOR; MOUNT AT 60" A.F.F.
22. ACCESS DOOR FOR TRANSFER FAN.
23. ½"RS AND ¼"RL LINES UP FROM AC-1 THROUGH ROOF TO ACCU-1.
24. ½"RS AND ¼"RL LINES FROM AC-2 BELOW AND UP THROUGH ROOF TO ACCU-2.

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LEVEL 2 MECHANICAL PLAN

M-104

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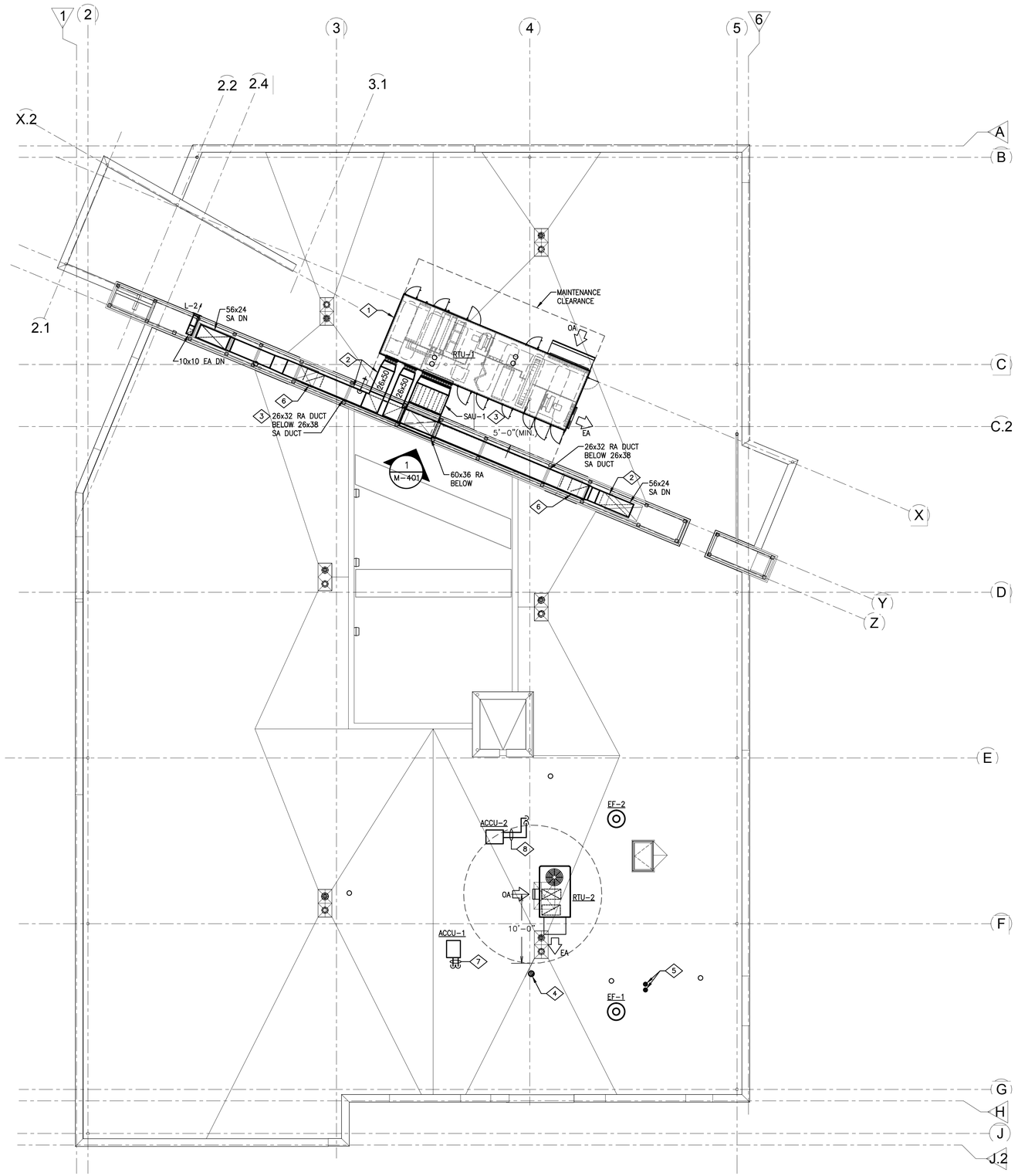

ROOF LEVEL MECHANICAL PLAN

SCALE: 1/8" = 1'-0"

4' 2' 0 4' 8' 16'

GENERAL NOTES:

1. COORDINATE WITH PLUMBING VENTS AND ENVIRONMENT VENTS TO MAINTAIN MINIMUM OF 10'-0" CLEARANCE BETWEEN ROOFTOP UNIT OUTSIDE AIR INTAKES AND VENT TERMINATIONS AT ROOF.
2. ALL DUCT DIMENSIONS ARE OUTSIDE DIMENSIONS. WHERE DUCT LINER IS USED, THE THICKNESS OF THE LINER TO MAINTAIN THE CLEAR INSIDE DIMENSION HAS BEEN INCLUDED. REFER TO DUCT DIVISION 23 OF THE SPECIFICATIONS.

WORK NOTES:

1. SEE RTU-1 DETAIL ON M-401 FOR DIMENSIONS AND INTERNAL SECTION REQUIREMENTS.
2. PROVIDE EXTERIOR DUCTWORK CONSTRUCTION FOR ALL SUPPLY AIR DUCTWORK ABOVE ROOF INCLUDING DUCTWORK INSIDE THE WONDERWALL.
3. PROVIDE EXTERIOR DUCTWORK CONSTRUCTION FOR ALL RETURN AIR DUCTWORK ABOVE ROOF INCLUDING DUCTWORK INSIDE THE WONDERWALL.
4. DOMESTIC WATER HEATER VENT/FLUE; PROVIDE VENT KIT TO TERMINATE FLUE AT 36" ABOVE FINISHED ROOF; RE: DETAIL.
5. TERMINATE BOILER EXHAUST FLUES AT 36" ABOVE FINISHED ROOF WITH OPEN TOP TERMINATION KIT; RE: DETAIL.
6. 26"x32" RETURN DUCT DOWN INTO TOP OF RETURN AIR PLENUM FOR LEVEL 2 RETURN.
7. ½"RS AND ¼"RL TO AC-1.
8. ½"RS AND ¼"RL TO AC-2.

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ROOF LEVEL MECHANICAL PLAN

M-105

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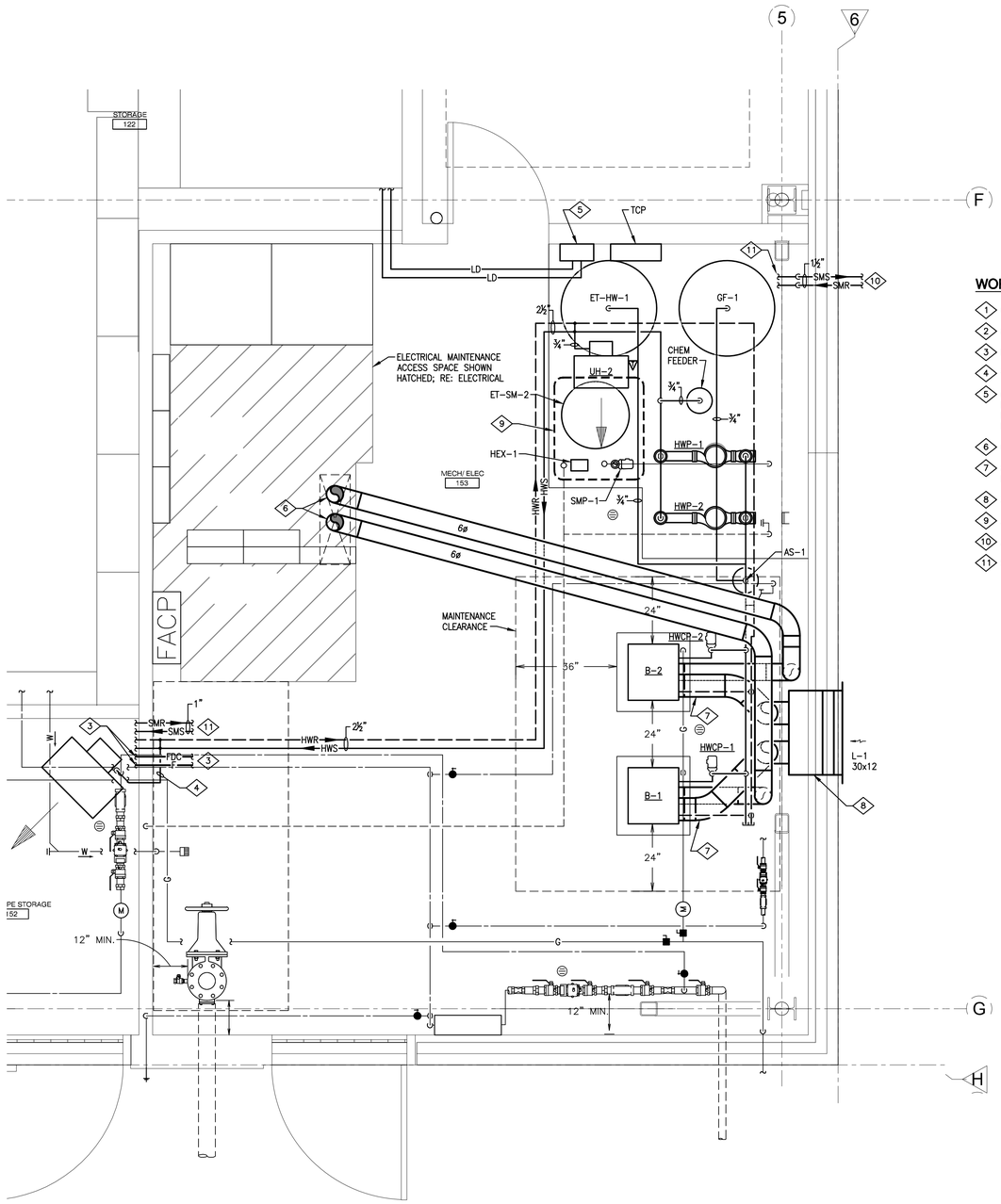

ENLARGED MECHANICAL/ELECTRICAL ROOM PLAN

SCALE: 1/2" = 1'-0"

1' 6" 0 1' 2' 4'

WORK NOTES:

1. 6"ø BOILER FLUE; TERMINATE BOTTOM OF PIPE AT 8'-0" A.F.G. REFER TO DETAIL.
2. 8"ø BOILER INTAKE; TERMINATE OUTLET AT 2'-6" A.F.G. REFER TO DETAIL.
3. FOR CONTINUATION SEE FIRE PROTECTION DRAWING FP-101.
4. ¾"HWS AND HWR TO UH-1.
5. (2) LEAK DETECTION MONITORING SYSTEM PANELS; STACKED. PROVIDE 1 MONITORING PANEL FOR LEVEL 1 AND LEVEL 2 UNDER FLOOR SYSTEMS AND A SECOND MONITORING PANEL FOR RTU-1 CURB SYSTEM; SEE PLANS FOR CABLE LAYOUT. PROVIDE FRAMED MAP OF EACH LEAK DETECTION CABLE LAYOUT.
6. 6"ø BOILER FLUE UP INSIDE RATED SHAFT INCLOSURE AT LEVEL 2.
7. 8"ø SEALED COMBUSTION AIR VENT FROM BOILER; TERMINATE AT INTAKE PLENUM/LOUVER.
8. 30"x12" INTAKE AIR PLENUM.
9. ADD ALTERNATE 3a: SNOW MELT SYSTEM EQUIPMENT; SEE SCHEMATIC ON M-301.
10. ADD ALTERNATE 3b: PIPING TO SNOW MELT MANIFOLD FOR ZONE 2.
11. SEE SNOW MELT PIPING SCHEMATIC FOR SYSTEM PIPING REQUIREMENTS ON M-301.

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ENLARGED MECHANICAL PLAN AND ELEVATIONS

M-201

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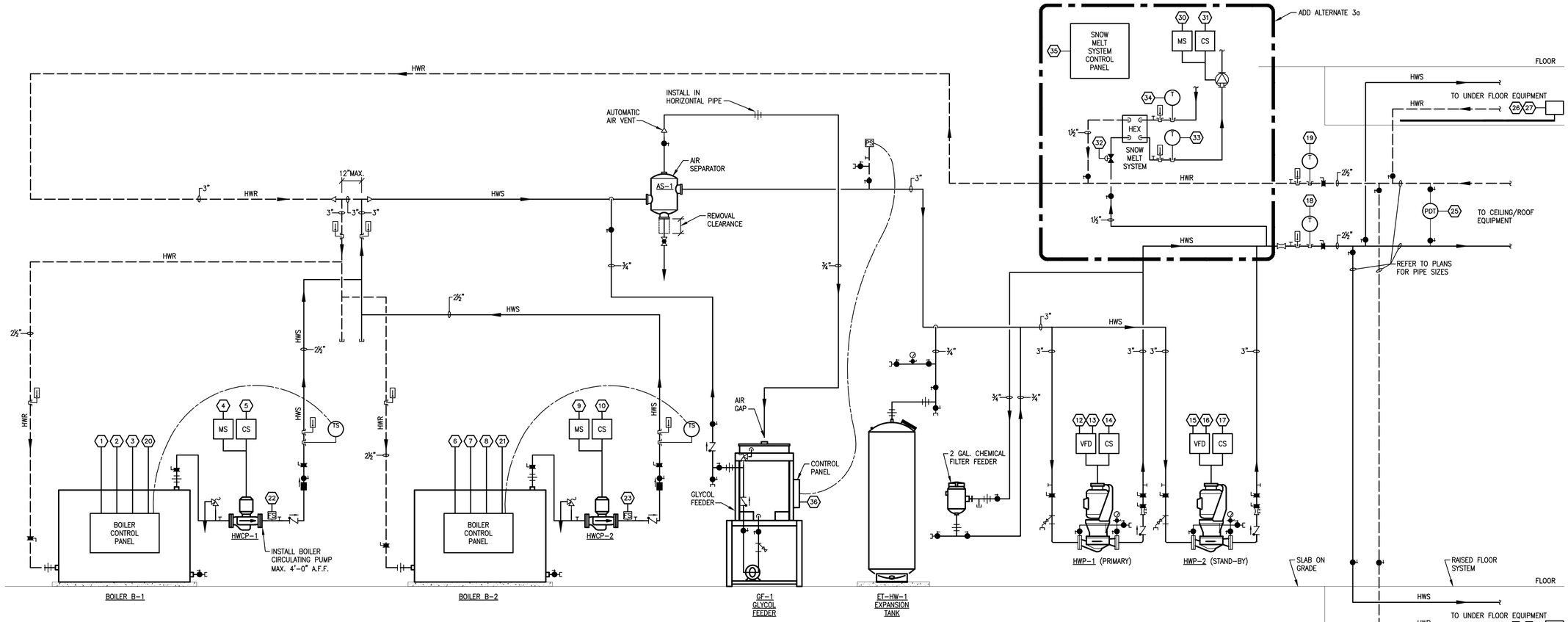

BOILER PLANT CONTROL AND PIPING DIAGRAM

NOT TO SCALE

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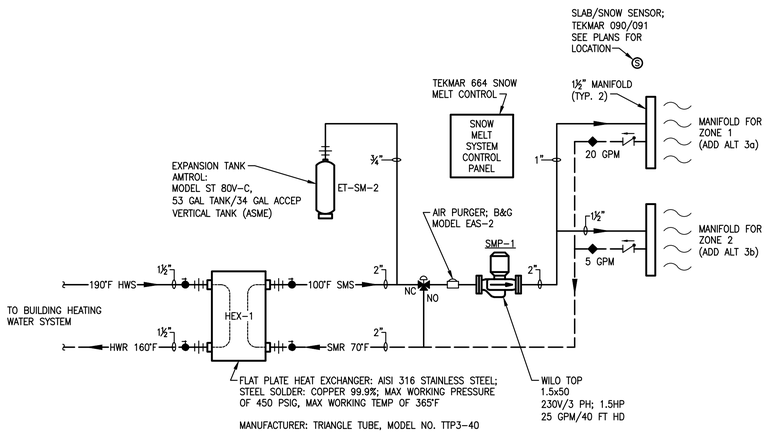

SNOW MELT PIPING SCHEMATIC - ADD ALTERNATE 3a

NOT TO SCALE

BOILER PLANT POINTS LIST

TAG	DESCRIPTION	TYPE
1	BOILER B-1 ALARM	BI
2	BOILER B-1 ENABLE/DISABLE	BO
3	BOILER B-1 STATUS	BI
4	BOILER PUMP HWCP-1 START/STOP	BO
5	BOILER PUMP HWCP-1 STATUS	BI
6	BOILER B-2 ALARM	BI
7	BOILER B-2 ENABLE/DISABLE	BO
8	BOILER B-2 STATUS	BO
9	BOILER PUMP HWCP-2 START/STOP	BO
10	BOILER PUMP HWCP-2 STATUS	BI
11	NOT USED	
12	HEATING PUMP HWP-1 START/STOP	BO
13	HEATING PUMP HWP-1 VFD MOUDULATION	AO
14	HEATING PUMP HWP-1 STATUS	BI
15	HEATING PUMP HWP-2 START/STOP	BO
16	HEATING PUMP HWP-2 VFD MOUDULATION	AO
17	HEATING PUMP HWP-2 STATUS	BI
18	HEATING WATER SUPPLY TEMPERATURE	AI
19	HEATING WATER RETURN TEMPERATURE	AI
20	BOILER B-1 FIRING RATE	AO
21	BOILER B-2 FIRING RATE	AO
23	BOILER B-1 FLOW SWITCH	BI
24	BOILER B-2 FLOW SWITCH	BI
25	HEATING WATER DIFF PRESSURE	AI
26	UPPER LEVEL LEAK DETECTION SYSTEM STATUS	BI
27	UPPER LEVEL LEAK DETECTION SYSTEM LEAK	BI
28	LOWER LEVEL LEAK DETECTION SYSTEM STATUS	BI
29	LOWER LEVEL LEAK DETECTION SYSTEM LEAK	BI
30	SNOW MELT DISTRIBUTION PUMP S/S	BO
31	SNOW MELT DISTRIBUTION PUMP STATUS	BI
32	SNOW MELT HEX TEMPERATURE CONTROL VALVE	AO
33	SNOW MELT HW SUPPLY TEMP	AI
34	SNOW MELT HW RETURN TEMP	AI
35	SNOW MELT SYSTEM MASTER ENABLE	BI
36	GLYCOL FEEDER LOW LEVEL ALARM	BI

BOILER PLANT SEQUENCE OF OPERATION

BOILERS ARE FURNISHED WITH FACTORY CONTROLS. INSTALL ALL FACTORY SUPPLIED DEVICES AND PROVIDE WIRING FOR ALL BOILER CONTROLS AS DIRECTED BY MFG. ALL DEVICES MAY NOT BE SHOWN ON THE DRAWINGS.

AT OUTSIDE AIR TEMPERATURE ≤ 62° F, THE LEAD BOILER HWCP SHALL BE ENABLED. ONCE PROOF OF FLOW IS ESTABLISHED, ENABLE LEAD BOILER.

BOILER "ENABLE" ALLOWS THE CONTROLS AND SAFETIES PROVIDED IN THE BOILER CONTROLLER TO FUNCTION.

BOILERS SHALL OPERATE IN A LEAD/LAG MODE WITH OUTDOOR AIR RESET OF THE HEATING WATER SUPPLY TEMPERATURE ACCORDING TO THE FOLLOWING LINEAR RESET SCHEDULE:

OA TEMP	HWS
60°F	160°F
20°F	200°F

THE MINIMUM RETURN WATER TEMPERATURE IS 140°F. IF THE RETURN WATER TEMPERATURE IS 140°F FOR 30 MINUTES, RAISE THE SUPPLY WATER TEMPERATURE IN 2 DEG. INCREMENTS UNTIL THE RETURN WATER TEMPERATURE REACHES 145°.

THE BAS SHALL MODULATE THE BOILER FIRING RATE, THROUGH AUXILIARY ANALOG INPUT TO CONTROL HEATING WATER SUPPLY TEMPERATURE, AS INDICATED.

THE BAS SHALL DIRECTLY ENERGIZE ASSOCIATED BOILER CIRCULATING PUMPS (HWCP) AND ALTERNATE LEAD BOILER TO EQUALIZE BOILER RUN TIME.

THE BAS SHALL MONITOR EACH BOILER AND PROVIDE A GENERAL ALARM FOR BOILER FAILURE. IN THE EVENT OF BOILER FAILURE, THE BAS SHALL ENABLE THE REMAINING BOILER, AS LEAD BOILER.

AT OUTSIDE AIR TEMPERATURE > 65°F (ADJ), DISABLE THE BOILERS.

MAIN HOT WATER DISTRIBUTION PUMPS SHALL OPERATE IN LEAD/STANDBY MODE WHENEVER THE BOILERS ARE ENABLED. THE STANDBY PUMP SHALL BE AUTOMATICALLY ENERGIZED IF THE LEAD PUMP FAILS. ALTERNATE THE LEAD PUMP TO EQUALIZE RUN TIME. MAIN HOT WATER DISTRIBUTION PUMPS SHALL CONTINUE TO RUN FOR 5 MINUTES AFTER BOILER SHUTDOWN.

MODULATE PUMP VFD TO CONTROL HEATING WATER PRESSURE DIFFERENTIAL TO 15 PSI (ADJ). T.C. CONTRACTOR AND T&B CONTRACTOR TO VERIFY ACTUAL MINIMUM PRESSURE REQUIRED TO SUPPLY DESIGN FLOW RATES TO DEVICES.

PROVIDE AN ALARM FOR MAIN HEATING WATER PUMP FAILURE.

UNDERFLOOR LEAK DETECTION SYSTEM SEQUENCE:

PROVIDE MONITORING OF ALARM POINTS FOR THE UNDERFLOOR LEAK DETECTION SYSTEM AS SHOWN ON THE POINTS LIST. THE LEAK DETECTION SYSTEM INCLUDES TWO DIGITAL OUTPUTS, ONE FOR LEAK DETECTION ALARMS, AND ONE FOR CABLE FAULT ALARMS.

UPON DETECTION OF WATER IN A ZONE, THE DDC SYSTEM SHALL GENERATE AN ALARM. COORDINATE WITH THE OWNER.

UPON DETECTION OF A CABLE FAULT IN A ZONE, THE DDC SYSTEM SHALL GENERATE AN ALARM. COORDINATE WITH OWNER.

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design collective
2942 Walton Street · Denver, CO 80205 · 303.308.1144 · www.studiotrope.com

OWNER
CITY AND COUNTY OF DENVER
201 W. Colfax Ave.
DENVER, COLROADO 80202

CIVIL ENGINEER
SAN ENGINEERING
6099 Windermere St.
LITTLETON, COLORADO 80120
P. 303.953.9014
F. 303.953.9016
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F. 303.865.5504
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P. 303.558.3145
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F. 303.422.7900
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Aurora, Colorado 80014
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Boulder, Colorado 80301
P. 303.865.5500
F. 303.865.5504
www.k2audio.com

SUSTAINABILITY
AMBIENT ENERGY
130 W. 5th Ave.
Denver, Colorado 80204
P. 303.278.1532
F. 303.278.8533
www.ambient-e.com

PROJECT: WEST DENVER BRANCH LIBRARY
1498 NORTH IRVING STREET
DENVER, COLORADO 80204

COLORADO REGISTERED PROFESSIONAL ENGINEER PAUL J. BISHOP 28801 1/5/12

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MECHANICAL CONTROL DIAGRAMS

M-301

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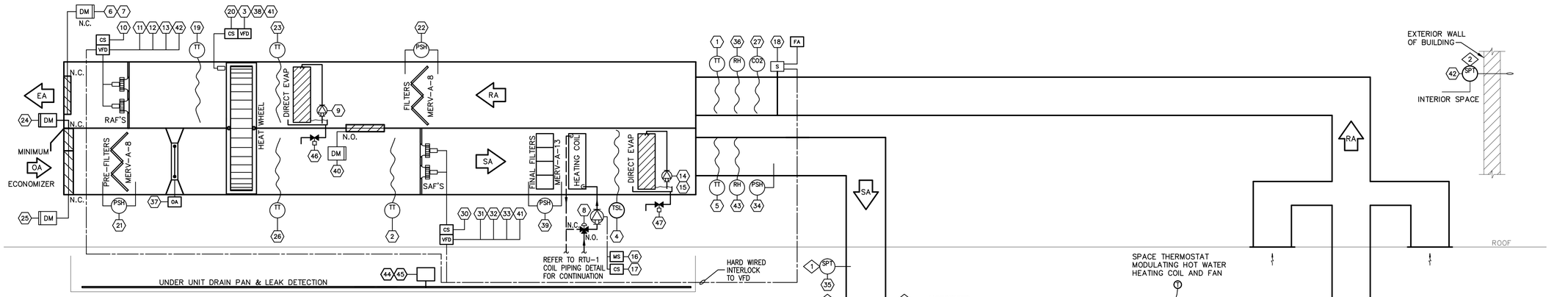
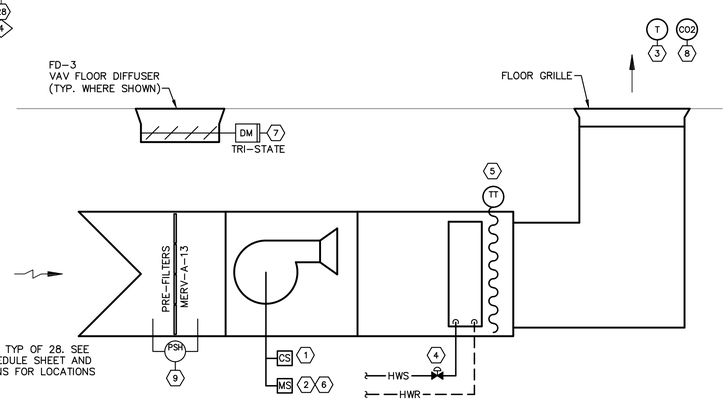


RTU-1 CONTROL DIAGRAM

NOT TO SCALE



TYPICAL UNDER FLOOR FAN COIL UNIT CONTROL DIAGRAM

NOT TO SCALE

WORK NOTES:

1. LOCATE DUCT STATIC PRESSURE TRANSMITTER AT LEAST 2/3 OF THE DISTANCE BETWEEN THE UNIT DISCHARGE AND THE FARTHEST MAIN DUCT RUN.
2. COORDINATE PLACEMENT OF EXTERIOR BUILDING STATIC PRESSURE SENSOR WITH ARCHITECT AND ENGINEER.
3. SEE UNDERFLOOR MECHANICAL PLANS FOR QUANTITY AND LOCATIONS.
4. SEE UNDERFLOOR PLAN FOR LOCATIONS; TAGGED AS FD-2.

SEQUENCE OF OPERATION (RTU-1)

MODES OF OPERATION
OCCUPIED MODE:
- OCCUPIED MODE SHALL BE BASED ON A USER-ADJUSTABLE SEVEN-DAY SCHEDULE AND ADDITIONAL HOLIDAY SCHEDULE.
- DURING OCCUPIED MODE THE RTU WILL BE ENABLED TO RUN AND WILL OPERATE AS DEFINED BY THIS SEQUENCE OF OPERATION TO HEAT OR COOL THE VENTILATION AIR FOR THE UNDER FLOOR AIR DISTRIBUTION SYSTEM.

UNOCCUPIED MODE:
- UNOCCUPIED MODE SHALL BE ANY TIME PERIOD THAT IS NOT SCHEDULED AS OCCUPIED.
- THE RTU WILL GENERALLY NOT BE ENABLED TO RUN, BUT MAY BE ENABLED AS IDENTIFIED IN THE SEQUENCE OF OPERATION FOR MINIMUM NIGHTTIME COOLING.
- UNOCCUPIED MODE HEATING SHALL BE PROVIDED BY THE PERIMETER UNDER FLOOR FAN COIL UNITS. SEE SEPARATE SEQUENCE OF OPERATION FOR THESE UNITS.

SUPPLY & RELIEF FANS
THE SUPPLY AND RELIEF FANS WILL RUN ANYTIME THE RTU IS ENABLED, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE SUPPLY AND RELIEF FANS WILL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.

FREEZE PROTECTION
UPON RECEIVING A FREEZESTAT STATUS, THE SUPPLY AND RELIEF FANS WILL STOP, THE OUTSIDE AIR AND RELIEF AIR DAMPERS WILL FULLY CLOSE, AND RETURN AIR DAMPER WILL OPEN, THE HEATING COIL VALVE WILL MODULATE FULLY OPEN TO THE COIL AND THE HEATING COIL CIRC PUMP WILL BE ENABLED.

SMOKE DETECTION
UPON RECEIVING A DUCT SMOKE SIGNAL, THE SUPPLY FANS AND RELIEF FANS WILL IMMEDIATELY STOP AND ALL DAMPERS WILL RETURN TO THEIR NORMAL, DEENERGIZED STATE. A SEPARATE DIRECT OUTPUT WILL BE SENT TO THE FIRE ALARM SYSTEM.

HIGH STATIC PRESSURE SHUTDOWN
THE RTU WILL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A HIGH STATIC PRESSURE SHUTDOWN SIGNAL.

SUPPLY AIR DUCT STATIC PRESSURE CONTROL
THE BAS SHALL MONITOR DUCT STATIC PRESSURE AND MODULATE THE SUPPLY FAN VFD SPEED TO MAINTAIN A DUCT STATIC PRESSURE SETPOINT OF 1.5" W.C. (DEFAULT). THE T.C. CONTRACTOR WILL COORDINATE WITH THE T&B CONTRACTOR TO DETERMINE THE FINAL SETPOINT VALUE TO BE USED, WHICH SHALL BE THE LOWEST VALUE THAT ACHIEVES THE REQUIRED DESIGN FLOW RATES FOR THE UNDER FLOOR DISCHARGE DAMPERS.

RELIEF FAN CONTROL
THE RELIEF AIR DAMPER SHALL BE ACTIVATED FULLY OPEN WHENEVER THE SUPPLY FAN IS ENABLED. UPON CONFIRMING THAT THE RELIEF AIR DAMPER IS OPEN (THROUGH N.O. END SWITCH), THE RELIEF FAN SHALL BE ENABLED AND SHALL RUN CONTINUOUSLY. THE RELIEF FAN SPEED WILL BE CONTROLLED IN ORDER TO MAINTAIN A BUILDING STATIC PRESSURE SETPOINT OF 0.025" W.C.

ECONOMIZER DAMPER CONTROL
A SEPARATE ECONOMIZER DAMPER SHALL BE CONTROLLED INDEPENDENT OF THE MINIMUM OUTSIDE AIR DAMPER, AND SHALL MODULATE AS DETERMINED BY THE SEQUENCE. THE RETURN AIR DAMPER SHALL BE MODULATED IN OPPOSITION TO THE POSITION OF THE ECONOMIZER DAMPER.

SUPPLY AIR TEMPERATURE CONTROL & RESET
THE BAS SHALL MONITOR THE SUPPLY AIR TEMPERATURE AND WILL MAINTAIN AN OCCUPIED SUPPLY AIR TEMPERATURE SETPOINT BASED ON ZONE COOLING AND HEATING REQUIREMENTS.

UPON RTU STARTUP THE SUPPLY AIR TEMPERATURE SETPOINT SHALL BE SET TO 60°F (DEFAULT). AT 10 MINUTE INTERVALS THE BAS SHALL RESET THE SUPPLY TEMPERATURE SETPOINT BASED ON THE UNDER FLOOR ZONE WITH THE MOST DEMAND AS FOLLOWS:

- THE STATIC PRESSURE SETPOINT SHALL BE RESET DOWN IN INCREMENTS OF 0.5°F WHEN AT LEAST TWO OR MORE ZONE MOTORIZED DAMPERS ARE AT THEIR MAXIMUM OUTPUT VALUE FOR MORE THAN 10 MINUTES
- THE STATIC PRESSURE SETPOINT SHALL BE RESET UP IN INCREMENTS OF 0.5°F WHEN ALL OF THE ZONE MOTORIZED DAMPERS ARE LESS THAN MAXIMUM OUTPUT VALUE FOR MORE THAN 10 MINUTES.

THE RANGE OF SETPOINT VALUES SHALL BE 55°F–70°F.

SUPPLY AIR TEMPERATURE CONTROL
THE HEAT WHEEL, ECONOMIZER DAMPERS, EVAPORATIVE COOLERS AND HEATING COIL SHALL ACT IN SEQUENCE TO MAINTAIN THE SUPPLY AIR TEMPERATURE AT SETPOINT, AS DESCRIBED ABOVE.

THE SPEED OF THE HEAT WHEEL VARIES FROM 12 HERTZ TO 90 HERTZ.

THE HEAT WHEEL SHALL BE ENABLED WHENEVER THE RTU IS ENABLED.

HEATING MODE
THE MINIMUM OUTSIDE AIR DAMPER SHALL OPEN TO THE MINIMUM POSITION, AS DETERMINED BY THE DEMAND CONTROLLED VENTILATION REQUIREMENTS.

DURING HEATING MODE, THE ECONOMIZER DAMPER SHALL REMAIN CLOSED AND THE EXHAUST/RELIEF AIR EVAPORATIVE COOLER PUMP SHALL NOT BE ENABLED.

THE HEAT WHEEL SHALL BE ENABLED AND THE SPEED SHALL BE INCREASED TO PROVIDE MORE HEAT TRANSFER AND DECREASED TO PROVIDE LESS HEAT TRANSFER TO THE PRIMARY AIR STREAM.

IF ADDITIONAL HEAT IS REQUIRED, THE HEAT WHEEL SPEED IS AT 100%, AND THE HOT WATER BOILERS HAVE BEEN ENABLED (SEE BOILER SEQUENCE FOR DETAILS), THEN THE HOT WATER COIL PUMP SHALL BE ENABLED AND THE COIL CONTROL VALVE SHALL MODULATE IN SEQUENCE TO PROVIDE ADDITIONAL HEAT TO THE PRIMARY AIR STREAM. WHILE THE HOT WATER COIL IS ENABLED, THE HEAT WHEEL SPEED SHALL REMAIN AT 100% TO MAXIMIZE HEAT RECOVERY POTENTIAL.

ON A FALLING DEMAND FOR HEATING, THE HOT WATER COIL WILL BE DISABLED FIRST, FOLLOWED BY REDUCED SPEED OF THE HEAT WHEEL UNTIL THE HEAT WHEEL IS AT MINIMUM RPM. IF THE HEAT WHEEL IS AT MINIMUM RPM FOR MORE THAN 15 MINUTES, THE WHEEL SHALL BE DISABLED.

WHEN THE OUTSIDE AIR TEMPERATURE IS BELOW 14°F (ADJ); THE RTU SHALL BE MONITORED TO ENSURE THAT A HEAT WHEEL FROSTING CONDITION DOES NOT OCCUR. WHEN THE HEAT WHEEL EXHAUST AIR TEMPERATURE DROPS BELOW 8°F. THE BAS SHALL START A TIMER; AFTER 5 HOURS BAS SHALL SEND AN ALARM FOR VISUAL VERIFICATION OF WHEEL FROSTING, IF AFTER 8 HOURS THE EXHAUST TEMPERATURE HAS REMAINED BELOW 8°F THEN THE WHEEL SPEED SHALL MODULATE TO 30% SPEED. DURING THIS CONDITION THE HOT WATER COIL SHALL SUPPLEMENT THE HEATING REQUIREMENT. AFTER 30 MINUTES, OR WHEN THE OUTSIDE AIR TEMPERATURE RISES ABOVE 14°F (ADJ), RE-INITIATE THE NORMAL WHEEL SEQUENCE.

COOLING MODE
THE MINIMUM OUTSIDE AIR DAMPER SHALL OPEN TO THE MINIMUM POSITION, AS DETERMINED BY THE DEMAND CONTROLLED VENTILATION REQUIREMENTS.

THE ECONOMIZER DAMPER SHALL BE MODULATED FIRST TO PROVIDE COOLING, BEFORE ACTIVATION OF THE HEAT WHEEL, OR ANY ADDITIONAL EVAPORATIVE COOLING FUNCTIONS. ONCE ANY OF THE EVAPORATIVE COOLING SECTIONS ARE ENABLED, THE ECONOMIZER DAMPER SHALL REMAIN FULLY OPEN AND THE RETURN AIR DAMPER FULLY CLOSED.

WHILE THE RTU IS IN ECONOMIZER ONLY OPERATION, PERIODICALLY OPERATE THE HEAT WHEEL AT MINIMUM SPEED FOR APPROXIMATELY 1 MINUTE EVERY HOUR (ADJ) IN ORDER TO PREVENT LOCALIZED PARTICULATE LOADING OF THE HEAT WHEEL.

ONCE THE ECONOMIZER DAMPER HAS REACHED IT'S FULL OPEN POSITION, THE RETURN DAMPER IS FULLY CLOSED, AND THE OUTDOOR AIR TEMPERATURE IS GREATER THAN 55°F, ENABLE THE HEAT WHEEL AND THE RELIEF AIR STREAM EVAPORATIVE COOLING SECTION, AND MODULATE THE HEAT RECOVERY WHEEL TO MAINTAIN THE CURRENT SUPPLY AIR TEMPERATURE SETPOINT. INCREASE THE SPEED OF THE HEAT WHEEL TO INCREASE COOLING AFFECT.

IF THE HEAT WHEEL IS AT MINIMUM SPEED, AND THE SUPPLY AIR TEMPERATURE FALLS MORE THAN 2°F (ADJ) BELOW SETPOINT, DISABLE THE RELIEF AIR STREAM EVAPORATIVE COOLING SECTION AND HEAT WHEEL, RETURN TO ECONOMIZER ONLY OPERATION.

ON INCREASING DEMAND FOR COOLING, WITH THE RELIEF AIR STREAM EVAPORATIVE COOLING SECTION IN OPERATION, AND THE HEAT WHEEL REACHES 90% OF ITS MAXIMUM SPEED, ENABLE THE SUPPLY AIR STREAM EVAPORATIVE COOLING SECTION PUMPS IN STAGES AS IDENTIFIED BELOW:

	1/3 CAPACITY PUMP	2/3 CAPACITY PUMP
STAGE 0:	DISABLE	DISABLE
STAGE 1:	ENABLE	DISABLE
STAGE 2:	DISABLE	ENABLE
STAGE 2:	ENABLE	ENABLE

AT EACH STAGE, CONTINUE TO MODULATE THE HEAT RECOVERY WHEEL TO MAINTAIN THE CURRENT SUPPLY AIR TEMPERATURE SETPOINT UNTIL THE HEAT WHEEL REACHES 90% OF IT'S MAXIMUM SPEED, THEN ADVANCE TO THE NEXT STAGE.

IF THE SUPPLY AIR TEMPERATURE FALLS MORE THAN 2°F (ADJ) BELOW SETPOINT FOR MORE THAN 15 MINUTES, REDUCE THE STAGE LEVEL OF THE SUPPLY AIR EVAPORATIVE COOLING SECTION UNTIL IT IS FULLY DISABLED (STAGE 0) WITH ONLY THE RELIEF AIR STREAM EVAPORATIVE COOLING SECTION ENABLED.

SUMMER UNOCCUPIED MODE MINIMUM COOLING
IF THE OUTSIDE AIR TEMPERATURE IS GREATER THAN 65°F DURING UNOCCUPIED MODE, THE RTU SHALL BE ENABLED TO RUN IN COOLING MODE WITH THE RELIEF AIR STREAM EVAPORATIVE COOLING SECTION ONLY IN OPERATION AS DESCRIBED IN THE COOLING SEQUENCE OF OPERATION.

SUPPLY AIR HUMIDITY LIMIT
WHEN THE RTU IS IN OPERATION THE BAS SHALL CONTINUOUSLY MONITOR THE SUPPLY AIR STREAM RELATIVE HUMIDITY. WHEN THE SUPPLY AIR STREAM EVAPORATIVE COOLING SECTION IS ENABLED AND THE SUPPLY AIR STREAM RELATIVE HUMIDITY EXCEEDS 80% RH (ADJ), THEN DISABLE THE SUPPLY AIR STREAM EVAPORATIVE COOLING SECTION UNTIL THE SUPPLY AIR STREAM RELATIVE HUMIDITY DROPS BELOW 70% RH (ADJ).

EVAPORATIVE COOLING MAINTENANCE
THE EVAPORATIVE SECTIONS WILL AUTOMATICALLY DRAIN WHEN OAT IS LESS THAN 40°F (ADJ.) FOR 60 MINUTES (ADJ.). THE EVAPORATIVE COOLER SUMP WILL FILL ONLY WHEN THE OUTSIDE AIR TEMPERATURE EXCEEDS 55°F.

WHEN ANY OF THE EVAPORATIVE COOLING SECTIONS HAVE BEEN USED IN THE PREVIOUS 24 HOURS, PROVIDE A DRY-OUT CYCLE OF 60 MINUTES (ADJ.) TO OCCUR DAILY BETWEEN 5 AM AND 6 AM, DURING WHICH SUPPLY AND RELIEF FANS SHALL RUN.

PROVIDE A WEEKLY SUMP DRAINAGE CYCLE TO COINCIDE WITH THE EVAPORATIVE COOLER DRY-OUT CYCLE.

OUTSIDE AIR VENTILATION RATE CONTROL:
A DEMAND CONTROLLED VENTILATION STRATEGY SHALL BE APPLIED WITH CO2 SENSORS LOCATED IN THE FOLLOWING ROOMS; 130 CLP AND 220 MEETING ROOM.

THE RATE OF OUTSIDE AIR VENTILATION SHALL BE CONTINUOUSLY MONITORED BY THE OUTSIDE AIR FLOW MONITORING STATION. DURING OCCUPIED HOURS, THE RATE OF OUTSIDE AIR SHALL BE ADJUSTED BETWEEN APP. 2100 CFM AND 4500 CFM AS INDICATED BELOW.

CONTINUOUSLY MONITOR THE CO2 LEVELS AT EACH OF THE SPACES LISTED ABOVE AND MODULATE THE MINIMUM OUTSIDE AIR DAMPER IN ORDER TO MAINTAIN A CO2 LEVEL OF NO HIGHER THAN 800 PPM (400 PPM AMBIENT + 400 PPM DIFFERENTIAL) IN THE MOST DEMANDING ZONE. NOTE: THIS SETPOINT MAY BE LOWERED AS OPERATIONAL SITUATIONS REQUIRE, BUT DO NOT INCREASE!

AS OCCUPANCY AND CO2 LEVELS INCREASE, INCREASE THE AMOUNT OF OUTSIDE AIR IN ORDER TO MAINTAIN THE CRITICAL SPACE CO2 LEVEL SETPOINT, OR UNTIL THE MAXIMUM VENTILATION RATE IS REACHED.

AS OCCUPANCY AND CO2 LEVELS DECREASE BELOW 600 PPM (ADJ) IN THE MOST DEMANDING ZONE, DECREASE THE AMOUNT OF OUTSIDE AIR IN ORDER TO MAINTAIN THE CRITICAL SPACE CO2 LEVEL SETPOINT, OR UNTIL THE MINIMUM VENTILATION RATE IS REACHED.

CONTINUOUSLY MONITOR AND TREND RETURN AIR CO2, AND SPACE CO2 LEVELS FOR ALL SENSORS.

ISSUE A VISUAL ALARM THROUGH THE BAS WORKSTATION IF ANY OF THE FOLLOWING CONDITIONS ARE PRESENT:
- MONITORED RETURN AIR CO2 LEVEL IS MORE THAN 1000 PPM.
- OUTSIDE AIR VENTILATION RATE IS LESS THAN THE MINIMUM CFM QUANTITY.
- ANY SPACE CO2 LEVELS EXCEED 880 PPM (10% ABOVE SETPOINT).

MAINTAIN DATA HISTORY OF CO2 LEVELS AND OUTSIDE AIR VENTILATION RATES TAKEN AT REGULAR INTERVALS, NOT LESS THAN EVERY 15 MINUTES.

ALARMS
- SUPPLY FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
- SUPPLY FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
- SUPPLY FAN VFD FAULT
- RETURN FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
- RETURN FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
- RETURN FAN VFD FAULT.
- HIGH SUPPLY AIR STATIC PRESSURE: IF THE SUPPLY AIR STATIC PRESSURE IS 25% (ADJ.) GREATER THAN SETPOINT.
- LOW SUPPLY AIR STATIC PRESSURE: IF THE SUPPLY AIR STATIC PRESSURE IS 25% (ADJ.) LESS THAN SETPOINT.
- HIGH SUPPLY AIR HUMIDITY, GREATER THAN 85% RH
- HIGH RETURN AIR HUMIDITY, GREATER THAN 55% RH
- DIRTY FILTER PRESSURE DROP GREATER THAN 0.75"
- RTU LEAK DETECTION SYSTEM ALARM
- DUCT SMOKE DETECTOR

UNDER FLOOR DISCHARGE DAMPERS
IN OCCUPIED MODE MODULATE UNDER FLOOR DAMPERS IN UNISON (BY FLOOR) TO MAINTAIN 0.05" W.C. PRESSURE DIFFERENTIAL (BASED ON LOWEST SENSOR INDICATION) BETWEEN THE UNDER FLOOR PLENUM AND ABOVE FLOOR SPACE.

IN UNOCCUPIED MODE, WITH THE RTU OFF, THE UNDER FLOOR DAMPERS WILL REMAIN IN THEIR LAST POSITION UNTIL RESUMPTION OF THE NEXT OCCUPIED SCHEDULE.

ROOFTOP UNIT POINTS LIST

TAG	DESCRIPTION	TYPE
1	RETURN AIR TEMPERATURE	AI
2	MIXED AIR TEMPERATURE	AI
3	HEAT WHEEL START/STOP	BO
4	TEMPERATURE SWITCH LOW	BI
5	DISCHARGE AIR TEMPERATURE	AI
6	RELIEF AIR DAMPER	BO
7	RELIEF AIR DAMPER END SWITCH	BI
8	HEATING WATER CONTROL VALVE	AO
9	DIRECT EVAP PUMP ENABLE/DISABLE	BO
10	EXHAUST FAN STATUS (CURRENT SWITCH)	BI
11	EXHAUST FAN START/STOP	BO
12	EXHAUST FAN FAULT STATUS	BI
13	EXHAUST FAN VFD SPEED CONTROL	AO
14	DIRECT EVAP 1/3 PUMP ENABLE/DISABLE	BO
15	DIRECT EVAP 2/3 PUMP ENABLE/DISABLE	BO
16	COIL PUMP START/STOP (HWCP-3)	BO
17	COIL PUMP STATUS (CURRENT SWITCH)	BI
18	DUCT SMOKE DETECTOR	BI
19	RELIEF AIR TEMP	AI
20	HEAT WHEEL STATUS	BI
21	FILTER PRESSURE SENSOR	BI
22	FILTER PRESSURE SENSOR	BI
23	HEAT RECOVERY SOURCE TEMPERATURE	AI
24	OUTSIDE AIR MINIMUM DAMPER	AO
25	OUTSIDED AIR ECONOMIZER DAMPER	AO
26	PRE-HEAT/PRE-COOL TEMPERATURE	AI
27	RETURN AIR CO2	AI
28	UNDER FLOOR DIFFERENTIAL PRESSURE SENSOR (8)	AI
29	UNDER FLOOR MOTORIZED DAMPER (8)	AO
30	SUPPLY FAN STATUS (CURRENT SWITCH)	BI
31	SUPPLY FAN START/STOP	BO
32	SUPPLY FAN FAULT STATUS	BI
33	SUPPLY FAN VFD SPEED CONTROL	AO
34	SA DUCT HIGH PRESSURE	BI
35	SA DUCT STATIC PRESSURE	AI
36	RETURN AIR RELATIVE HUMIDITY	AI
37	OUTSIDE AIR FLOW MONITOR	AI
38	HEAT WHEEL VFD SPEED CONTROL	AO
39	FILTER PRESSURE SWITCH	BI
40	RETURN AIR DAMPER	AO
41	HEAT WHEEL VFD GENERAL ALARM	BI
42	INTERIOR/EXTERIOR BUILDING PRESSURE SENSOR	AI
43	SUPPLY AIR RELATIVE HUMIDITY	AI
44	RTU LEAK DETECTION SYSTEM STATUS	BI
45	RTU LEAK DETECTION SYSTEM ALARM	BI
46	DRAIN SOLENOID VALVES (3 – EXHAUST EVAP SYSTEM)	BO
47	DRAIN SOLENOID VALVES (3– SUPPLY EVAP SYSTEM)	BO

SEQUENCE OF OPERATION, FLOOR DIFFUSERS & UNDER FLOOR FCU'S:

OCCUPIED MODE
FOR COOLING, MODULATE THE VAV FLOOR DIFFUSERS TO MAINTAIN A MAXIMUM SPACE TEMPERATURE OF 75°F (ADJ.). IF THE FLOOR DIFFUSERS ARE 100% OPEN AND SPACE TEMPERATURE IS STILL NOT SATISFIED, THE FCU ECM MOTOR SHALL BE ENABLED AND MODULATED TO MAINTAIN SPACE TEMPERATURE SETPOINT.

FOR HEATING, MODULATE THE VAV FLOOR DIFFUSERS TO MINIMUM POSITION TO MAINTAIN SPACE TEMPERATURE OF 68°F (ADJ). IF SPACE TEMPERATURE IS NOT SATISFIED, THE FCU ECM MOTOR SHALL BE ENABLED AT MINIMUM SPEED AND THE HOT WATER VALVE SHALL BEGIN MODULATING TO MAINTAIN SPACE TEMPERATURE.

UNOCCUPIED MODE
THERE IS NO UNOCCUPIED COOLING MODE, IF THE RTU IS NOT RUNNING. IF THE RTU IS RUNNING IN MINIMUM COOLING MODE, THEN MODULATE THE VAV FLOOR DIFFUSERS TO MAINTAIN A MAXIMUM SPACE TEMPERATURE 78°F (ADJ), BUT DO NOT ENABLE THE FCU. FOR HEATING, IF THE SPACE TEMPERATURE FALLS BELOW 58°F (ADJ) THE LOCAL FLOOR DIFFUSER(S) SHALL BE OPENED AND THE FCU SHALL BE ENABLED AT MINIMUM SPEED AND THE HOT WATER VALVE SHALL MODULATE TO MAINTAIN SETPOINT.

MORNING WARMUP
IF THE OUTSIDE AIR TEMPERATURE IS LESS THAN 45°F (ADJ) DURING UNOCCUPIED MODE, ENABLE MORNING WARMUP BY RESETTING LOCAL SETPOINT UP FROM 58°F TO THE NORMAL OCCUPIED SETPOINT 68°F (ADJ) 60 MINUTES PRIOR TO THE START OF THE NEXT OCCUPIED PERIOD. THE RTU WILL NOT BE ENABLED DURING THIS PERIOD, BUT LOCAL HEATING WILL BE THROUGH THE UNDER FLOOR FCU'S AS DESCRIBED ABOVE.

UNDER FLOOR FCU POINTS LIST

TAG	DESCRIPTION	TYPE
1	FAN STATUS	BI
2	FAN START/STOP	BO
3	SPACE TEMP	AI
4	VALVE POSITION	AO
5	DISCHARGE AIR TEMPERATURE	AI
6	FAN SPEED (ECM MOTOR)	AO
7	FLOOR DIFFUSER FD-3 DAMPER (TRI-STATE 24VAC)	BO
8	SPACE CO2 SENSOR (WHERE INDICATED ON PLANS)	AI
9	FILTER HIGH PRESSURE SWITCH	BI

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MECHANICAL CONTROL DIAGRAMS

M-302

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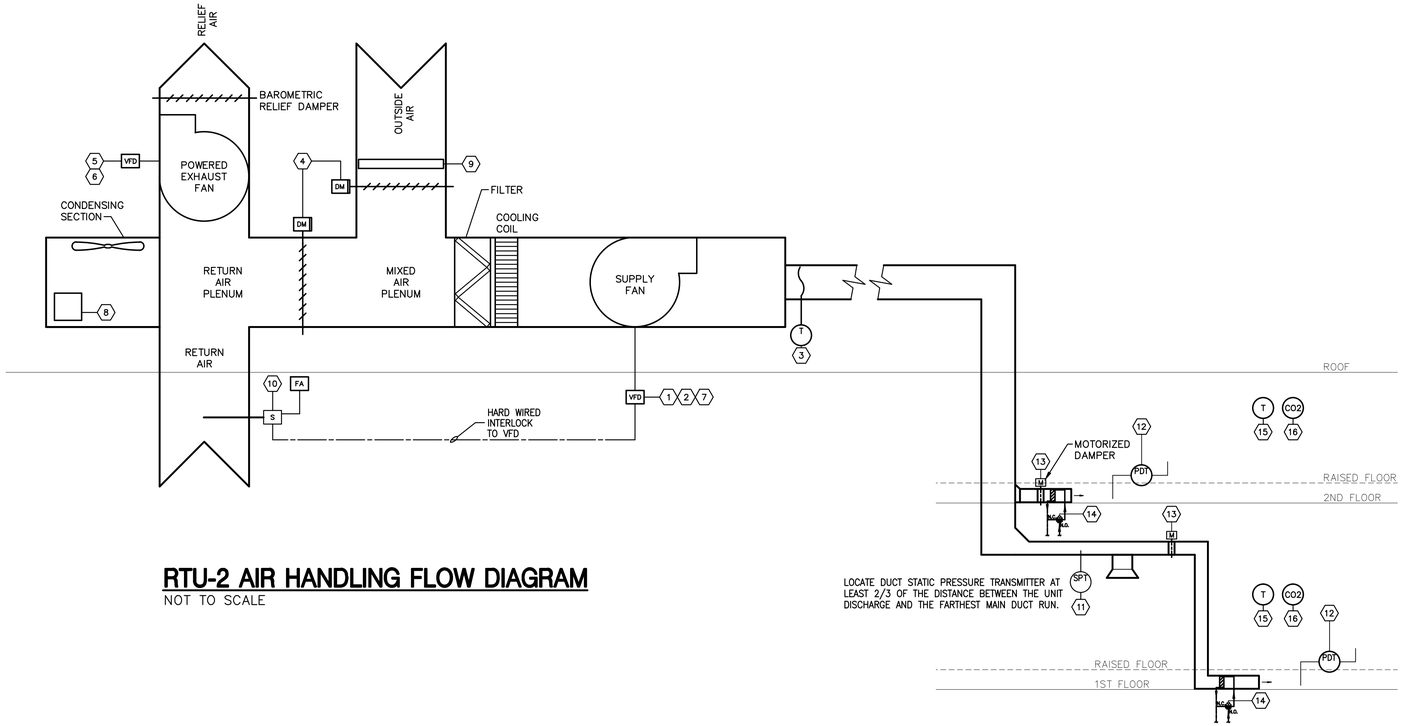
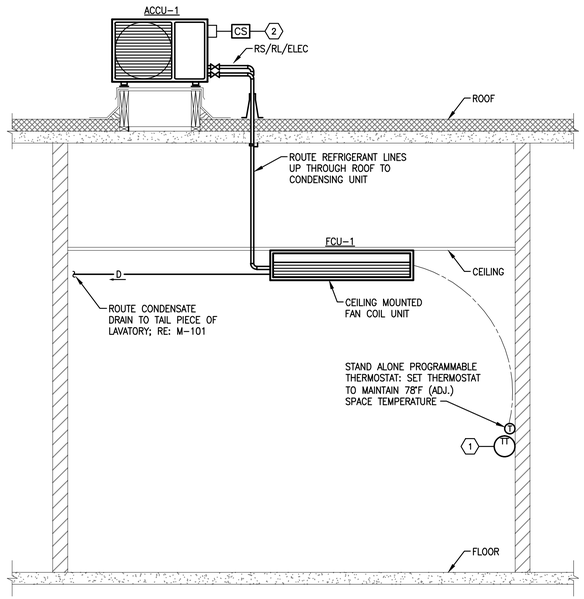


RTU-2 AIR HANDLING FLOW DIAGRAM

NOT TO SCALE

RTU-2 POINTS LIST		
TAG	DESCRIPTION	TYPE
1	RTU START/STOP	BO
2	RTU STATUS/GENERAL ALARM	BI
3	SUPPLY AIR TEMPERATURE/LOW LIMIT	AI
4	ECONOMIZER DAMPER (OA & RA)	AO
5	RELIEF FAN START/STOP	BO
6	RELIEF FAN VFD SPEED	AO
7	SUPPLY FAN VFD SPEED	AO
8	COOLING ENABLE/DISABLE	BO
9	OSA FLOW MONITOR	AI
10	DUCT SMOKE DETECTOR	BI
11	DUCT STATIC PRESSURE	AI
12	UNDER FLOOR DIFFERENTIAL PRESSURE SENSOR (2)	AI
13	UNDER FLOOR MOTORIZED DAMPER (2)	AO
14	HOT WATER HEATING COIL (2)	AO
15	SPACE TEMP (2)	AI
16	SPACE CO2 SENSOR (WHERE INDICATED ON PLANS)	AI



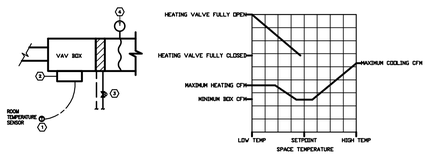
IT ROOM AND ELEVATOR MACHINE ROOM CONTROL DIAGRAM (AC-1/ACCU-1 & AC-2/ACCU-2)

NOT TO SCALE

TELE/COM POINTS LIST		
TAG	DESCRIPTION	TYPE
1	SPACE TEMPERATURE SENSOR	AI
2	CONDENSING UNIT STATUS	BI

SEQUENCE OF OPERATION:

FAN COIL AND CONDENSING UNIT SHALL OPERATE IN CONJUNCTION TO MAINTAIN 78°F (ADJ) SPACE TEMPERATURE COOLING SETPOINT. THE SPACE TEMPERATURE SETPOINT SHALL NOT RESET OR HAVE A SETBACK FOR UNOCCUPIED MODE. THE FAN COIL AND CONDENSING UNIT SHALL BE ENABLED 24HRS A DAY, 7 DAYS A WEEK. A SECONDARY TEMPERATURE SENSOR INDEPENDENT OF THE SPLIT SYSTEM PACKAGED CONTROLS SHALL BE PROVIDED AND INTEGRATED INTO THE BUILDING AUTOMATION SYSTEM. THE BAS SHALL GENERATE AN ALARM IF THE TEMPERATURE IN THE ROOM RISES ABOVE 90°F (ADJ).



VAV BOX CONTROL DIAGRAM

TB-29 POINTS LIST		
TAG	DESCRIPTION	TYPE
1	SPACE TEMPERATURE	AI
2	DAMPER POSITION	AO
3	HEATING COIL VALVE	BO
4	VAV DISCHARGE AIR TEMPERATURE	AI

SEQUENCE OF OPERATION (RTU-2):

GENERAL

TC INSTALLER SHALL PROVIDE A UNIT CONTROLLER AND FIELD DEVICES, INSTALL FACTORY FURNISHED FIELD DEVICES, AND PROVIDE WIRING TO ACCOMPLISH THE SEQUENCE OF OPERATION. AN ECONOMIZER SECTION WILL ALSO BE PROVIDED WITH THE RTU WITH DAMPER MOTOR AND RELIEF FAN VFD TO BE WIRED BY TC INSTALLER.

THE BUILDING AUTOMATION SYSTEM (BAS) SHALL ENABLE/DISABLE THE UNIT AND PERFORM ALL CONTROL FUNCTIONS IDENTIFIED BELOW.

WHEN THE UNIT IS OFF, THE RETURN AIR DAMPER SHALL BE OPEN AND THE OUTSIDE AIR DAMPERS SHALL BE CLOSED.

SAFETIES AND OVERRIDES

A SMOKE DETECTOR IN THE RETURN AIR DUCT SHALL SHUTDOWN THE UNIT. THE DETECTOR SHALL BE HARDWIRED TO THE SUPPLY AND RELIEF FAN VFD ENABLE TERMINALS, WITH DIRECT OUTPUT TO THE FIRE ALARM SYSTEM.

FREEZE PROTECTION SHALL BE ACCOMPLISHED THROUGH BAS. A TEMPERATURE SENSOR MOUNTED IN THE SUPPLY DUCT SHALL SERVE AS A LOW LIMIT TEMPERATURE SENSOR AND TO MONITOR SUPPLY AIR TEMPERATURE. WHEN THE SUPPLY AIR TEMPERATURE FALLS BELOW 40 DEG F FOR 30 SEC, THE UNIT SHALL SHUTDOWN. IF THE SUPPLY AIR TEMPERATURE WARMS ABOVE 45 DEG F, THE UNIT SHALL RETURN TO ITS CURRENT MODE. SUPPLY AIR TEMPERATURE RESET SHALL BE ACCOMPLISHED THROUGH SOFTWARE.

OCCUPIED MODE

WHEN THE UNIT IS IN OCCUPIED MODE AS DETERMINED BY THE BAS, THE SUPPLY FAN SHALL BE ENABLED AND RUN CONTINUOUSLY. THE OUTSIDE AIR DAMPER SHALL BE INITIALLY SET TO MINIMUM POSITION. THE DAMPER AND RELIEF FAN SHALL BE CONTROLLED BY THE BAS.

SUPPLY FAN CONTROL

ENABLE AND MODULATE THE SUPPLY VFD TO MAINTAIN DUCT STATIC PRESSURE SETPOINT OF 0.65"W.C. (ADJ).

RELIEF FAN CONTROL

ENABLE AND MODULATE THE RELIEF FAN VFD BASED ON A VARIABLE OUTPUT IN PROPORTION TO THE MONITORED OUTSIDE AIR QUANTITY. THE NET EFFECT TO MAINTAIN SLIGHTLY MORE AIR DELIVERED INTO BUILDING, THAN EXHAUSTED.

SUPPLY AIR TEMPERATURE RESET

THE BAS SHALL RESET THE SUPPLY AIR TEMPERATURE BASED UPON OUTSIDE AIR TEMPERATURE. AT OUTSIDE AIR TEMPERATURES ABOVE 50°F, THE SUPPLY AIR TEMPERATURE SHALL BE 55°F. AT OUTSIDE AIR TEMPERATURES BELOW 47°F, THE SUPPLY AIR TEMPERATURE SHALL BE 60°F.

THE BAS SHALL MODULATE THE ECONOMIZER DAMPERS AND COOLING STAGES IN SEQUENCE TO MAINTAIN THE CURRENT SUPPLY AIR TEMPERATURE SETPOINT.

OUTSIDE AIR VENTILATION RATE CONTROL:

A DEMAND CONTROLLED VENTILATION STRATEGY SHALL BE APPLIED WITH CO2 SENSORS LOCATED IN THE FOLLOWING ROOMS; 252 CONFERENCE AND 253 STAFF LOUNGE.

THE RATE OF OUTSIDE AIR VENTILATION SHALL BE CONTINUOUSLY MONITORED BY THE OUTSIDE AIR FLOW MONITORING STATION. DURING OCCUPIED HOURS, THE RATE OF OUTSIDE AIR SHALL BE ADJUSTED BETWEEN APP. 400 CFM AND 900 CFM AS INDICATED BELOW.

CONTINUOUSLY MONITOR THE CO2 LEVELS AT EACH OF THE SPACES LISTED ABOVE AND MODULATE THE MINIMUM OUTSIDE AIR DAMPER IN ORDER TO MAINTAIN A CO2 LEVEL OF NO HIGHER THAN 800 PPM (400 PPM AMBIENT + 400 PPM DIFFERENTIAL) IN THE MOST DEMANDING ZONE. NOTE: THIS SETPOINT MAY BE LOWERED AS OPERATIONAL SITUATIONS REQUIRE, BUT DO NOT INCREASE!

AS OCCUPANCY AND CO2 LEVELS INCREASE, INCREASE THE AMOUNT OF OUTSIDE AIR IN ORDER TO MAINTAIN THE CRITICAL SPACE CO2 LEVEL SETPOINT, OR UNTIL THE MAXIMUM VENTILATION RATE IS REACHED.

AS OCCUPANCY AND CO2 LEVELS DECREASE BELOW 600 PPM (ADJ) IN THE MOST DEMANDING ZONE, DECREASE THE AMOUNT OF OUTSIDE AIR IN ORDER TO MAINTAIN THE CRITICAL SPACE CO2 LEVEL SETPOINT, OR UNTIL THE MINIMUM VENTILATION RATE IS REACHED.

CONTINUOUSLY MONITOR AND TREND RETURN AIR CO2, AND SPACE CO2 LEVELS FOR ALL SENSORS.

ISSUE A VISUAL ALARM THROUGH THE BAS WORKSTATION IF ANY OF THE FOLLOWING CONDITIONS ARE PRESENT:

- MONITORED RETURN AIR CO2 LEVEL IS MORE THAN 1000 PPM.
- OUTSIDE AIR VENTILATION RATE IS LESS THAN THE MINIMUM CFM QUANTITY.
- ANY SPACE CO2 LEVELS EXCEED 880 PPM (10% ABOVE SETPOINT).

MAINTAIN DATA HISTORY OF CO2 LEVELS AND OUTSIDE AIR VENTILATION RATES TAKEN AT REGULAR INTERVALS, NOT LESS THAN EVERY 15 MINUTES.

UNOCCUPIED MODE

WHEN THE UNIT IS IN UNOCCUPIED MODE AS DETERMINED BY THE BAS, THE UNIT SHALL BE OFF. THE UNIT SHALL NOT RESPOND TO A CALL FOR COOLING.

ALARMS

THE FOLLOWING POINTS SHALL BE FIELD WIRED AND MONITORED BY THE BAS:

- SUPPLY FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
- SUPPLY FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
- SUPPLY AIR LOW LIMIT/TEMPERATURE ALARM
- HIGH SUPPLY AIR STATIC PRESSURE: IF THE SUPPLY AIR STATIC PRESSURE IS 25% (ADJ.) GREATER THAN SETPOINT.
- LOW SUPPLY AIR STATIC PRESSURE: IF THE SUPPLY AIR STATIC PRESSURE IS 25% (ADJ.) LESS THAN SETPOINT.
- DIRTY FILTER PRESSURE DROP GREATER THAN 0.75"
- RTU LEAK DETECTION SYSTEM ALARM
- DUCT SMOKE DETECTOR

VAV DIFFUSERS (SD-3)

VAV DIFFUSER SPACE SENSOR SHALL PROVIDE +/- 3 DEGREE F ADJUSTMENT FROM SETPOINT. PROVIDE SPACE SENSOR WITH SLIDE BAR.

UNDER FLOOR REHEAT CONTROL

MODULATE UNDER FLOOR HOT WATER REHEAT COIL TO MAINTAIN INTERIOR SPACE TEMPERATURE OF 75°F MAXIMUM (COOLING) AND 68°F MINIMUM (HEATING).

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MECHANICAL CONTROL DIAGRAMS

M-303

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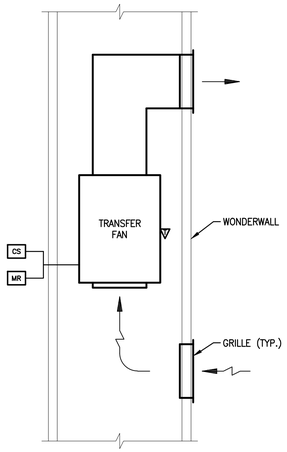


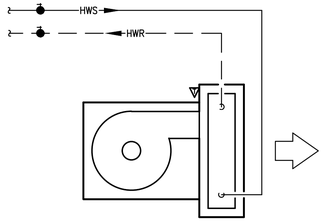
WONDERWALL TRANSFER FAN CONTROL DIAGRAM (TF-5)

NOT TO SCALE

TRANSFER FAN POINTS LIST		
TAG	DESCRIPTION	TYPE
1	FAN ENABLE/DISABLE	BO
2	FAN STATUS	BI

SEQUENCE OF OPERATION

FAN SHALL BE ENABLED WHEN OUTSIDE AIR IS 45°F OR LESS. FAN SHALL RUN CONTINUOUSLY. DISABLE FAN WHEN OUTSIDE AIR IS 48°F OR GREATER.

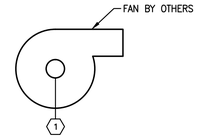


UNIT HEATER CONTROL DIAGRAM

NOT TO SCALE

SEQUENCE OF OPERATION

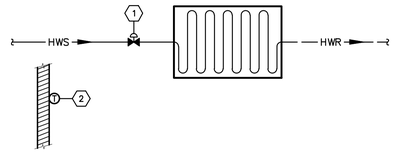
THE LINE VOLTAGE, UNIT MOUNTED, THERMOSTAT SHALL CYCLE FAN ON/OFF TO MAINTAIN SPACE TEMPERATURE. HOT WATER COIL RUNS WILD.



UNDER SLAB VENTING CONTROL DIAGRAM

NOT TO SCALE

UNDER SLAB VENT POINTS LIST		
TAG	DESCRIPTION	TYPE
1	FAN STATUS (TYPICAL OF 4)	BI



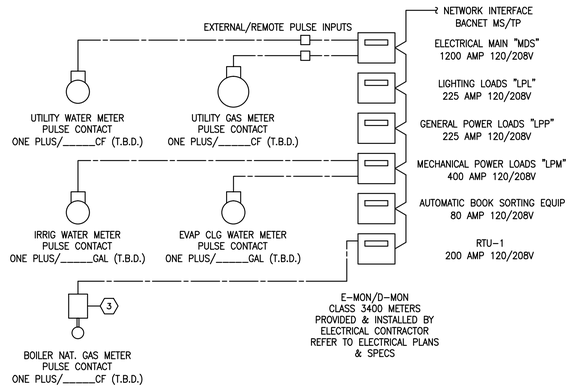
RADIANT HEATING PANEL CONTROL DIAGRAM

NOT TO SCALE

RADIANT HEATING PANEL POINTS LIST		
TAG	DESCRIPTION	TYPE
1	CONTROL VALVE	AO
2	SPACE SENSOR	AI

SEQUENCE OF OPERATION

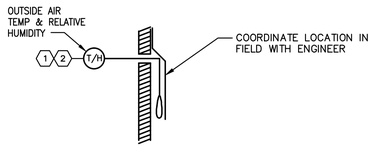
THE SPACE THERMOSTAT / SENSOR SHALL MODULATE THE NORMALLY OPEN HEATING VALVE TO MAINTAIN SPACE SETPOINT.



NOTE: METER REMOTE PULSE CONTACTS ARE NOT LIMITED TO TERMINATION AT THE DEVICE SHOWN. REMOTE PULSE CONTACTS CAN BE TERMINATED AT THE NEAREST E-MON D-MON LOCATION, MAXIMUM 2 PULSE INPUTS PER DEVICE.

SUB-METER INPUT DIAGRAM AND MISC. INPUT POINTS

NOT TO SCALE



SUB-METER & MISC. INPUT POINTS LIST		
TAG	DESCRIPTION	TYPE
1	OUTDOOR AIR TEMPERATURE	AI
2	OUTDOOR AIR RELATIVE HUMIDITY	AI
3	BOILER GAS METER FLOW, CORRECTED SCFH	AI

SEQUENCE OF OPERATION

METERING
COLLECT AND LOG METERED DATA THROUGH THE BAS INTERFACE WITH E-MON D-MON METERS, INSTALLED BY ELECTRICAL CONTRACTOR, AS SHOWN. COORDINATE FINAL PULSE CONTACT MULTIPLIERS, WITH UTILITY OR METER INSTALLER. REFER TO ELECTRICAL PLANS & SPECS FOR DETAILS.

METER DATA SHALL BE COLLECTED AND LOGGED THROUGH THE ANDOVER BAS AND STORED AT THE LOCAL WORKSTATION COMPUTER. ACCUMULATE AND TREND THE FOLLOWING MINIMUM INFORMATION AT A MINIMUM 15 MINUTE INTERVAL:

OUTSIDE AIR: CURRENT TEMPERATURE AND RELATIVE HUMIDITY

ELECTRIC: VOLTS/PHASE, AMPS/PHASE, POWER FACTOR/PHASE
CURRENT KW, TOTAL CUMULATIVE KWH

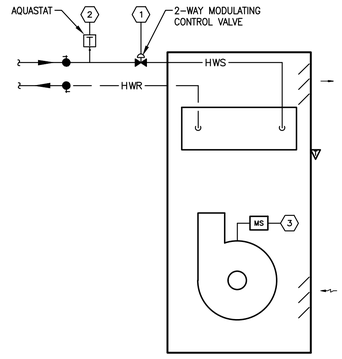
GAS: TOTAL CUMULATIVE SCF, OR MCF FROM PULSE INPUTS
CURRENT RATE OF FLOW, SCFH, USING INTEGRATION OVER TIME (WITH APPLIED PRESSURE CORRECTION FACTOR)
OR DIRECT FLOW RATE INPUT VIA A/I WHERE AVAILABLE

WATER: TOTAL CUMULATIVE GALLONS, OR MGAL FROM PULSE INPUTS
CURRENT RATE OF FLOW, GPM, USING INTEGRATION OVER TIME

GRAPHIC DISPLAY
IN CONJUNCTION WITH OWNER, DEVELOP APPROPRIATE GRAPHIC DISPLAY OF BUILDING ENERGY USE. POSSIBLE VALUES TO DISPLAY MIGHT INCLUDE THE FOLLOWING:

OUTDOOR TEMP & HUMIDITY: CURRENT, MONTHLY MAX & MIN VALUES
ELECTRICAL USAGE: CURRENT BLDG KW, MONTHLY TOTALIZED KWH
NATURAL GAS USAGE: CURRENT BLDG THERMS, MONTHLY TOTALIZED THERM

DEVELOP METHODOLOGY TO ALLOW COMPARISON OF BLDG ENERGY USE WITH A "TYPICAL" BLDG OF SIMILAR FUNCTION, EITHER ON AN INSTANTANEOUS OR CUMULATIVE MONTHLY OR YEARLY BASIS.



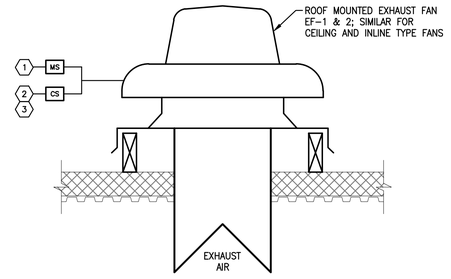
TYPICAL CUH CONTROL DIAGRAM

NOT TO SCALE

CUH POINTS LIST		
TAG	DESCRIPTION	TYPE
1	HEATING COIL VALVE	AO
2	AQUASTAT	BI
3	FAN ENABLE/DISABLE	BO

SEQUENCE OF OPERATION

THE THERMOSTAT SHALL MODULATE THE NORMALLY OPEN HEATING VALVE AND CYCLE THE FAN TO MAINTAIN SETPOINT. THE AQUASTAT SHALL PREVENT THE UNIT FROM RUNNING WHEN HOT WATER IS NOT AVAILABLE.



EXHAUST FAN CONTROL DIAGRAM (EF 1-4)

NOT TO SCALE

EXHAUST FAN POINTS LIST		
TAG	DESCRIPTION	TYPE
1	FAN ENABLE/DISABLE	BO
2	FAN STATUS	BI
3	FAN ALARM	BI

SEQUENCE OF OPERATION

EF-2 & EF-4
ENABLE FANS DURING OCCUPIED MODE AND DISABLE DURING UNOCCUPIED MODE. BAS SHALL ALARM IF FAN STATUS IS NOT PROVEN.

EF-3
FAN SHALL RUN CONTINUOUSLY. BAS SHALL ALARM IF FAN STATUS IS NOT PROVEN.

EF-1
FAN CONTROLLED BY WALL SWITCH; RE: DIVISION 26.

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sDC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02089

ISSUE DATE 01-12-2012
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MECHANICAL CONTROL DIAGRAMS

M-304

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XREFS=(xx-tb) Layouts=(M-304 MECHANICAL CONTROL DIAGRAMS)
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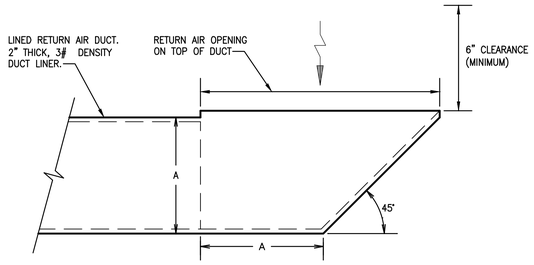
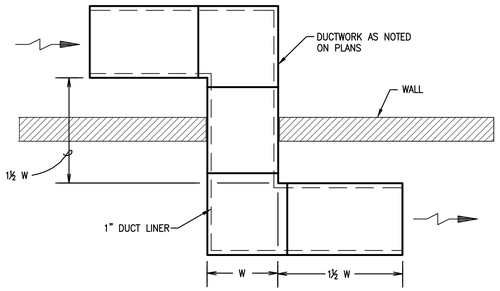


RETURN AIR DUCT DETAIL

NOT TO SCALE

233713.16
5/13/10



TRANSFER AIR BOOT

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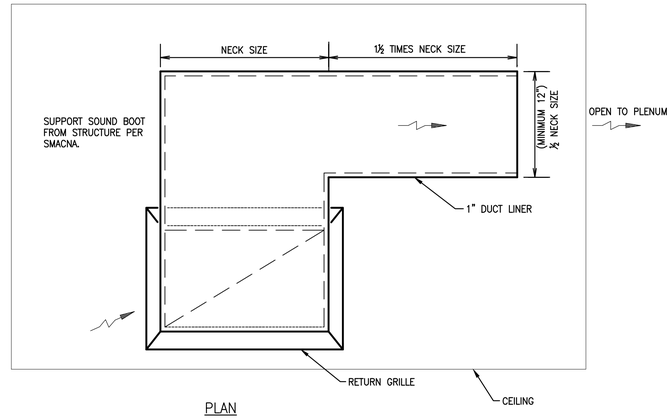
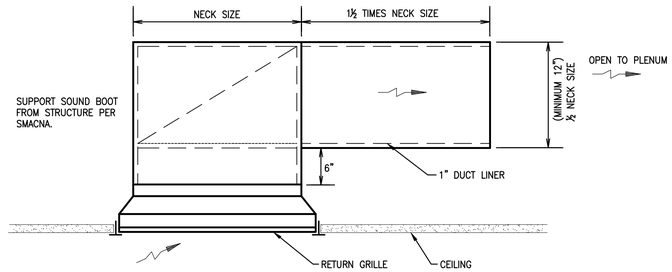
9/22/09



PLAN



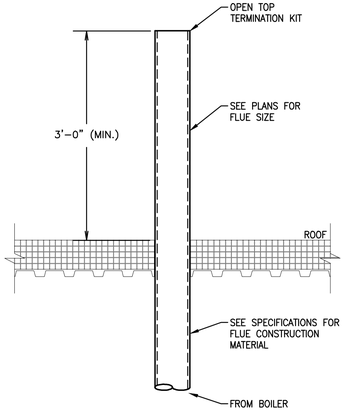
ELEVATION

NOTE:
USE THIS FOR SIZING AIR BOOT UNLESS NOTED OTHERWISE ON DRAWINGS.

CEILING GRILLE RETURN AIR BOOT

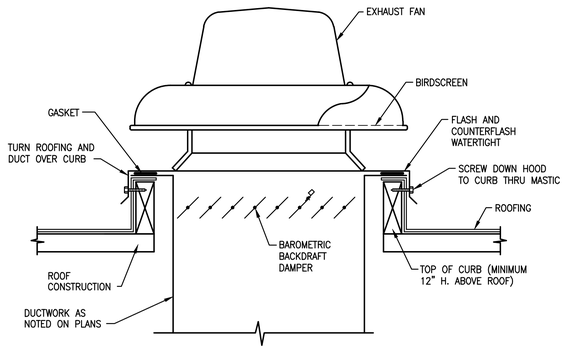
NOT TO SCALE

233713.12
9/22/09



BOILER FLUE DETAIL

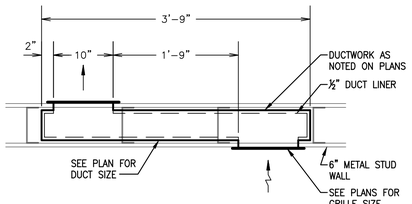
NOT TO SCALE



CENTRIFUGAL ROOF EXHAUST FAN

NOT TO SCALE

851.02
1/12/12

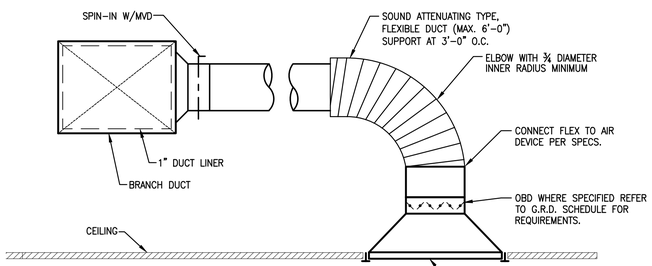


GENERAL NOTES:

1. REFER TO ARCHITECTURAL DETAILS FOR WALL FRAMING REQUIREMENTS.
2. REFER TO ARCHITECTURAL ELEVATIONS FOR GRILLE LOCATIONS.

STUDY ROOM/MEETING TRANSFER AIR DUCT DETAIL

NOT TO SCALE



AIR DEVICE DETAIL

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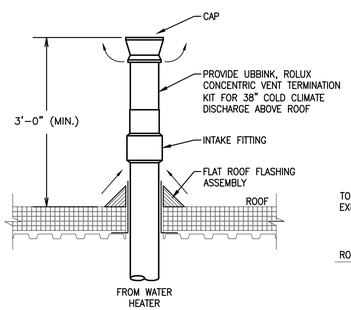
9/22/09



DOMESTIC WATER HEATER FLUE DETAIL

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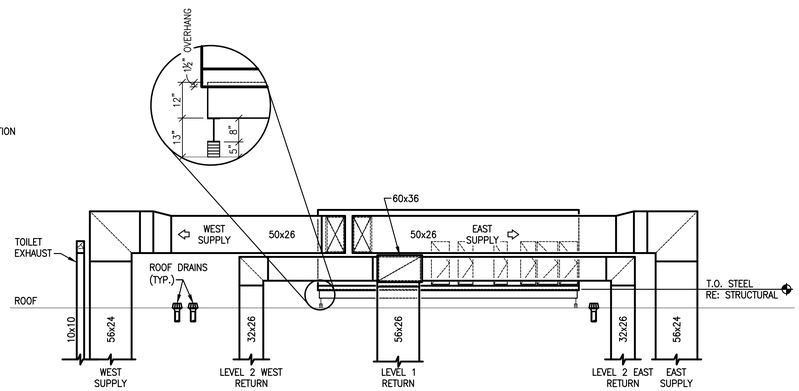
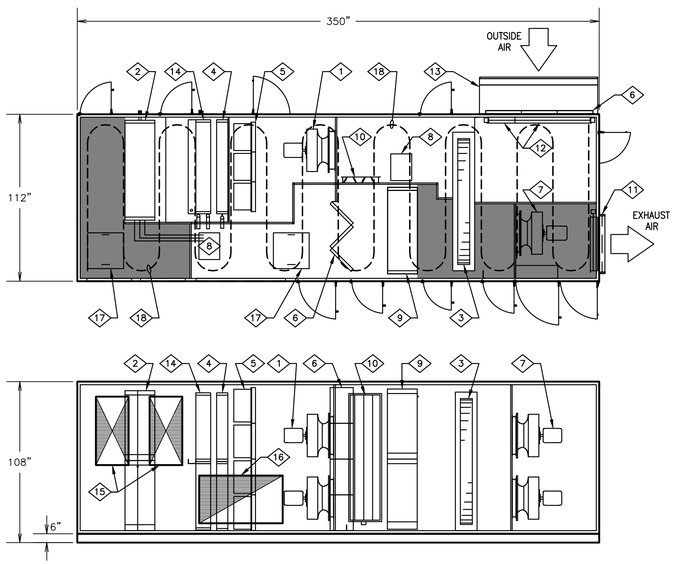


1 RTU-1 SUPPLY AND RETURN DUCTWORK ELEVATION

NOT TO SCALE



RTU-1 PLAN AND ELEVATION DETAIL

NOT TO SCALE

GENERAL NOTES:

1. SEAL ALL PIPING, PIPE CHASES AND CONDUIT PENETRATIONS INTO UNIT AIR AND WATER TIGHT.
2. PROVIDE ALUMINUM LINER WITH TPO MEMBRANE ON FLOORING FOR SECTIONS SHOWN SHADED.
3. DIMENSIONS SHOWN ARE MAXIMUM UNIT DIMENSIONS.
4. SEE SPECIFICATIONS FOR ADDITIONAL UNIT REQUIREMENTS.

WORK NOTES:

1. SUPPLY AIR FANS; (2) FANS, DIRECT DRIVE, STACKED.
2. DIRECT EVAPORATIVE COOLER; SUPPLY AIRSTREAM.
3. SENSIBLE HEAT WHEEL.
4. HOT WATER HEATING COIL.
5. FILTERS; MERV-A-13.
6. FILTERS; MERV-A-8.
7. RELIEF/EXHAUST AIR FANS; (2) FANS, DIRECT DRIVE, STACKED.
8. PIPE CHASE.
9. DIRECT EVAPORATIVE COOLER; EXHAUST AIRSTREAM.
10. RETURN AIR DAMPER.
11. EXHAUST AIR DAMPER.
12. OUTSIDE AIR DAMPERS; (1) 4500 CFM; VENTILATION AND (1) 13,000 CFM; ECONOMIZER.
13. OUTSIDE AIR HOOD.
14. COIL SPACE WITH DRAIN PAN FOR FUTURE DX COOLING COIL.
15. 22"x46" SUPPLY AIR OPENING.
16. 56"x32" RETURN AIR OPENING.
17. FLOOR HATCH FOR ACCESS TO UNDERSIDE OF UNIT.
18. LIEBERT LT500V LEAK DETECTION CABLE, INSTALL CABLE AS SHOWN, ATTACH TO FLAT SURFACE UNDER UNIT, INSIDE CURB PER MANUFACTURERS INSTALLATION REQUIREMENTS. ROUTE CABLE TO LIEBERT LIQUI-TECT MONITORING SYSTEM LOCATED IN MECHANICAL/ELECTRICAL ROOM. SEE SHEET M-201 FOR MONITORING SYSTEM PANEL LOCATION.

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sDC PROJECT NO: 1020.00
COOD PROJECT NO: CE 02089

ISSUE DATE
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MECHANICAL DETAILS

M-401

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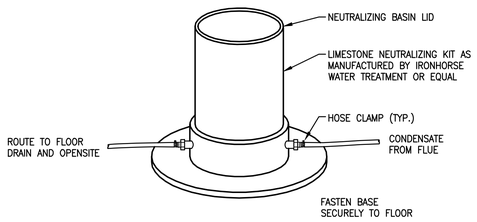
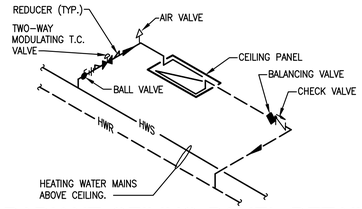


GENERAL NOTES:

1. TEST DOWNSTREAM OF NEUTRALIZING KIT AND IF NECESSARY, ADD ADDITIONAL KITS UNTIL DESIRED RESULTS ARE MET.
2. PROVIDE PRE-MANUFACTURED UNIT AS MANUFACTURED BY AXIOM INDUSTRIES.

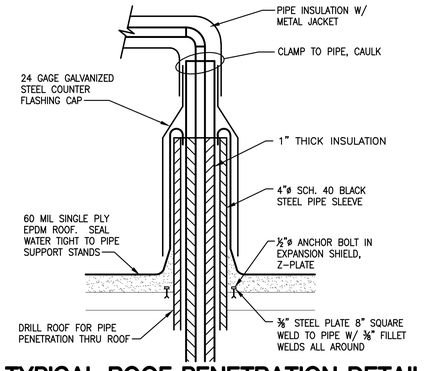
LIMESTONE NEUTRALIZING KIT FOR BOILER CONDENSATE DRAIN

NOT TO SCALE



RADIANT CEILING PANEL DETAIL

NOT TO SCALE 238200.130 9/22/09



TYPICAL ROOF PENETRATION DETAIL

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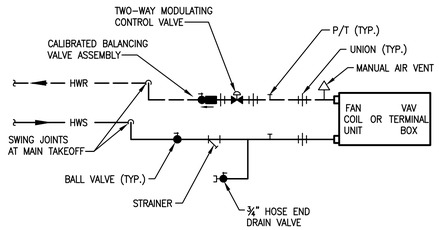
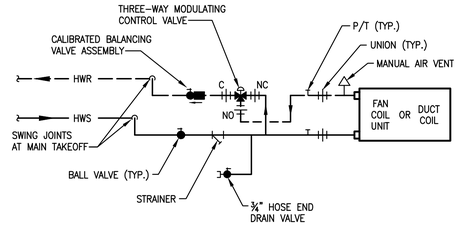


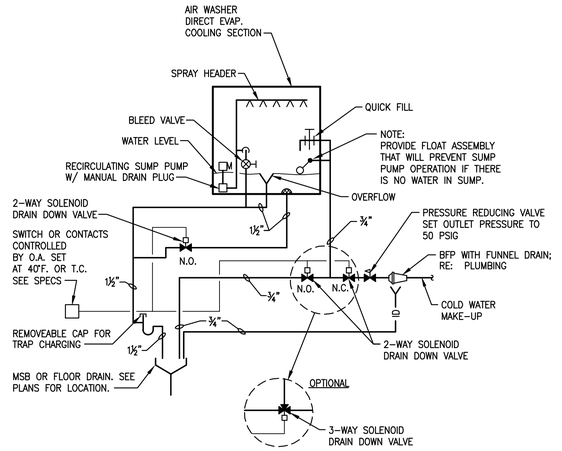
2-WAY VALVE HEATING COIL PIPING DETAIL

NOT TO SCALE (2-PIPE HEATING COIL) 238200.61 9/22/09



3-WAY VALVE HEATING COIL PIPING DETAIL

NOT TO SCALE (2-PIPE HEATING COIL) 238200.61 9/22/09

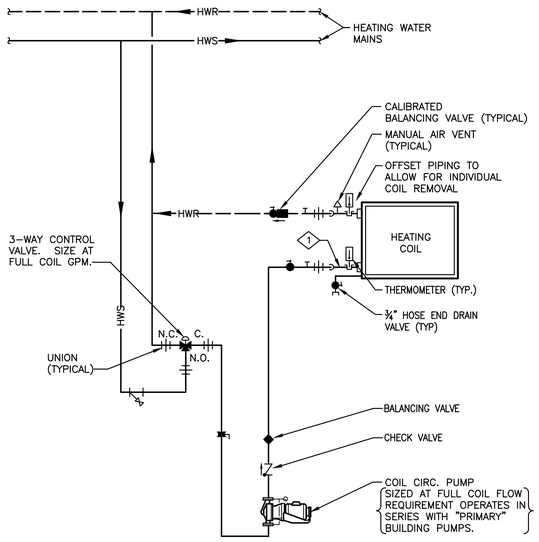


GENERAL NOTES:

1. PROVIDE FILL/DRAIN KIT (AS SHOWN IN DETAIL) FOR SUPPLY EVAPORATIVE COOLER AND A SECOND, SEPARATE KIT FOR EXHAUST EVAPORATIVE COOLER.

EVAPORATIVE COOLER AUTO-FILL/ AUTO-DRAIN DOWN DETAIL

NOT TO SCALE 232113.51 9/22/09



RTU-1 HEATING COIL W/ COIL PUMP (CONSTANT FLOW SYSTEMS)

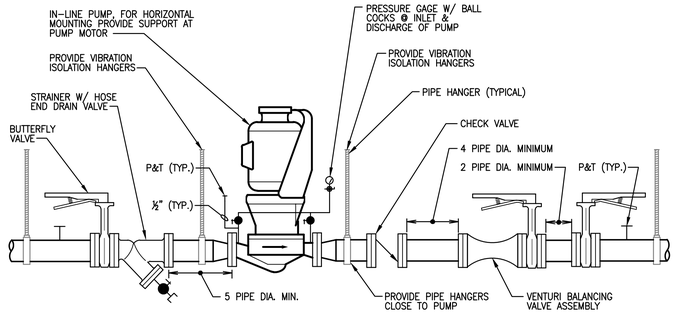
NOT TO SCALE 232113.28 12/4/09

GENERAL NOTES:

1. NO INSULATION ON PIPING/VALVES INSIDE OF UNIT.

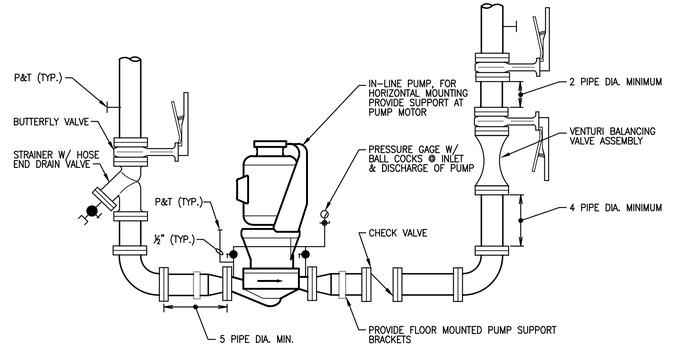
WORK NOTES:

1. INSTALL HWS PIPE ON LEAVING AIR SIDE OF COIL.
2. VALVES: BALL VALVES 2" & SMALLER.



SUSPENDED INLINE PUMP ASSEMBLY

NOT TO SCALE (2-1/2 PIPE AND LARGER) 232123.02 12/11/09



FLOOR MOUNTED INLINE PUMP ASSEMBLY

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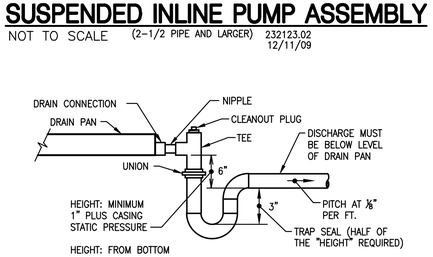
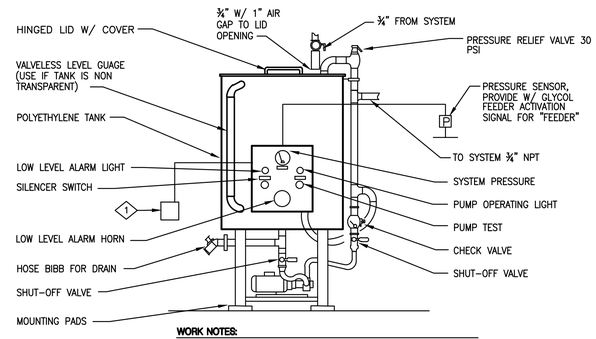


WORK NOTES:

1. PITCH DRAIN FOR PROPER RUN-OFF.
2. MANUALLY PRIME FILL TRAP BEFORE STARTUP TO FORM INITIAL DRY SEAL.
3. SUPPORT DRAIN LINES TO PREVENT SAG AND CONDENSATE OVERFLOW.
4. CORE DRILL FLOOR IF SLAB ON GRADE AND PROVIDE ROCK FILL OR INSTALL TRAP ON FLOOR BELOW FOR ABOVE GRADE APPLICATIONS AS REQUIRED TO MEET TRAP SEAL DIMENSION.

DRAW-THROUGH UNIT COIL CONDENSATE TRAP PIPING DETAIL

NOT TO SCALE 232113.60 9/22/09



WORK NOTES:

1. BINARY INPUT TO LCP LOW LEVEL ALARM.

GLYCOL FEEDER DETAIL

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MECHANICAL DETAILS

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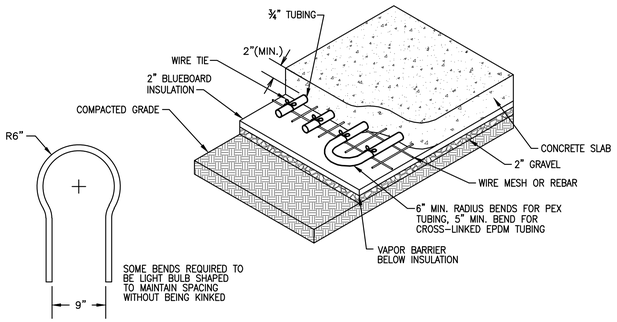
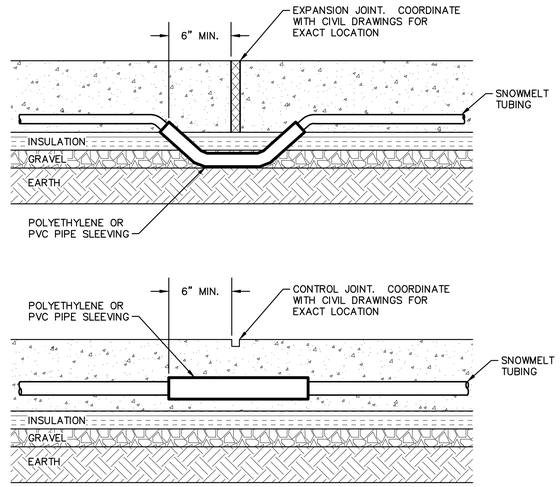


SNOWMELT SLAB INSTALLATION DETAIL

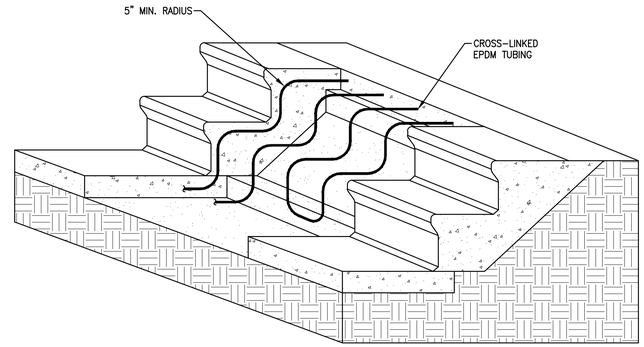
NOT TO SCALE

510.10
1/11/12



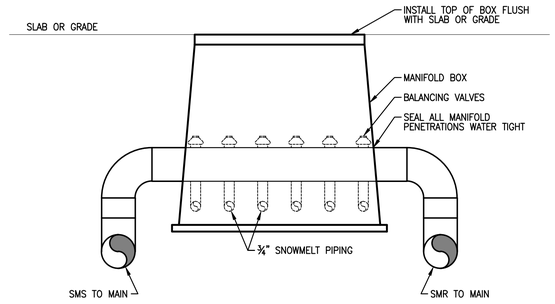
SNOWMELT PIPING AT CONTROL AND EXPANSION JOINTS DETAIL

NOT TO SCALE



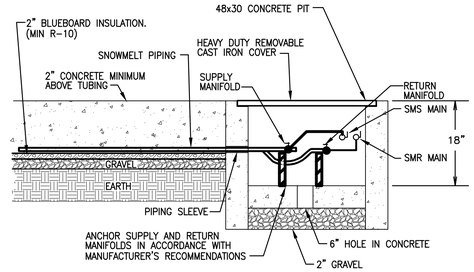
SNOWMELT STAIR INSTALLATION DETAIL

NOT TO SCALE



UNDERGROUND SNOWMELT MANIFOLD DETAIL

NOT TO SCALE



SNOWMELT MANIFOLD PIT DETAIL

NOT TO SCALE

510.01
1/11/12

NOTE:
ALL SNOWMELT DETAILS SHOWN ARE FOR ADD ALTERNATE 3.

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201 W. Colfax Ave.
DENVER, COLROADO 80202

CIVIL ENGINEER
SAN ENGINEERING
6099 Windermere St.
LITTLETON, COLORADO 80120
P. 303.953.9014
F. 303.953.9016
www.sanengineeringllc.com

LANDSCAPE ARCHITECT
MUNDUS BISHOP
333 West Colfax Ave. #350
Denver, Colorado 80204
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F. 303.865.5504
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STUDIO NYL
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Boulder, Colorado 80303
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F. 303.440.8536
www.studionyl.com

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F. 303.340.8233
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Boulder, Colorado 80301
P. 303.865.5500
F. 303.865.5504
www.k2audio.com

SUSTAINABILITY
AMBIENT ENERGY
130 W. 5th Ave.
Denver, Colorado 80204
P. 303.278.1532
F. 303.278.8533
www.ambient-e.com

PROJECT:
WEST DENVER BRANCH LIBRARY
1498 NORTH IRVING STREET
DENVER, COLORADO 80204

COLORADO REGISTERED PROFESSIONAL ENGINEER
PAUL B. MISKOWICZ
28801
1/3/12

sDC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02089

ISSUE DATE
01-12-2012

PHASE
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MECHANICAL DETAILS

M-403

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PROJECT NARRATIVE

PLUMBING

A 2" DOMESTIC WATER SERVICE WILL BE PROVIDED FOR THE BUILDING. THE DOMESTIC WATER LINE WILL HAVE A REDUCED PRESSURE BACKFLOW PREVENTER ASSEMBLY AND INCORPORATE THE REQUIREMENTS OF DENVER WATER ENGINEERING DESIGN STANDARDS. A REDUCED PRESSURE BACKFLOW PREVENTER ASSEMBLY AND WATER METER WILL BE ADDED TO SERVE MAKE-UP WATER TO THE EVAPORATIVE COOLING SECTIONS IN ROOFTOP UNIT, RTU-1. A REDUCED PRESSURE BACKFLOW PREVENTER ASSEMBLY AND WATER METER WILL BE ADDED TO SERVE IRRIGATION SYSTEM. A REDUCED PRESSURE BACKFLOW PREVENTER ASSEMBLY WILL BE PROVIDED TO SERVE MAKE-UP WATER TO THE BOILERS.

THE DOMESTIC HOT WATER SYSTEM TO SERVE CUSTODIAL 116, FAMILY R.R. 115, R.R. 244, R.R. 246, JANITOR 261 AND STAFF LOUNGE 253 IS AN ON-DEMAND, GAS-FIRED, TANK-LESS TYPE RINNAI WATER HEATER. DOMESTIC HOT WATER SHALL BE SET AT 110 DEGREES F. THE DOMESTIC HOT WATER WILL BE GENERATED AT 140 DEGREES F AND TEMPERED DOWN TO 110 DEGREES F THROUGH A MASTER THERMOSTATIC MIXING VALVE (TMV). THE ADVANTAGE OF THIS TYPE OF SYSTEM IS HAVING TWO PIECES OF EQUIPMENT RESIDING INSIDE THE SAME ROOM FOR MAINTENANCE. MENS 114, WOMENS 113, CLP 130 AND ARTS & CRAFTS 133 LAVATORIES AND SINKS SHALL HAVE ELECTRIC INSTANTANEOUS WATER HEATERS LOCATED BELOW EACH TO SERVE THEIR HOT WATER REQUIREMENTS.

PLUMBING FIXTURES THROUGHOUT THE BUILDING SHALL BE LOW-FLOW TYPE FIXTURES IN ACCORDANCE WITH DENVER WATER GUIDELINES. PROPOSED WATER CONSUMPTION AND OPERATION PER FIXTURE IS AS FOLLOWS:

WATER CLOSET 1.28 GPF TOUCH-LESS URINAL .125 GPF TOUCH-LESS LAVATORY 0.5 GPM
SINK 1.0 GPM

A GAS METER SET WILL BE PROVIDED BY XCEL ENERGY. NATURAL GAS WILL BE ROUTED IN TO THE BUILDING TO SERVE THE BOILERS, DOMESTIC WATER HEATER.

A SUMP PUMP WITH OIL DETECTION WILL BE PROVIDED FOR THE ELEVATOR SUMP PIT.

THE ROOF DRAINAGE SYSTEM WILL CONSIST OF ROOF DRAINS TIED IN TO THE STORM SEWER AND OVERFLOW DRAINS TERMINATED AT GRADE.

SUSTAINABLE DESIGN CONCEPTS (BASE LINE)

- LOW CONSUMPTION PLUMBING FIXTURES.
- MEASUREMENT AND VERIFICATION OF UTILITIES.

PLEASE REFER TO THE SUSTAINABILITY NARRATIVE FOR ADDITIONAL INFORMATION.

PLUMBING LEGEND

ALL SYMBOLS IN LEGEND MAY NOT NECESSARILY BE USED ON THIS PROJECT

LINE DESIGNATIONS

- COLD WATER (CW)
- HOT WATER (HW)
- HOT WATER CIRCULATING (HWC)
- SANITARY WASTE ABOVE GRADE OR FLOOR
- SANITARY (BUILDING DRAIN) BELOW GRADE OR FLOOR
- SANITARY VENT (V)
- STORM/RAINWATER DRAIN ABOVE FLOOR OR GRADE
- STORM/RAINWATER DRAIN BELOW FLOOR OR GRADE
- OVERFLOW DRAIN ABOVE FLOOR OR GRADE
- OVERFLOW DRAIN BELOW FLOOR OR GRADE
- PIPING TO SAND/OIL INTERCEPTOR BELOW FLOOR OR GRADE
- SCW SOFT COLD WATER
- SHW SOFT HOT WATER
- IW INDIRECT WASTE
- GW GREASE WASTE
- NP NON-POTABLE WATER
- G NATURAL GAS
- LP LIQUIFIED PETROLEUM GAS
- CA COMPRESSED AIR
- PD PUMP DISCHARGE
- PC PUMPED CONDENSATE
- D EQUIPMENT DRAIN
- TW TEMPERED WATER
- SCS SOLAR COLLECTOR SUPPLY
- SCR SOLAR COLLECTOR RETURN

VALVES and FITTINGS

- ELBOW UP
- ELBOW DOWN
- TEE UP
- TEE DOWN
- RISE OR DROP
- BRANCH-TOP CONNECTION
- BRANCH-BOTTOM CONNECTION
- GATE VALVE IN VERTICAL
- P-TRAP
- PIPE CAP OR PLUG
- UNION
- WALL HYDRANT WITH VACUUM BREAKER
- HOSE BIBB WITH VACUUM BREAKER
- SHOWER HEAD
- EXPANSION JOINT
- PIPE ANCHOR
- PIPE ALIGNMENT GUIDE
- PIPE HANGER
- FLEXIBLE CONNECTION
- STRAINER
- STRAINER W/BLOWOFF VALVE
- FLOOR SINK; (1/2" GRATE SHOWN)
- FLOOR DRAIN
- ROOF DRAIN
- OVERFLOW ROOF DRAIN
- CLEANOUT, FLOOR (FCO) OR GRADE (GCO)
- CLEANOUT, WALL (WCO)
- CLEANOUT PLUG (LCO)
- DOWNSPOUT NOZZLE
- METER (GAS OR WATER)
- STEAM TRAP (INDICATE TYPE)
- TEMPERATURE GAUGE
- BALL VALVE
- GATE VALVE
- CALIBRATED BALANCE VALVE
- PLUG VALVE
- SOLENOID VALVE
- PRESSURE REDUCING VALVE
- CHECK VALVE
- GLOBE VALVE
- THERMOSTATIC MIXING VALVE
- BUTTERFLY VALVE
- CIRCUIT SETTER
- GAS COCK
- TEMPERATURE/PRESSURE RELIEF VALVE
- AUTOMATIC AIR VENT
- MANUAL AIR VENT
- GAS PRESSURE REGULATOR
- PRESSURE/TEMPERATURE TAP
- PRESSURE GAUGE
- FS FLOW SWITCH
- PS PRESSURE SWITCH
- PI PRESSURE INDICATOR
- WELL
- GAUGE COCK
- WATER HAMMER ARRESTER W/ BALL VALVE
- T AQUASTAT
- VACUUM BREAKER
- VALVE IN YARD BOX
- HOSE END BALL VALVE WITH VACUUM BREAKER
- BFP BACKFLOW PREVENTER

FIRE PROTECTION

- POST INDICATOR VALVE
- NON-INDICATING VALVE (NON-RISING STEM)
- OUTSIDE SCREW & YOKE VALVE (RISING STEM)
- FIRE DEPARTMENT CONNECTION
- FREE STANDING FIRE DEPARTMENT CONNECTION
- WATER FLOW SWITCH
- ALARM CHECK VALVE (HORIZONTAL OR VERTICAL)
- DRY PIPE VALVE
- DELUGE VALVE OR PREACTION VALVE
- PS PRESSURE SWITCH
- ANGLE VALVE (FIRE HOSE VALVE)
- ANGLE DRAIN VALVE AND SIGHT GLASS
- BUTTERFLY VALVE W/TAMPER SWITCH
- OUTSIDE LIGHT AND HORN
- TAMPER SWITCH
- FIRE HOSE RACK
- SUCTION MAIN OR FIRE LINE LEAD-IN
- W PUBLIC WATER MAIN
- F FIRE
- SP FIRE SPRINKLER
- FSP FIRE STANDPIPE
- DFSP DRY FIRE STANDPIPE
- ASD AUTOMATIC FIRE SPRINKLER SYSTEM DRAIN
- NEW SPRINKLER HEAD
- EXISTING SPRINKLER HEAD
- SIDEWALL SPRINKLER HEAD
- SPRINKLER RISER
- FIRE HOSE VALVE CABINET (SURFACE MOUNTED)
- FIRE HOSE VALVE CABINET (RECESSED)
- F XX FIRE STANDPIPE DESIGNATION
- SP XX FIRE SPRINKLER RISER DESIGNATION

MEDICAL GAS SYMBOLS

MEDICAL GAS WALL OUTLETS

- OXYGEN
- VACUUM
- GAS
- MEDICAL COMPRESSED AIR
- NITROGEN
- NITROUS OXIDE
- W WASTE ANESTHESIA GAS DISPOSAL
- ZONE VALVE BOX
- N NITROGEN
- N2O NITROUS OXIDE
- OX OXYGEN
- VAC VACUUM
- MV MEDICAL VACUUM
- MA MEDICAL COMPRESSED AIR
- WAGD WASTE ANESTHESIA GAS DISPOSAL
- DV DENTAL VACUUM
- DA DENTAL COMPRESSED AIR

LABORATORY SYMBOLS

- LA LAB COMPRESSED AIR
- LG LAB GAS (NAT. OR PROP.)
- LV LAB VACUUM
- LN LAB NITROGEN
- DI DEIONIZED WATER
- DIC DEIONIZED WATER CIRCULATING
- LW LAB WASTE ABOVE FLOOR OR GRADE
- LBD LAB BUILDING DRAIN BELOW FLOOR OR GRADE
- LVT LAB VENT

MISCELLANEOUS

- A DIRECTION OF VEW / PICTURE DESIGNATION
- 1 / M-?? SECTION DESIGNATION / DRAWN ON THIS SHEET
- P XX PLUMBING STACK DESIGNATION
- L XX STORM WATER LEADER DESIGNATION
- EXIST. / NEW LIGHT LINE WEIGHT FOR EQUIPMENT, PIPING, SYMBOLS, TEXT, ETC. INDICATES EXISTING CONDITIONS WITH NEW WORK SHOWN AS DARK
- SCREENING INDICATES EXISTING TO BE REMOVED
- EXISTING TO BE REMOVED
- POINT OF CONNECTION NEW TO EXISTING

ABBREVIATIONS

AFF	ABOVE FINISHED FLOOR	DIA, D	DIAMETER	TYP	TYPICAL	(R)	RELOCATED
AP	ACCESS PANEL	I.E.	INVERT ELEVATION	VCP	VITRIFIED CLAY PIPE	(F)	FUTURE
C	COMMON	NC	NORMALLY CLOSED	VTR	VENT THROUGH ROOF		
CI	CAST IRON	NIC	NOT IN CONTRACT	(N)	NEW		
℄ EL.	CENTER LINE ELEVATION	NO	NORMALLY OPEN	(E)	EXISTING		

EQUIPMENT ABBREVIATIONS

AC-L	AIR COMPRESSOR - LABORATORY	DCP	PUMP - DOMESTIC CIRCULATING	PRV	PRESSURE REDUCING VALVE
AC-M	AIR COMPRESSOR - MEDICAL	DET	DOMESTIC EXPANSION TANK	RPBFP	REDUCED PRESSURE BACKFLOW PREVENTER
AC-SH	AIR COMPRESSOR - SHOP	DWH	DOMESTIC WATER HEATER	SEP	SEWAGE EJECTOR
BFP	BACKFLOW PREVENTER	DWS	DOMESTIC WATER SOFTENER	SP	SUMP PUMP
DBP	PUMP - DOMESTIC BOOSTER	GI	GREASE INTERCEPTOR	TMV	THERMOSTATIC MIXING VALVE
				VP-L	VACUUM PUMP - LABORATORY
				VP-M	VACUUM PUMP - MEDICAL

PLUMBING GENERAL NOTES:

1. THE EQUIPMENT SPECIFIED ON THE DRAWINGS HAVE BEEN SELECTED AS THE BASIS OF DESIGN. THE USE OF REVIEWED OR SPECIFIED EQUALS SHALL BE COORDINATED BY THE CONTRACTOR FOR SPACE REQUIREMENTS, EQUIPMENT DIMENSIONS AND PERFORMANCE.
2. DRAWINGS ARE DIAGRAMMATIC AND SHOW THE GENERAL DESIGN INTENT, ARRANGEMENT AND EXTENT OF SYSTEMS. DO NOT SCALE DRAWINGS NOR USE AS SHOP DRAWINGS. WHERE ALTERNATE ROUTING, OFFSETS AND TRANSITIONS ARE REQUIRED FOR FIELD COORDINATION OF ALL TRADES, THIS CONTRACTOR SHALL MAKE CHANGES WITHOUT ADDITIONAL COSTS.
3. CONTRACTOR SHALL NOT SHUT-OFF/PUT OUT OF SERVICE ANY SYSTEMS/SERVICES WITHOUT FIRST COORDINATING ALL DOWNTIME WITH OWNER'S PERSONNEL. CONTRACTOR SHALL PROVIDE A DETAILED M.O.P. AS REQUIRED. DO NOT BEGIN WORK WITHOUT WRITTEN APPROVAL.
4. ALL EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY DIRECTED OTHERWISE.
5. CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATION AND INSTALLING SLEEVES, INSERTS AND SUPPORTS AS REQUIRED FOR THIS SCOPE OF WORK AND/OR CORE DRILL REQUIREMENTS. COORDINATE WITH GENERAL CONTRACTOR AND STRUCTURAL ENGINEER AS REQUIRED.
6. CONTRACTOR SHALL CLOSELY COORDINATE NEW PLUMBING WITH ALL NEW AND EXISTING MECHANICAL, PLUMBING, ELECTRICAL, FIRE PROTECTION, ARCHITECTURAL AND STRUCTURAL MEMBERS. REFER TO DIVISION 22 FOR CEILING SPACE ALLOCATION PRIORITIES.
7. CONTRACTOR SHALL FIELD VERIFY ALL PLUMBING ITEMS PRIOR TO SUBMITTING A BID. NO ADDITIONAL COST WILL BE ALLOWED FOR CONTRACTOR'S FAILURE TO BECOME FAMILIAR WITH ALL EXISTING CONDITIONS.
8. ALL PLUMBING SYSTEMS SHALL BE INSTALLED IN ACCORDANCE WITH THE CURRENT VERSION OF INTERNATIONAL BUILDING CODE, INTERNATIONAL FIRE CODE AND NFPA, INTERNATIONAL MECHANICAL CODE, INTERNATIONAL PLUMBING CODE, INTERNATIONAL FUEL GAS CODE AND INTERNATIONAL ENERGY CONSERVATION CODE, INCLUDING LOCAL AMENDMENTS. REFER TO ARCHITECTURAL CODE PLAN.
9. CONTRACTOR SHALL PROVIDE SUBMITTALS ON ITEMS LISTED IN THE PLUMBING SCHEDULES AND AS REQUIRED IN EACH SECTION OF SPECIFICATION TO THE ENGINEER FOR REVIEW PRIOR TO THE ORDER, PURCHASE OR INSTALLATION OF THESE SAME ITEMS.
10. NATURAL GAS INPUTS ARE AT SEA LEVEL.
11. ALL EXISTING EQUIPMENT TO BE REMOVED SHALL HAVE ALL RELATED HOUSEKEEPING PADS, PIPING, CONTROLS, GAUGES, ELECTRICAL SERVICE, HANGERS, SUPPORTS AND ANY MISCELLANEOUS RELATED SERVICE OR PARTS REMOVED COMPLETELY.
12. PROVIDE WATER HAMMER ARRESTERS AT ALL QUICK CLOSING VALVES WITH ISOLATION VALVE AND WITH ACCESS OR ACCESS PANEL.
13. PROVIDE WATER BALANCE OF DOMESTIC WATER CIRC LINES TO GPM INDICATED ON DRAWING.
14. ALL THREADED HOSE CONNECTIONS TO DOMESTIC WATER SYSTEM SHALL HAVE AN APPROVED VACUUM BREAKER. IE: HOSE BIBBS, WALL HYDRANTS, SYSTEM DRAINS, EQUIPMENT DRAINS, ETC.
15. IT IS THE PLUMBING CONTRACTORS RESPONSIBILITY TO PROVIDE BACKFLOW PREVENTION AS REQUIRED BY CODE TO ALL PLUMBING, MECHANICAL EQUIPMENT AND IRRIGATION, INCLUDING BUT NOT LIMITED TO COFFEE MAKERS, JUICE MACHINES, TEA BREWERS, ICE MAKERS, ETC.
16. PROVIDE REDLINE MARKUPS OF ANY FIELD CHANGES OR MODIFICATIONS ON THE CONSTRUCTION DOCUMENTS. REDLINE DRAWINGS SHALL BE REQUIRED WHETHER COORDINATION DRAWINGS ARE REQUIRED OR NOT.
17. EQUIPMENT E.E.R. AND/OR C.O.P. SHALL COMPLY WITH ASHRAE 90.1.
18. EXISTING EQUIPMENT AS NOTED ON DRAWINGS SHALL BE RETURNED TO THE OWNER AT THEIR DESIGNATED LOCATION.

BCER CONTACT LIST

010.06
1/12/12

303-422-7400 FAX 303-422-7900

PROJECT DESIGNER	RICH GARNER	EXT 247	rgarner@bcer.com
PROJECT ENGINEER	WENDY MERCHANT	EXT 244	wmerchant@bcer.com
PROJECT MANAGER	PAUL MISKOWICZ	EXT 275	pmiskowicz@bcer.com

PRELIMINARY DESIGN INFORMATION
CITY WATER FLOW TEST INFORMATION

INFORMATION PROVIDED BY:	DENVER WATER
MODEL FLOW TEST:	APM2007MD SS
LOCATION:	14TH & IRVING
HYDRANT NO.	2720
DATE:	07/23/2007
STATIC PRESSURE:	79 PSI
RESIDUAL PRESSURE:	69
FLOW RATE (GPM):	1500

PLUMBING DRAWING LIST

Sheet Number	Sheet Title
P-000	PLUMBING LEGEND AND GENERAL INFORMATION
P-001	PLUMBING SCHEDULES
P-100	UNDERGROUND PLUMBING PLAN
P-101	LEVEL 1 UNDER FLOOR PLUMBING PLAN
P-102	LEVEL 1 PLUMBING PLAN
P-103	LEVEL 2 UNDER FLOOR PLUMBING PLAN
P-104	LEVEL 2 PLUMBING PLAN
P-105	ROOF LEVEL PLUMBING PLAN
P-201	ENLARGED MECHANICAL ROOM PLUMBING PLAN
P-202	ENLARGED PLUMBING PLANS
P-301	PLUMBING ISOMETRICS
P-302	PLUMBING DETAILS
P-303	PLUMBING DETAILS

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COLORADO REGISTERED PROFESSIONAL ENGINEER PAUL MISKOWICZ 28801 1/13/12

eDC PROJECT NO: 1020.00
COOD PROJECT NO: CE 02089

ISSUE DATE 01-12-2012
PHASE 100% CD

PLUMBING LEGEND AND GENERAL INFORMATION

P-000

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PLUMBING FIXTURE SCHEDULE

PLAN CODE	DESCRIPTION	LOCATION	FIXTURE MFGR.	FIXTURE MODEL	FIXTURE MOUNTING STYLE	FIXTURE INSTALLED		FLUSH VALVE MFGR.	FLUSH VALVE MODEL	FIXTURE INSTALLED		FLUSH VALVE STYLE	FAUCET MFGR.	FAUCET MODEL	FAUCET INSTALLED		FAUCET STYLE	FIXTURE MOUNTING HEIGHT A.F.F.	WATER CONSUMPTION	REMARKS
						FIXTURE MFGR.	FIXTURE MODEL			FLUSH VALVE MFGR.	FLUSH VALVE MODEL				FAUCET MFGR.	FAUCET MODEL				
WC-1	WATER CLOSET - STANDARD MOUNTING HEIGHT	MEN'S & WOMEN'S TOILET ROOMS	SLOAN	WETS 2050.1401-1.28 G2	WALL			SLOAN	COMPLETE HET SYSTEM			NA	NA	NA			NA	STANDARD	1.28 PF	(3)(6)
WC-2	WATER CLOSET - ADA	MEN'S, WOMEN'S, 2ND LEVEL RR & STAFF TOILET ROOMS	SLOAN	WETS 2050.1401-1.28 G2	WALL			SLOAN	COMPLETE HET SYSTEM			NA	NA	NA			NA	17"- 19" TO TOP OF SEAT	1.28 PF	(3)(6)
UR-1	URINAL - ADA	MEN'S TOILET ROOM	SLOAN	WEUS-1000.1401-0.13 EC0S	WALL			SLOAN	COMPLETE HEU SYSTEM			NA	NA	NA			NA	17" TO RIM	0.125 PF	(6) BATTERY OPERATED SENSOR FLUSH VALVE
L-1	LAVATORY	MENS & WOMENS TOILET ROOMS	XYLEM	CUA198RWT	UNDER COUNTER			NA	NA			NA	SLOAN	EAF-275			SENSOR	RE: ARCH DWGS	0.5 GPM	(5) SOLAR POWERED SENSOR FAUCET, SINGLE HOLE PUNCH, PROVIDE OPEN GRID STRAINER.
S-1	STAINLESS STEEL SINK - SINGLE COMPARTMENT	CLP	JUST	SL-ADA-1921-A-GR	COUNTER			NA	NA			NA	CHICAGO FAUCETS	895-317GNBAE26-5ABXKCP			WRIST	RE: ARCH DWGS	1.0 GPM	(7) 4"CENTERS - GRID STRAINER, PROVIDE WITH 1.0 GPM AERATOR
S-2	STAINLESS STEEL SINK - DOUBLE COMPARTMENT	STAFF LOUNGE	JUST	DL-ADA-1933-A-GR	COUNTER			NA	NA			NA	CHICAGO FAUCETS	2301-8CP			SINGLE HANDLE	RE: ARCH DWGS	1.0 GPM	(7) 8"CENTERS - BASKET STRAINER, PROVIDE WITH 1.0 GPM AERATOR, GARBAGE DISPOSER
S-3	STAINLESS STEEL SINK - DOUBLE COMPARTMENT	ARTS & CRAFTS	JUST	DL-ADA-1933-A-GR	COUNTER			NA	NA			NA	CHICAGO FAUCETS	895-317GNBAE26-5ABXKCP			WRIST	RE: ARCH DWGS	1.0 GPM	(7) 4"CENTER - GRID STRAINER, PROVIDE WITH 1.0 GPM AERATOR
GD-1	GARBAGE DISPOSER	STAFF LOUNGE	INSINKERATOR	EVOLUTION ESSENTIAL	UNDERSINK			NA	NA			NA	NA	NA			NA		NA	3/4 HP - PROVIDE WITH CORD AND PLUG. OPERATE FROM WALL SWITCH.
DF-1	DRINKING FOUNTAIN	TOILET ROOMS CORRIDOR	ELKAY	EDFPBM117C	WALL			NA	NA			NA	NA	NA			NA	ADA-RE: ARCH DWGS	NA	PROVIDE WITH WALL MOUNTING FRAME, ALL FASTENERS.
MSB-1	MOP SERVICE BASIN	CUSTODIAL	FIAT	MSB 2424	FLOOR			NA	NA			NA	CHICAGO FAUCETS	897-RCF			LEVER		NA	(4) PROVIDE WITH VACUUM BREAKER SPOUT AND WALL SUPPORT BRACE.
FD-1	FLOOR DRAIN	FINISHED AREAS	JAY R. SMITH	200SY-A	NA			NA	NA			NA	NA	NA			NA		NA	(1)
FD-2	FLOOR DRAIN	MECHANICAL ROOM	JAY R. SMITH	2131-B	NA			NA	NA			NA	NA	NA			NA		NA	(1) PROVIDE WITH SEDIMENT BUCKET.
FD-3	FLOOR DRAIN	SHOWER	JAY R. SMITH	200SY-A	NA			NA	NA			N	NA	NA			NA		NA	(1) PROVIDE WITH CHROME STRAINER
FS-1	FLOOR SINK	MECHANICAL ROOM	WADE																	PROVIDE WITH 1/2 GRATE
RD-1	ROOF DRAIN	ROOF	JAY R. SMITH	1010	NA			NA	NA			NA	NA	NA			NA		NA	PROVIDE WITH CAST IRON DOME STRAINER, UNDERDECK CLAMP, SUMP RECEIVER
OFD-1	OVERFLOW DRAIN	ROOF	JAY R. SMITH	1070	NA			NA	NA			NA	NA	NA			NA		NA	PROVIDE WITH CAST IRON DOME STRAINER, UNDERDECK CLAMP, SUMP RECEIVER
DSN-1	DOWNSPOUT NOZZLE	EXTERIOR LOCATIONS	JAY R. SMITH	1770	NA			NA	NA			nn	NA	NA			NA		NA	REFER TO ARCH FOR FINISH
WH-1	WALL HYDRANT	EXTERIOR LOCATIONS	NA	NA	WALL			NA	NA			NA	WOODFORD	B67			LOOSE KEY	RE: ARCH DWGS	NA	PROVIDE RECESSED BOX
HB-1	HOSE BIBB	MECHANICAL ROOM	NA	NA	WALL			NA	NA			NA	CHICAGO FAUCETS	998-RCF			WHEEL HANDLE	RE: ARCH DWGS	NA	
HB-2	HOSE BIBB	TOILET ROOMS	NA	NA	WALL			NA	NA			NA	WOODFORD	B75			LOOSE KEY	RE: ARCH DWGS		PROVIDE RECESSED BOX
TS-1	TRAP SEAL	VARIOUS LOCATIONS	SURE SEAL	NA	NA			NA	NA			NA	NA	NA			NA		NA	ASSE 1072 APPROVED DEVICE
WB-1	WALL BOX	STAFF LOUNGE	GUY GRAY	MIB1AB	WALL			NA	NA			NA	NA	NA			NA	RE: ARCH DWGS	NA	WHITE POWDER COATED METAL BOX WITH QUARTER TURN VALVE AND 1/2" SWEAT CONNECTION
WB-2	DRAIN DISCHARGE WALL BOX	WONDERWALL STORAGE	GUY GRAY	FR-12	WALL			NA	NA			N	NA	NA			NA	36" A.F.F.	NA	
SI-1	SOLIDS INTERCEPTOR	ARTS & CRAFTS	JAY R. SMITH	8710-ARI	NA			NA	NA			NA	NA	NA			NA		NA	PROVIDE WITH ARC INSIDE
SH-1	SHOWER	STAFF TOILET ROOM	NA	NA	NA			NA	NA			NA	POWERS	P-905-H4-O-2-W			LEVER	RE: ARCH DWGS	1.5	
RH-1	ROOF HYDRANT	ROOF	WOODFORD	RHY2-MS	NA			NA	NA			NA	NA	NA			NA		NA	PROVIDE DRAIN TO MSB

(1) PROVIDE "SURE SEAL" TRAP PROTECTION, ASSE 1072 APPROVED.
(2) PROVIDE WITH NICKLE BRONZE 3/4 GRATE, ARC COATED INTERIOR.
(3) PROVIDE WITH ELONGATED OPEN FRON SEAT, SELF SUSTAINING CHECK HINGES, BENEKE MODEL 523 SS OR EQUAL.
(4) PROVIDE FIAT QUICK DRAIN CONNECTOR, FIAT MODEL F-77-AA VINYL BUMPER GUARDS, FIAT MODEL 1453 BB FLAT SS STRAINER, STAINLESS STEEL WALL GUARDS MSG 2424
(5) PROVIDE TRUEBRO INSULATION KIT ON ALL EXPOSED PIPING.
(6) PROVIDE COMMERCIAL GRADE CARRIER WITH FEET SECURELY BOLTED TO FRAMEWORK AND ALL FIXTURE MOUNTING ACCESSORIES. RE: DETAIL FOR FRAMEWORK.
(7) PROVIDE 6-1/2" DEPTH.
(8) WATER CLOSET FLUSH VALVE HANDLES SHALL BE LOCATED TO THE WIDE SIDE OF THE STALL.

THERMOSTATIC MIXING VALVE SCHEDULE

S410.01\<(0/24/02)\>7 12/12/11 14:13:09

PLAN CODE	MFR.	MODEL	INSTALLED MFR.	INSTALLED MODEL	SERVICE	TOTAL CAPACITY GPM	INLET TEMP. °F	OUTLET TEMP. °F	ASSE STANDARD	REMARKS
TMV-1	POWERS	LM490 SERIES			MAIN BUILDING - MASTER MIXING VALVE	11	140	110	1017	(1)(2)(3)(4)(5)(6)

(1) LOCATE IN ACCESSIBLE LOCATION OR PROVIDE ACCESS DOOR.
(2) SERVES MULTIPLE FIXTURES.
(3) ALL MIXING VALVES TO CHECK VALVES ON BOTH HOT AND COLD SUPPLIES. SOME UNITS HAVE INTEGRAL CHECK VALVES. VERIFY EACH LOCATION HAS CHECK VALVES.
(4) PROVIDE THERMOMETER DOWNSTREAM OF MIXING VALVE.
(5) PROVIDE WITH 1" UNION CONNECTION.
(6) BASED ON 10 PSI PRESSURE DROP.

GAS EQUIPMENT AND GAS METER SCHEDULE

S488.01\<(5/21/03)\>7 01/11/12 14:50:52

PLAN CODE	TYPE / SERVICE	BTUH INPUT	CFH	MIN. GAS PRESSURE (IN. W.C.)	MAX. GAS PRESSURE (IN. W.C.)	FINAL CONNECTION SIZE	REMARKS
B-1	BOILER	750,000	902.5	5	14	2-1/2"	(1)(2)(3)(4)
B-2	BOILER	750,000	902.5	5	14	2-1/2"	(1)(2)(3)(4)
DWH-1	DOM. WATER HEATER	199,000	239.5	5	10.5	1-1/4"	(1)(2)(3)(4)(6)
	TOTAL METER LOAD	1,699,000	2044.5				

(1) GAS SUPPLIED BY XCEL; 6 IN. W.C.
(2) BTUH HEATING VALUE: **&37.**
(3) HARD PIPE FINAL CONNECTION.
(4) PROVIDE UNION, 6" DIRT LEG AND GAS COCK.
(5) SEE PLANS / SCHEMATIC FOR REGULATORS.
(6) PROVIDE FLUE CONDENSATE NEUTRALIZATION KIT. RE: DETAIL.

GAS DOMESTIC WATER HEATER SCHEDULE

S450.08\<(0/24/02)\>7 01/11/12 14:51:40

PLAN CODE	MFGR.	MODEL	INSTALLED MFGR.	INSTALLED MODEL	STORAGE CAPACITY (GALLONS)	BTUH INPUT @ S.L.	RECOVERY GPH @ 80 DEG. F. @ S.L.	VENT SIZE	UNIT WIDTH	UNIT HEIGHT	UNIT DEPTH	GAS TYPE	REMARKS
DWH-1	RINNAI	RC98HPI			TANKLESS	199,000	INSTANTANEOUS	5"	18.5"	26.5"	10"	NAT.	(1)(2)(3)(4)(5)(6)

(1) EXPANSION TANK: REFER TO SCHEDULE
(2) PROVIDE WITH SPARK IGNITION.
(3) PROVIDE UNIT WITH ENERGY USAGE COMPLIANCE TO ASHRAE 90.1 - LATEST VERSION.
(4) PROVIDE ELECTRICAL CONNECTION, 115V/1.
(5) PROVIDE VERTICAL CONCENTRIC ALL WEATHER VENT KIT MODEL 184119.
(6) PROVIDE FLUE CONDENSATE NEUTRALIZATION KIT. RE: DETAIL.

SUMP PUMP SCHEDULE

22142_01 (01/02/02) 12/06/11 11:38:40

PLAN CODE	MFR.	MODEL	INSTALLED MFR.	INSTALLED MODEL	CAPACITY GPM	HEAD FT. WATER	BASIN	MOTOR HP	MOTOR VOLTS/PH	REMARKS
SP-1	WEIL	2443-09DL			50	35		3/4	115/1	(1)

1. PROVIDE SIMPLEX PUMP SYSTEM, CONTROL PANEL WEIL MODEL 8109-L WITH EXTRA SET OF DRY CONTACTS FOR CONNECTIONS TO BAS. PROVIDE HIGH WATER ALARM (AUDIBLE) AND LIGHT. PROVIDE 3 FLOAT SYSTEMS. PROVIDE WEIL LIQUID SENSOR MODEL 8100K7126 FOR OIL DETECTION. ALL COMPONENTS TO BE COMPATIBLE.

PLUMBING FIXTURE CONNECTION SCHEDULE

S440.01\<(0/22/02)\>7 12/06/11 08:55:31

FIXTURE TYPE	SYMBOL	MIN TRAP SIZE	SOIL OR WASTE	VENT (1)	COLD WATER	HOT WATER	REMARKS
WATER CLOSET (FLUSH VALVE)	WC	--	4"	2"	1"	--	(3)
URINAL	UR	--	2"	1-1/2"	3/4"	--	(3)
LAVATORY	L	1-1/4"	1-1/2"	1-1/2"	1/2"	1/2"	(2)
SINK	S	1-1/2"	2"	1-1/2"	1/2"	1/2"	
MOP SERVICE BASIN	MSB	3"	3"	2"	1/2"	1/2"	
WATER COOLER / DRINKING FOUNTAIN	EWC/DF	1-1/4"	1-1/2"	1-1/2"	1/2"	--	(2)
SHOWER	SH	1-1/2"	1-1/2"	1-1/2"	1/2"	1/2"	(2)

(1) 2" MINIMUM VENT BELOW GRADE.
(2) 2" MINIMUM WASTE BELOW GRADE.
(3) PROVIDE SHOCK ARRESTOR ON COLD WATER SUPPLY W/ ACCESS DOOR.

BACKFLOW PREVENTER ASSEMBLY SCHEDULE

S411.01\<(8/08/02)\>7 01/11/12 14:49:19

PLAN CODE	TYPE	SYSTEM	MFR.	MODEL	INSTALLED MFR.	INSTALLED MODEL	QUANTITY	LINE SIZE (INCHES)	PRESS. DROP (PSIG)	REMARKS
BFP-1	HORIZONTAL REDUCED PRESSURE	DOMESTIC WATER	FEBCO	860			1	2	12	(1)(2)(3)(4)(5)
BFP-2	VERTICAL DOUBLE CHECK	FIRE PROTECTION	FEBCO	850			1	6	12	(2)(6)
BFP-3	HORIZONTAL REDUCED PRESSURE	EVAPORATIVE COOLERS	FEBCO	860			1	3/4	12	(1)(2)(3)(4)(5)
BFP-4	HORIZONTAL REDUCED PRESSURE	BOILERS	FEBCO	860			1	3/4	12	(1)(2)(3)(4)(5)
BFP-5	HORIZONTAL REDUCED PRESSURE	IRRIGATION	FEBCO	860			1	1	12	(1)(2)(3)(4)(5)

(1) COMPLETE ASSEMBLY WITH VALVES, FULL LINE SIZE.
(2) PROVIDE TESTING AND CERTIFICATION IN ACCORDANCE WITH COLORADO REQUIREMENTS.
(3) PROVIDE WITH BALL VALVE AND UNION.
(4) REFER ALSO TO DETAIL.
(5) PROVIDE FUNNEL WITH FULL SIZE DRAIN TO FLOOR DRAIN OR TO EXTERIOR OF BUILDING. OPTION TO PROVIDE SHUT DOWN DEVICE. (OBTAIN APPROVAL BY CODE AUTHORITY)
(6) COMPLETE ASSEMBLY WITH UL/FM LISTED OS&Y VALVES.

EXPANSION TANK SCHEDULE

S120.01 (03/11/0 07/20/11 12:07:52

PLAN CODE	MFR.	MODEL	INSTALLED MFR.	INSTALLED MODEL	SERVICE	CHARGE PRESSURE	CAPACITY ACCEPT. VOLUME	CAPACITY TOTAL VOLUME	OPERATING WEIGHT (LBS.)	SYSTEM WATER VOLUME (GAL.) APPROX	REMARKS
DET-1	THERM-X-TROL	ST-12			DOMESTIC HOT WATER	SYSTEM PRESSURE	3.30	4.50	40.00	50.00	(1)

1. SUSPENDED TYPE MOUNTING.
2. FLOOR MOUNTED TYPE.

ELECTRIC DOMESTIC WATER HEATER SCHEDULE

22320D.03 (01/02/02) 12/06/11 09:08:01

DESIGNATION	MANUFACTURER	MODEL NO.	INSTALLED MANUFACTURER	INSTALLED MODEL NO.	CAPACITY (GALLONS)	TEMP. RISE °F	TOTAL KW	AMPS	ELEC VOLT/PH	REMARKS
EDWH-1	EEMAX	MT00724OT			TANKLESS	67 @ 0.5 GPM	4.9	20.3	208/1	(1)(2)
EDWH-2	EEMAX	EX95-T			TANKLESS	65 @ 1.0 GPM	7.2	30	208/1	(1)(2)

(1) SET MAXIMUM OUTLET TEMPERATURE AT 102°F
(2) PROVIDE 208 VOLTS TO UNIT. TEMPERATURE RISE, TOTAL KW AND AMPS BASED ON 75% OF 240 VOLT LOAD.

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SAN ENGINEERING
6099 Windermere St.
LITTLETON, COLORADO 80120
P. 303.953.9014
F. 303.953.9016
www.sanengineeringllc.com

LANDSCAPE ARCHITECT
MUNDUS BISHOP
333 West Colfax Ave. #350
Denver, Colorado 80204
P. 303.865.5500
F. 303.865.5504
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STRUCTURAL ENGINEER
STUDIO NYL
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P. 303.558.3145
F. 303.440.8536
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PROJECT:
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DENVER, COLORADO 80204

COLORADO REGISTERED PROFESSIONAL ENGINEER 28801 MICHAEL BISHOP 1/5/12

sDC PROJECT NO: 1020.00
COOD PROJECT NO: CE 02089

ISSUE DATE 01-12-2012
PHASE 100% CD

PLUMBING SCHEDULES

P-001

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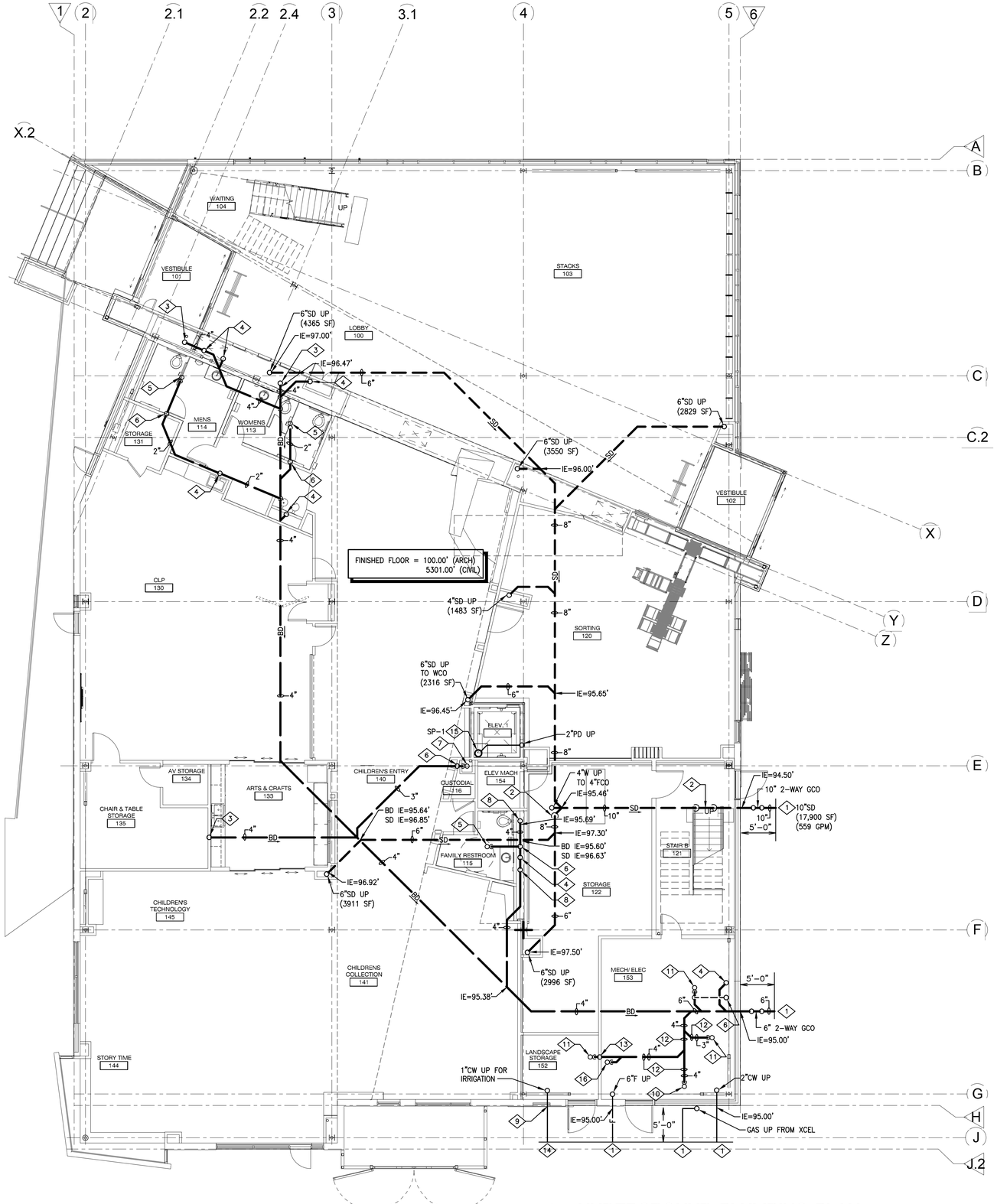

UNDERGROUND PLUMBING PLAN

SCALE: 1/8" = 1'-0"

4' 2' 0 4' 8' 16'

GENERAL NOTES:

1. ALL FLOOR DRAINS TO HAVE TRAP SEAL PROTECTION, TS-1.

WORK NOTES:

1. REFER TO CIVIL DRAWINGS FOR CONTINUATION.
2. DROP PIPING TO MEET INVERT.
3. 4"WASTE UP TO 4"WCO. COORDINATE EXACT LOCATION WITH SOLIDS INTERCEPTOR PIPING ON FIRST LEVEL.
4. 2"WASTE UP.
5. 2"WASTE UP TO FLOOR DRAIN.
6. 2"VENT UP.
7. 3"WASTE UP TO MOP SERVICE BASIN.
8. 4"WASTE UP.
9. COORDINATE IRRIGATION PIPING INVERT WITH IRRIGATION CONTRACTOR.
10. 4"WASTE UP TO FLOOR DRAIN.
11. 3"WASTE UP TO FLOOR DRAIN.
12. THIS PIPING IS A COMBINATION DRAIN AND VENT SYSTEM AND SHALL BE SLOPED AT ¼" PER FOOT.
13. 3"VENT UP.
14. REFER TO IRRIGATION DRAWINGS FOR CONTINUATION.
15. ELEVATOR SUMP PUMP LOCATED IN PIT WITH GRATE. ROUTE PUMPED DISCHARGE HORIZONTALLY BELOW LOWEST PORTION OF ELEVATOR AS INDICATED.
16. 4"WASTE UP TO FLOOR SINK.
17. COORDINATE EXACT LOCATION WITH SOLIDS INTERCEPTOR FINAL LOCATION.

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UNDERGROUND PLUMBING PLAN

P-100

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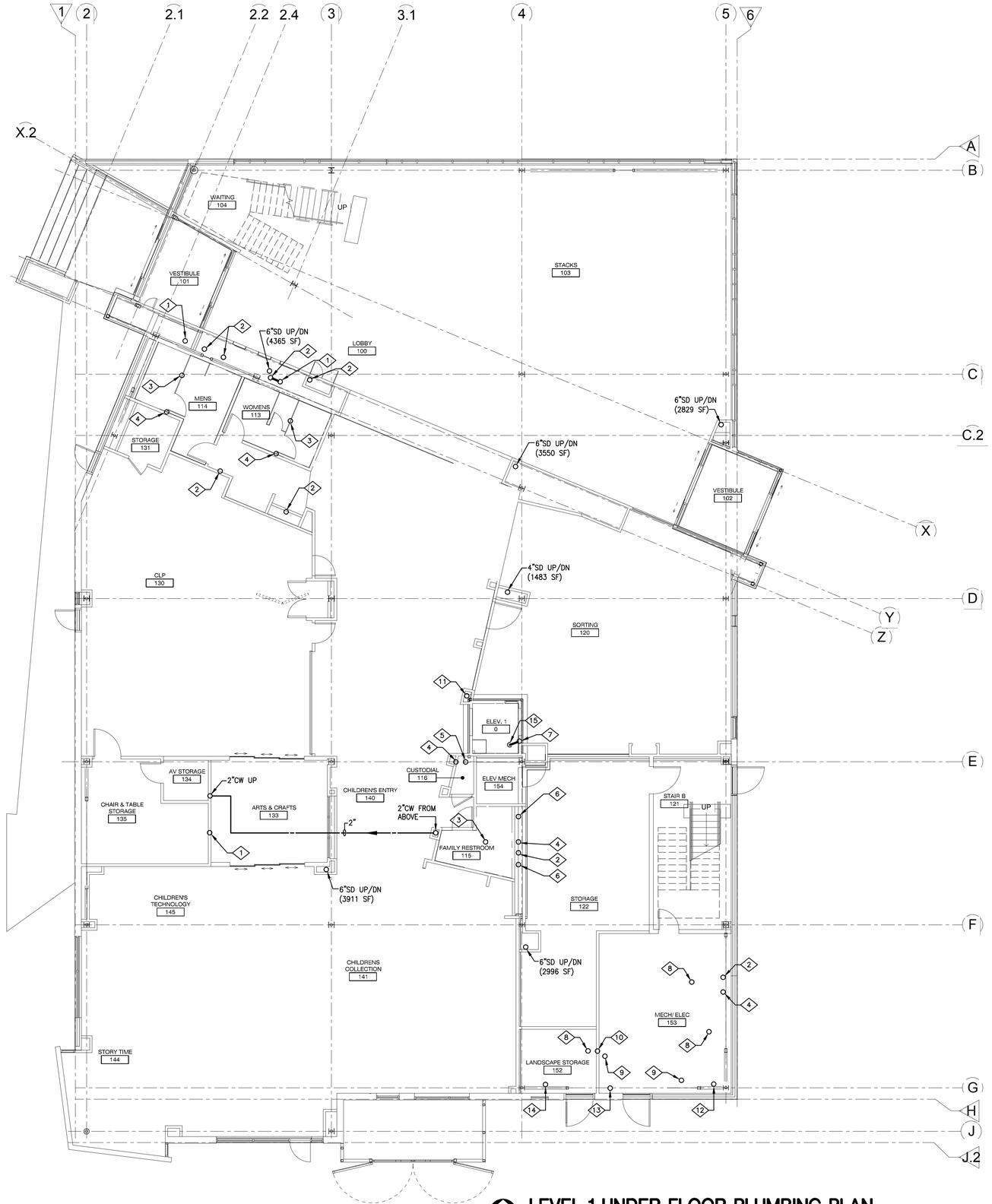

LEVEL 1 UNDER FLOOR PLUMBING PLAN

SCALE: 1/8" = 1'-0"

4' 2' 0 4' 8' 16'

WORK NOTES:

1. 4"WASTE UP TO 4"WCO.
2. 2"WASTE UP.
3. 2"WASTE UP TO FLOOR DRAIN.
4. 2"VENT UP.
5. 3"WASTE UP TO MOP SERVICE BASIN.
6. 4"WASTE UP.
7. 2"PD UP.
8. 3"WASTE UP TO FLOOR DRAIN.
9. 4"WASTE UP TO FLOOR DRAIN.
10. 3"VENT UP.
11. 6"SD UP/DN.
12. 2"CW UP SERVING DOMESTIC WATER SYSTEM.
13. 6"F UP SERVING FIRE PROTECTION SYSTEM.
14. 1"CW UP SERVING IRRIGATION SYSTEM.
15. 2"PD DOWN TO SUMP PUMP.

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eDC PROJECT NO: 1020.00
CCOD PROJECT NO: CE 02089

ISSUE DATE 01-12-2012
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LEVEL 1 UNDER FLOOR PLUMBING PLAN

P-101

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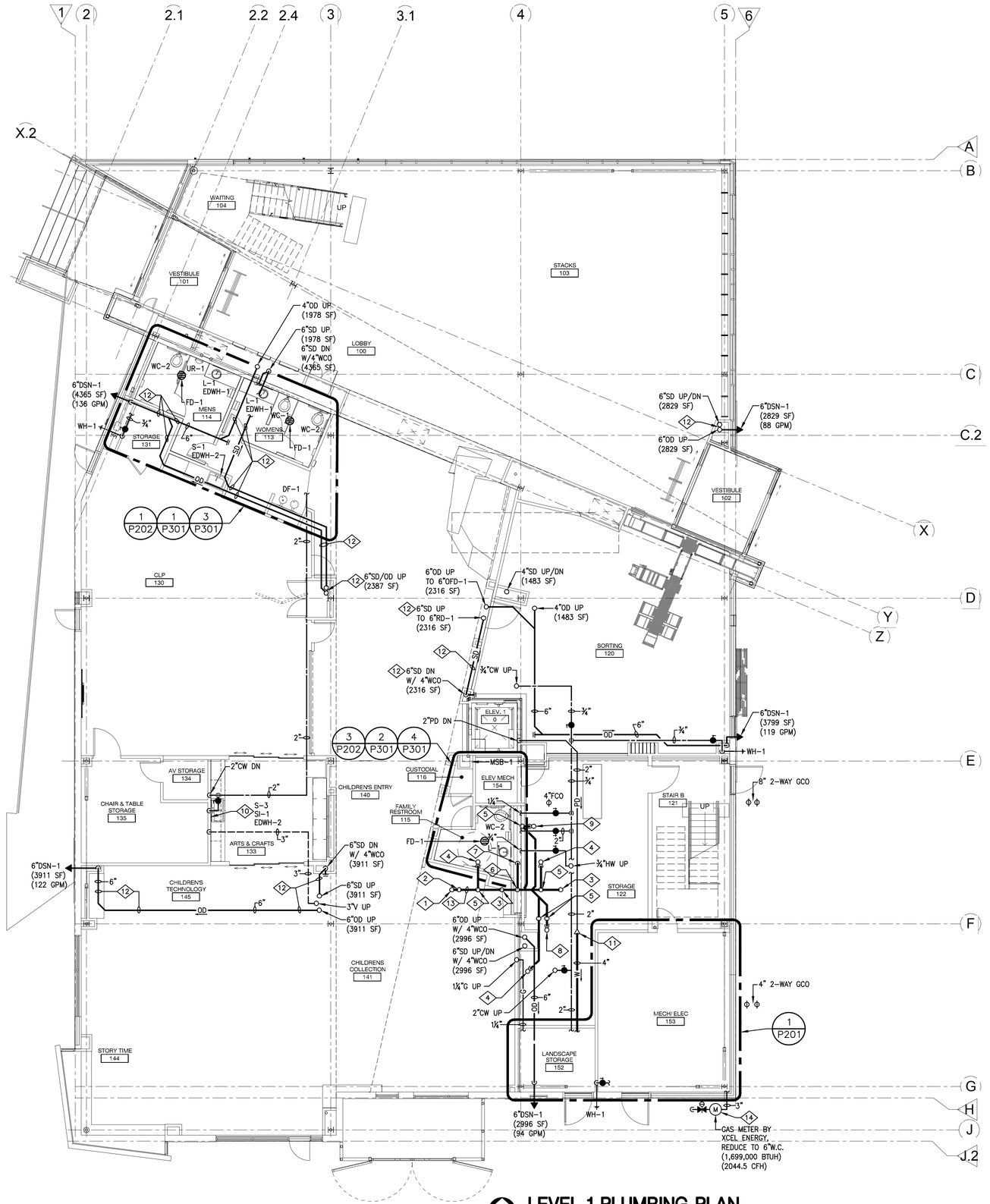


LEVEL 1 PLUMBING PLAN

SCALE: 1/8" = 1'-0"

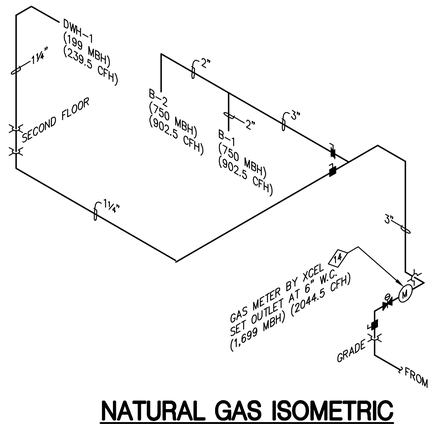
4' 2' 0 4' 8' 16'

GENERAL NOTES:

1. ALL FLOOR DRAINS TO HAVE TRAP SEAL PROTECTION, TS-1.

WORK NOTES:

1. 4"WASTE UP TO 4"WCO.
2. 4"WASTE UP.
3. 2"WASTE UP.
4. 2"WASTE UP TO FLOOR DRAIN.
5. 2"VENT UP.
6. 4"WASTE UP/DN.
7. 4"WASTE DOWN.
8. 3"WASTE UP TO MSB.
9. 2"WASTE UP TO SHOWER.
10. ½"CW AND 2"VENT DOWN, 2"WASTE. ROUTE ½"CW TO CW SIDE OF FAUCET AND CONNECT. OFFSET ½"CW TO ELECTRIC DOMESTIC WATER HEATER LOCATED BELOW SINK. ROUTE ½"TW FROM EDWH-2 TO HW SIDE OF FAUCET AND CONNECT. FACTORY SET OUTLET TEMPERATURE AT 105°F. PROVIDE SOLIDS INTERCEPTOR, SI-1 IN CABINET SPACE. REFER TO DETAIL FOR ADDITIONAL INFORMATION. PROVIDE 2"WCO. TRANSITION 2"VENT AT CEILING SPACE TO 3"VENT AND ROUTE AS INDICATED.
11. TRANSITION TO GRAVITY DRAIN AT THIS POINT.
12. PROVIDE SOUND WRAP AROUND STORM/OVERFLOW PIPING; RE: SPECIFICATIONS.
13. PROVIDE SOUND WRAP AROUND WASTE PIPING; RE: SPECIFICATIONS.
14. PROVIDE DRY CONTACTS FOR CONNECTION TO BAS.



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sDC PROJECT NO: 1020.00
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LEVEL 1 PLUMBING PLAN

P-102

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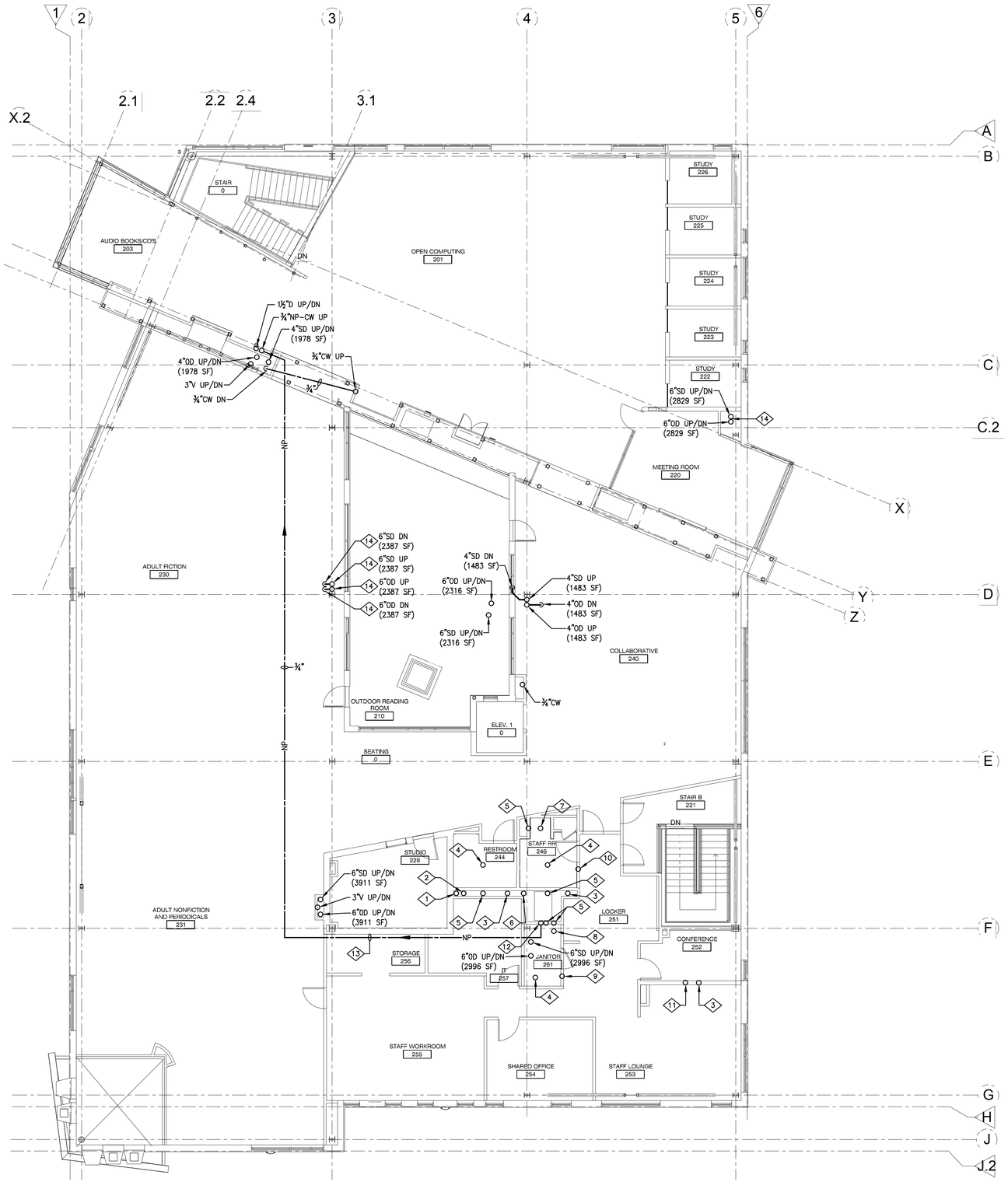

LEVEL 2 UNDER FLOOR PLUMBING PLAN

SCALE: 1/8" = 1'-0"

4' 2' 0 4' 8' 16'

WORK NOTES:

1. 4"WASTE UP TO 4"WCO.
2. 4"WASTE UP.
3. 2"WASTE UP.
4. 2"WASTE UP TO FLOOR DRAIN.
5. 2"VENT UP.
6. 4"WASTE UP/DN.
7. 2"WASTE UP TO SHOWER.
8. 3"WASTE UP TO MOP SINK BASIN.
9. 2"CW UP/DN.
10. ¾"HW UP/DN.
11. 3"VENT UP/DN.
12. ¾"NP-CW UP.
13. ROUTE ¾"NP-CW PIPE SOUTH OF STUDIO 228 TO MINIMIZE NOISE IN STUDIO SPACE.
14. PROVIDE SOUND WRAP AROUND STORM/OVERFLOW PIPING. RE: SPECIFICATION.

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COLORADO REGISTERED PROFESSIONAL ENGINEER
RAUL B. MISKOWICZ
28801
1/5/12

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LEVEL 2 UNDER FLOOR PLUMBING PLAN

P-103

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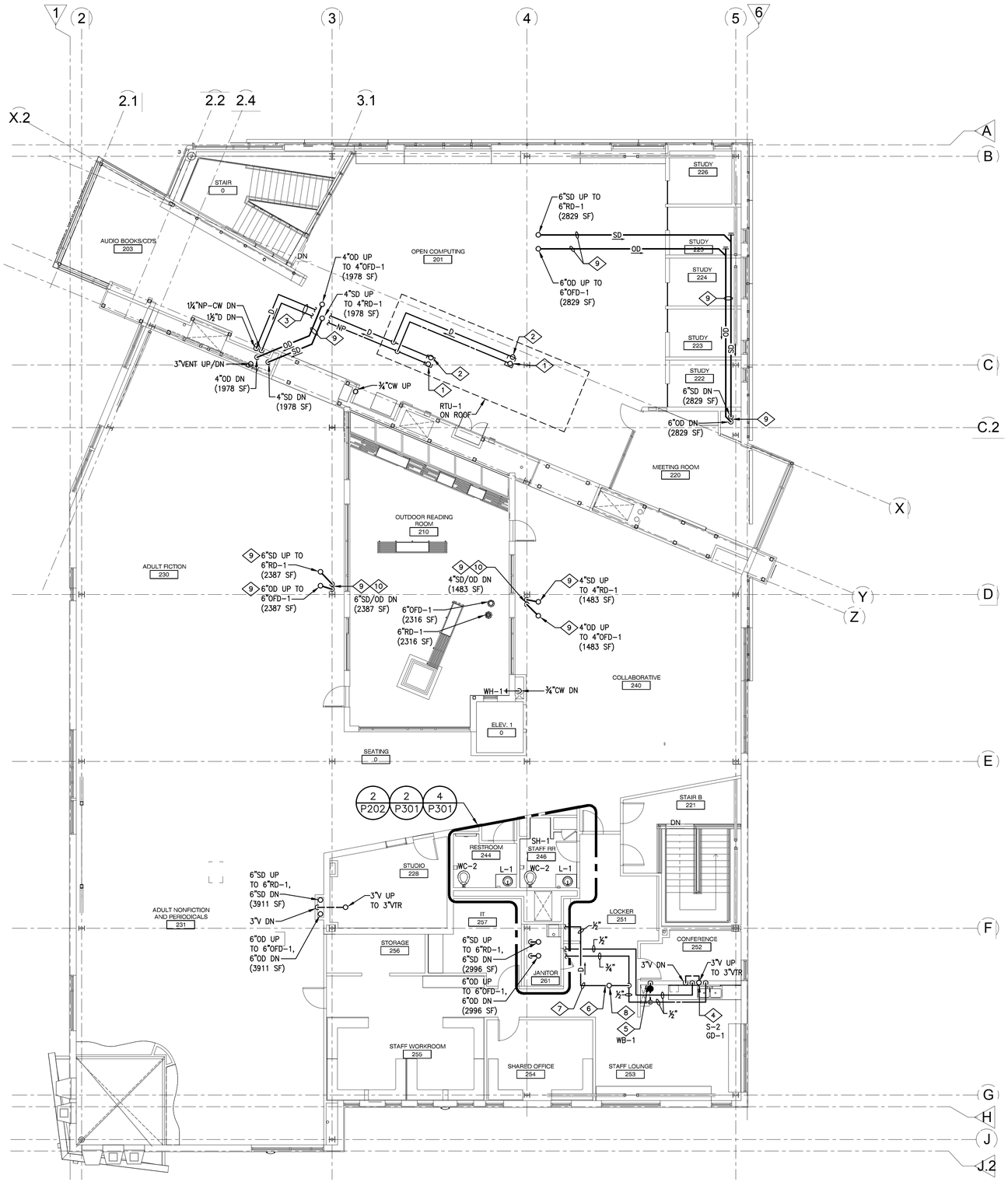

LEVEL 2 PLUMBING PLAN

SCALE: 1/8" = 1'-0"

4' 2' 0 4' 8' 16'

WORK NOTES:

1. ¾"NP-CW UP TO EVAP COOLERS. COORDINATE EXACT ROOF PENETRATION LOCATION WITH EQUIPMENT.
2. 1½"CONDENSATE DRAIN UP TO RTU-1. COORDINATE EXACT ROOF PENETRATION LOCATION WITH EQUIPMENT.
3. ROUTE ¾"NP-CW AND 1½"CONDENSATE DRAIN PIPING CROSSING CEILING FROM WONDERWALL TO RTU-1 AT SAME LOCATION. PAINT PIPING; COLOR SELECTION BY ARCHITECT.
4. ½"CW/HW AND 2"VENT DOWN, 2"WASTE. CONNECT TO FIXTURE. OFFSET ½"HW TO DISHWASHER AND TERMINATE WITH BALL VALVE. PROVIDE 2"WCO. TRANSITION TO 3"VENT AT CEILING SPACE AND EXTEND 3"VTR.
5. ROUTE ½"CW DOWN TO REFRIGERATOR WALL BOX AND CONNECT.
6. ROOF HYDRANT DRAIN, TRANSITION ⅜"NPT CONNECTION TO ½"COPPER PIPING AND ROUTE AS INDICATED.
7. ROOF HYDRANT DRAIN TO SLOPE AT ¼" PER FOOT. ROUTE IN WEB SPACE WHERE POSSIBLE.
8. ¾"CW UP TO ROOF HYDRANT.
9. PROVIDE SOUND WRAP AROUND STORM/OVERFLOW PIPING; RE: SPECIFICATIONS.
10. ROUTE STORM/OVERFLOW PIPING TIGHT TO COLUMN.

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COLORADO REGISTERED PROFESSIONAL ENGINEER PAUL J. MISKOWICZ 28801 1/13/12

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LEVEL 2 PLUMBING PLAN

P-104

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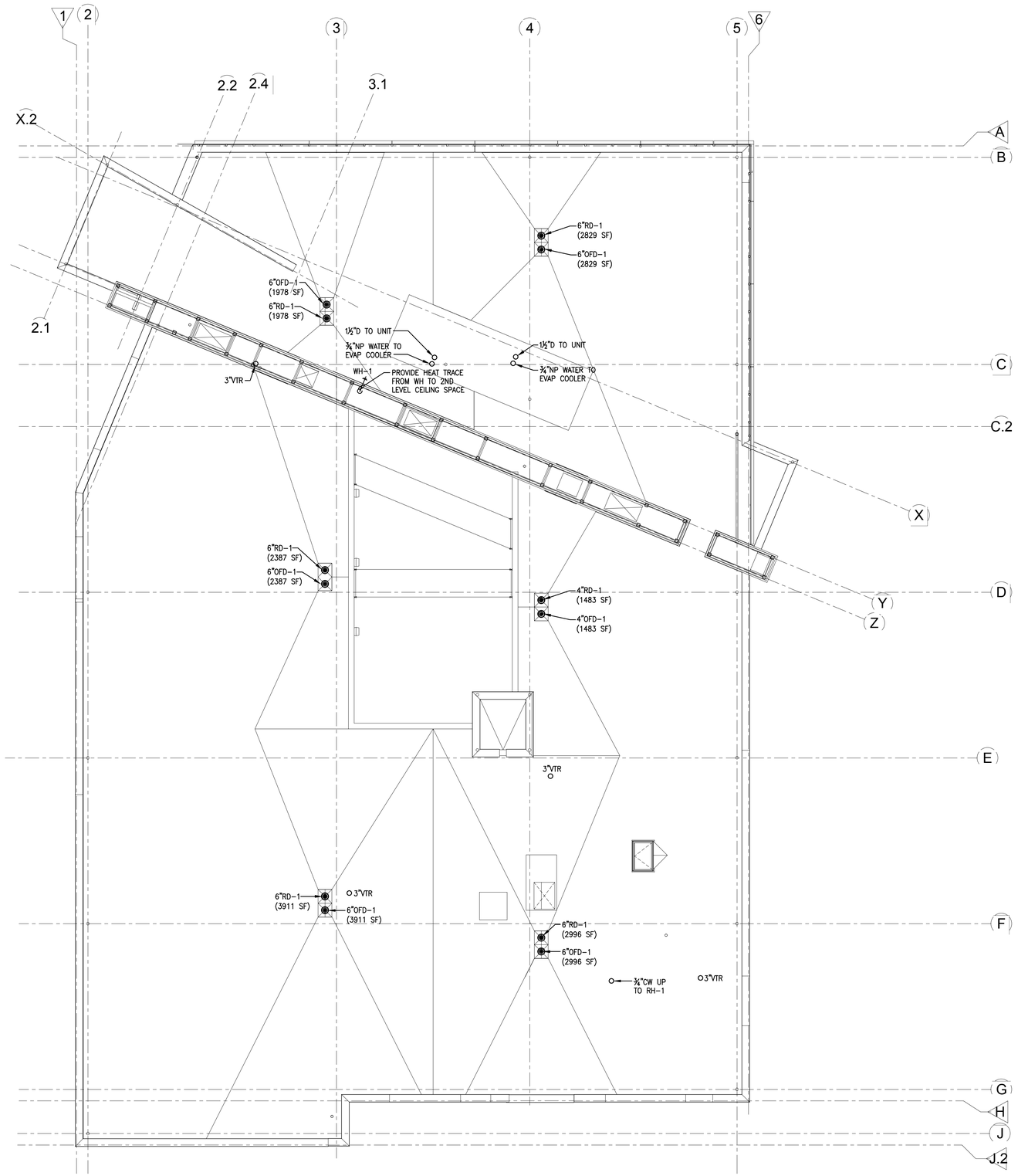

ROOF LEVEL PLUMBING PLAN

SCALE: 1/8" = 1'-0"

4' 2' 0 4' 8' 16'

GENERAL NOTES:

1. COORDINATE VENT THRU ROOF PENETRATION WITH HVAC EQUIPMENT, 10'-0" MINIMUM FROM UNIT INTAKE.

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1/3/12

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ROOF LEVEL PLUMBING PLAN

P-105

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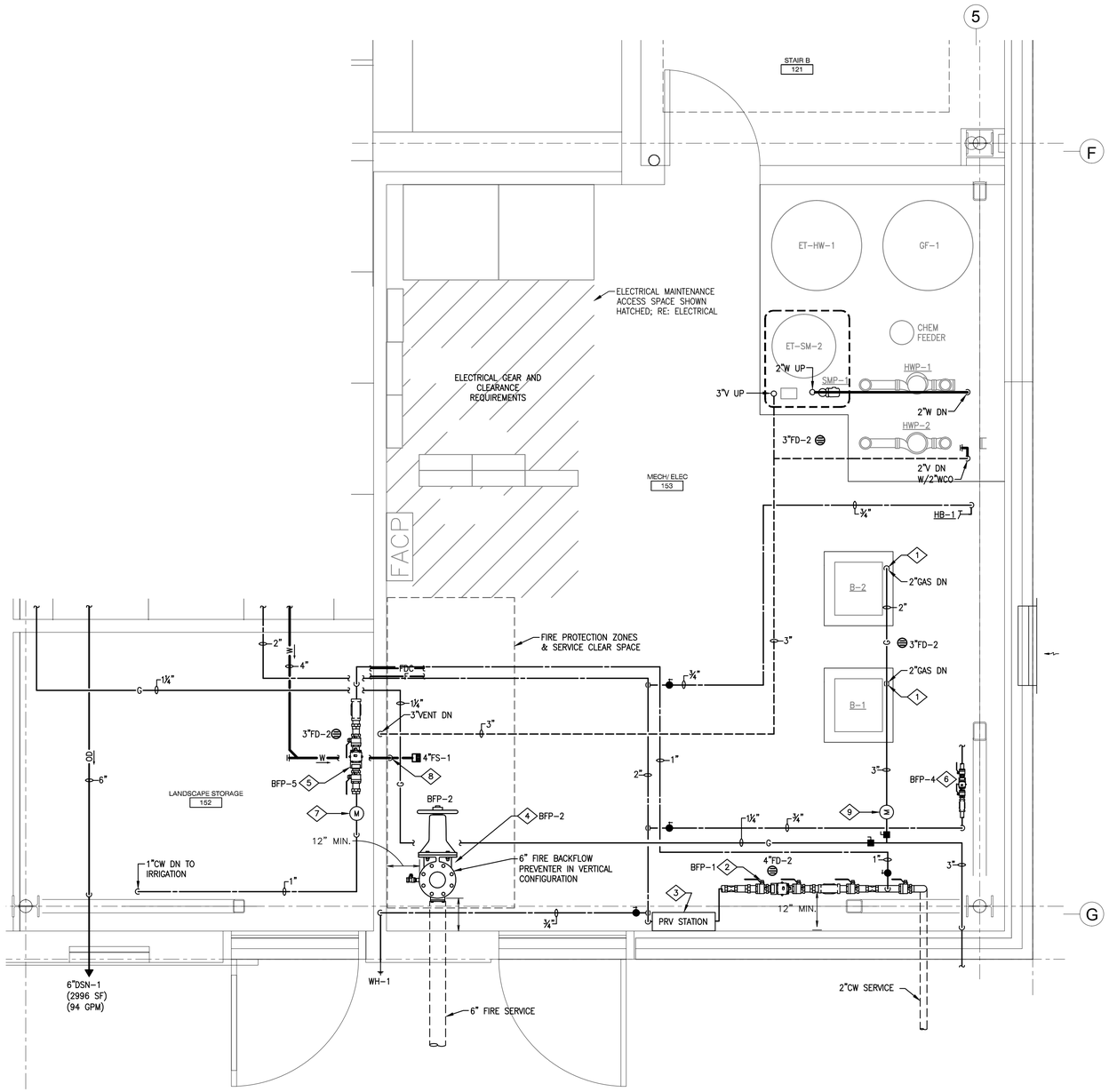

LEVEL 1
ENLARGED MECHANICAL ROOM PLUMBING PLAN
SCALE: 1/2" = 1'-0"

1' 6" 0 1' 2' 4'

GENERAL NOTES:

1. ALL FLOOR DRAINS TO HAVE TRAP SEAL PROTECTION, TS-1.

WORK NOTES:

1. GAS REGULATOR VENT TO BE ONE SIZE LARGER THAN VENT CONNECTION SIZE OF REGULATOR; INSTALL PER MANUFACTURER'S GUIDELINES.
2. 2"REDUCED PRESSURE BACKFLOW PREVENTER ASSEMBLY MOUNTED ON UNISTRUT SERVING DOMESTIC WATER SYSTEM. REFER TO BFP DETAIL FOR ADDITIONAL VALVES AND INFORMATION.
3. PRESSURE REDUCING STATION. REFER TO PRV STATION DETAIL FOR VALVES AND ADDITIONAL INFORMATION.
4. DOUBLE CHECK BACKFLOW PREVENTER ASSEMBLY SERVING FIRE PROTECTION SYSTEM. REFER TO FIRE PROTECTION DRAWINGS FOR CONTINUATION.
5. 1"REDUCED PRESSURE BACKFLOW PREVENTER ASSEMBLY SERVING IRRIGATION SYSTEM. ROUTE AS INDICATED. REFER TO IRRIGATION DRAWINGS FOR CONTINUATION. REFER TO BFP DETAIL FOR ADDITIONAL VALVES AND INFORMATION.
6. ¾"REDUCED PRESSURE BACKFLOW PREVENTER ASSEMBLY MOUNTED ON UNISTRUT SERVING BOILERS. REFER TO MECHANICAL DRAWINGS FOR CONTINUATION. REFER TO BFP DETAIL FOR ADDITIONAL VALVES AND INFORMATION.
7. WATER SUB-METER TO BE INSTALLED DOWNSTREAM OF BFP-5. PROVIDE DRY CONTACTS FOR CONNECTION TO BAS. REFER TO SPECIFICATION FOR METER INFORMATION. REFER TO SUB-METER INPUT DIAGRAM ON SHEET M-304.
8. ROUTE 4"WASTE DOWN WALL AND OPENSITE AT FLOOR SINK. COORDINATE ROUTING WITH FIRE PROTECTION EQUIPMENT.
9. GAS SUB-METER, PROVIDE DRY CONTACTS FOR CONNECTION TO BAS. REFER TO SPECIFICATION FOR METER INFORMATION. REFER TO SUB-METER INPUT DIAGRAM ON SHEET M-304.

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CHRISTOPHER M. MISKOWICZ
28801
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J.D.B.L.

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ENLARGED MECHANICAL ROOM PLUMBING PLAN

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XREFS=(xx-tb, xx-lvl 1, xc-plum-1-enlarged, xc-lvl 1 - ENLARGED MECH) Layouts=(P-201 ENLARGED MECHANICAL ROOM PLUMBING PLAN)
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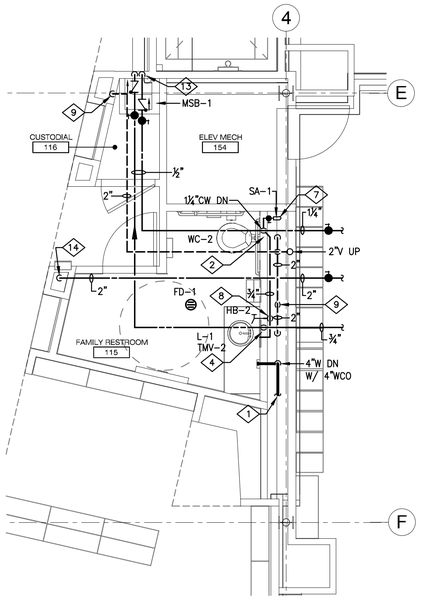
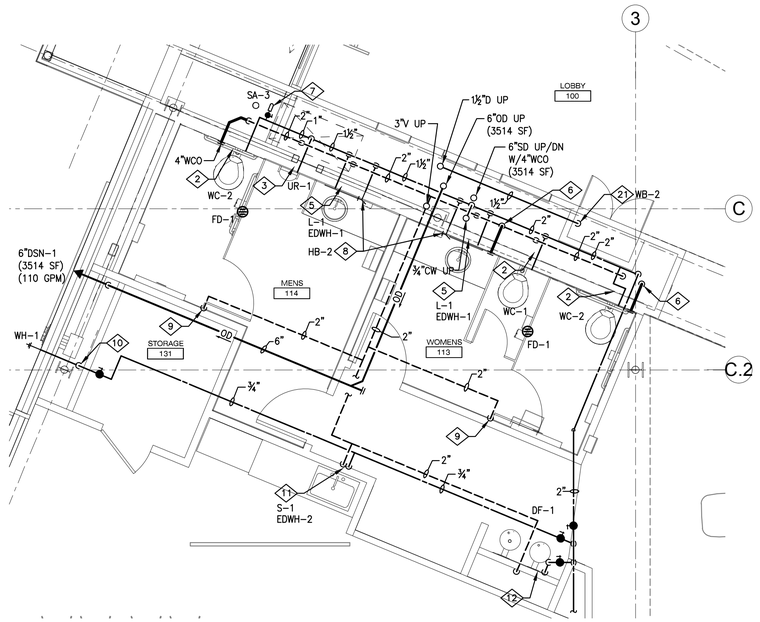


LEVEL 1 ENLARGED TOILET ROOM PLUMBING PLAN

3 SCALE: 1/4" = 1'-0"

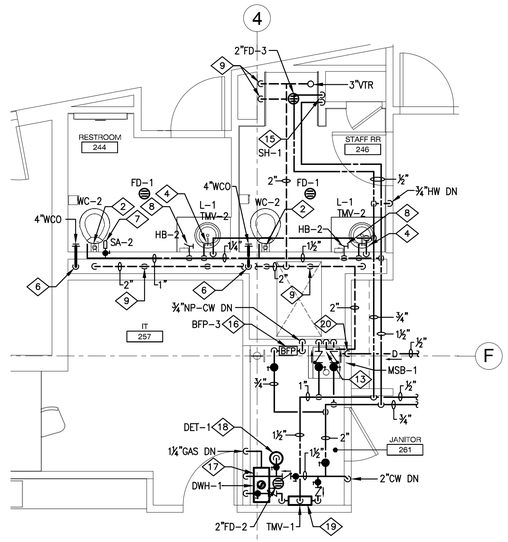
2' 1' 0 2' 4' 8'



LEVEL 1 ENLARGED TOILET ROOM PLUMBING PLAN

1 SCALE: 1/4" = 1'-0"

2' 1' 0 2' 4' 8'



LEVEL 2 ENLARGED TOILET ROOM PLUMBING PLAN

2 SCALE: 1/4" = 1'-0"

2' 1' 0 2' 4' 8'

GENERAL NOTES:

1. ALL FLOOR DRAINS TO HAVE TRAP SEAL PROTECTION, TS-1.

WORK NOTES:

1. REFER TO P-102 FOR LEVEL 2 WASTE PIPING.
2. 1"CW AND 2"VENT DOWN, 4"W. CONNECT TO FIXTURE.
3. ¾"CW AND 2"VENT DOWN, 2"W. CONNECT TO FIXTURE. PROVIDE 2"WCO.
4. ½"CW/HW AND 2"VENT DOWN, 2"W. ROUTE ½"CW/HW TO THERMOSTATIC MIXING VALVE LOCATED BELOW LAVATORY AND CONNECT. ROUTE ½"TW FROM TMV TO FAUCET AND CONNECT. SET OUTLET TEMPERATURE OF TMV AT 102°F. PROVIDE 2"WCO.
5. ½"CW AND 2"VENT DOWN, 2"W. ROUTE ½"CW TO ELECTRIC DOMESTIC WATER HEATER WITH ASSE 1070 APPROVAL LOCATED BELOW LAVATORY AND CONNECT. ROUTE ½"TW FROM EDWH-1 TO FAUCET AND CONNECT. SET OUTLET TEMPERATURE AT 102°F. PROVIDE 2"WCO.
6. 4"WASTE DOWN WITH 4"WCO.
7. PROVIDE SHOCK ARRESTER ON SUPPLY PIPING, SIZE INDICATED ON PLAN.
8. ¾"CW DOWN TO HOSE BIBB, HB-2.
9. 2"VENT DOWN.
10. ¾"CW DOWN TO WALL HYDRANT, WH-1.
11. ¾"CW AND 2"VENT DOWN, 2"W. ROUTE ½"CW TO CW SIDE OF FAUCET AND CONNECT. OFFSET ½"CW TO ELECTRIC DOMESTIC WATER HEATER LOCATED BELOW SINK AND CONNECT. ROUTE ½"TW FROM EDWH-2 TO HW SIDE OF FAUCET AND CONNECT. FACTORY SET UNIT AT 105°F. PROVIDE 2"WCO.
12. ½"CW AND 2"VENT DOWN, 2"W. CONNECT TO FIXTURE. PROVIDE 2"WCO.
13. ½"CW/HW AND 3"W. ROUTE ½"CW/HW DOWN TO MSB FAUCET AND CONNECT. PROVIDE CHECK VALVE IN CW/HW SUPPLY PIPING.
14. 2"CW DOWN.
15. ROUTE ½"CW/HW DOWN TO SHOWER MIXING VALVE AND CONNECT.
16. 1¼" REDUCED PRESSURE BACKFLOW PREVENTER ASSEMBLY MOUNTED ON WALL ABOVE OR NEAR MOP SERVICE BASIN. SERVING HUMIDIFIERS. ROUTE FUNNEL DRAIN TO MSB AND OPENSITE. REFER TO BFP DETAIL FOR ADDITIONAL VALVES AND INFORMATION. WATER SUB-METER TO BE INSTALLED DOWNSTREAM OF BFP-3. PROVIDE DRY CONTACTS FOR CONNECTION TO BAS. REFER TO SPECIFICATION FOR METER INFORMATION. REFER TO SUB-METER INPUT DIAGRAM ON SHEET M-304.
17. DOMESTIC WATER HEATER MOUNTED ON WALL. REFER TO DETAIL FOR VALVES AND ADDITIONAL INFORMATION.
18. DOMESTIC HOT WATER EXPANSION TANK. REFER TO WATER HEATER DETAIL FOR ADDITIONAL INFORMATION.
19. THERMOSTATIC MIXING VALVE MOUNTED ON WALL. SET OUTLET TEMPERATURE AT 120°F. REFER TO WATER HEATER DETAIL FOR ADDITIONAL INFORMATION.
20. ROUTE ½"ROOF HYDRANT DRAIN DOWN IN WALL AND OPENSITE ABOVE MSB.
21. ROUTE 1½"D (CONDENSATE) TO WALL BOX AND OPENSITE.

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COLORADO REGISTERED PROFESSIONAL ENGINEER
28801
1/5/12

sDC PROJECT NO: 1020.00
COOD PROJECT NO: CE 02089

ISSUE DATE
01-12-2012

PHASE
100% CD

ENLARGED PLUMBING PLANS

P-202

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XREFS=(xx-tb, xx-lvl 1, xc-plum-1-enlarged, xx-lvl 2, xc-plum-2-enlarged) Layouts=(P-202 ENLARGED PLUMBING PLANS)
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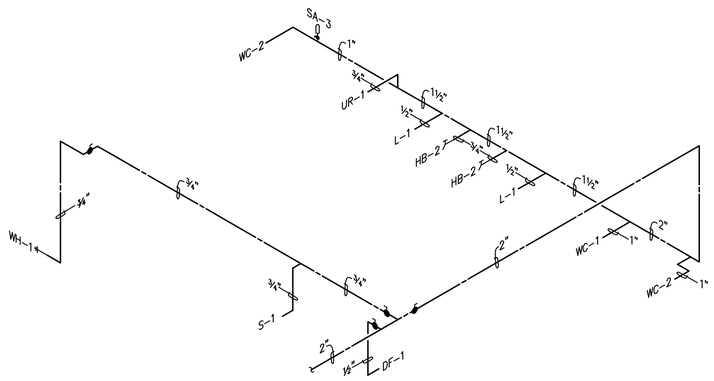
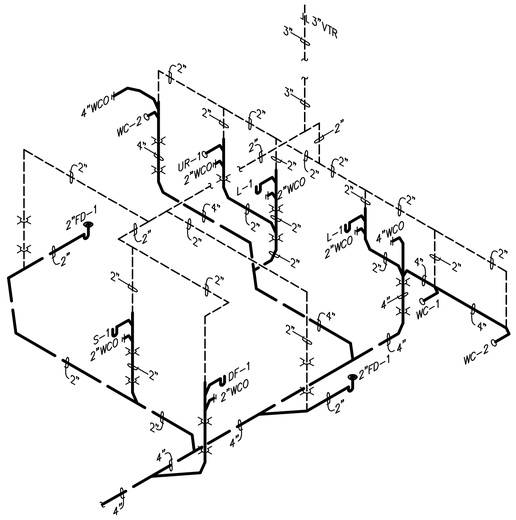


3 DOMESTIC WATER ISOMETRIC
NOT TO SCALE



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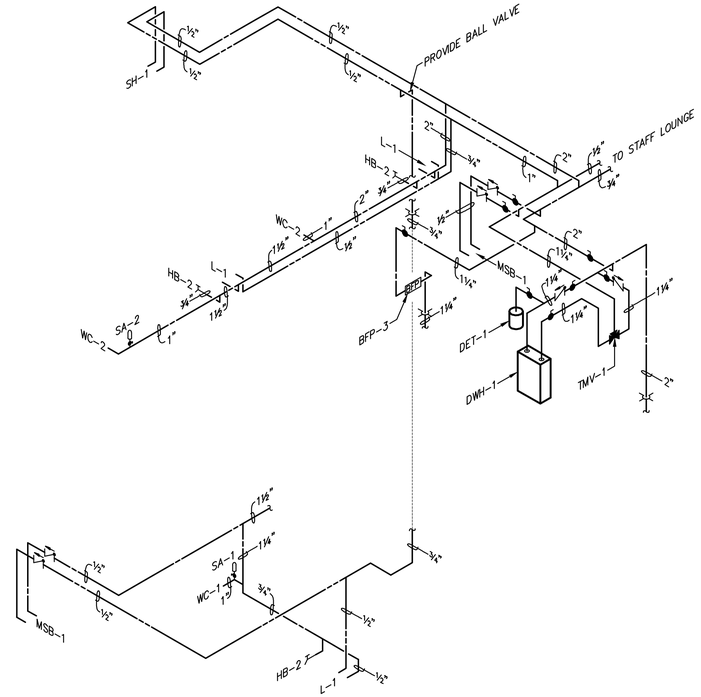
NOT TO SCALE



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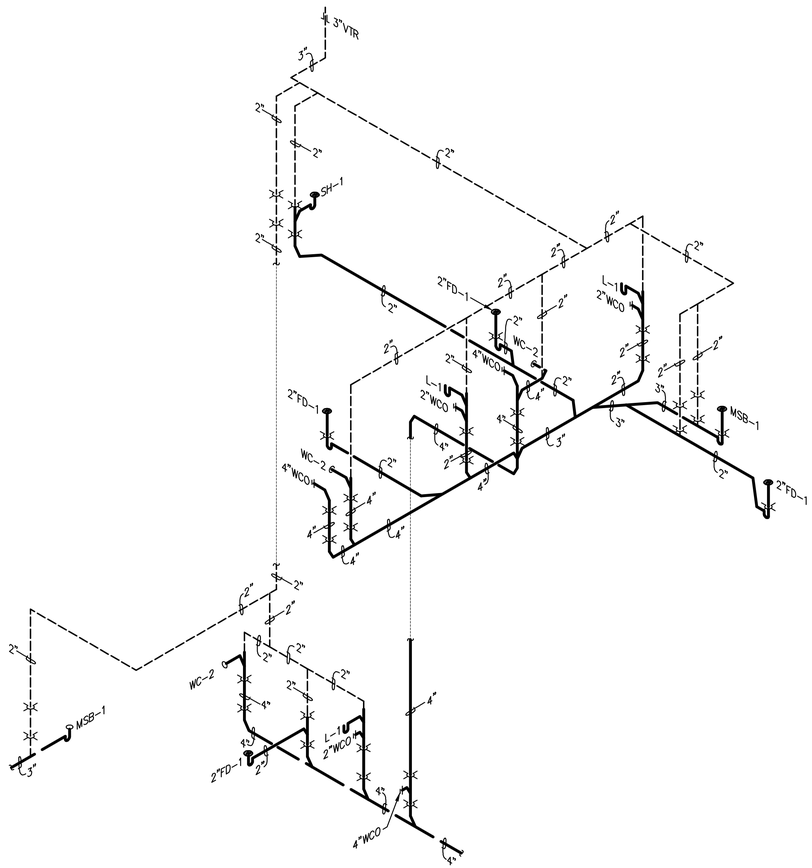

2 WASTE/VENT ISOMETRIC
NOT TO SCALE

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PLUMBING ISOMETRICS

P-301

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XREFS=(xx-tb) Layouts=(P-301 PLUMBING ISOMETRICS)
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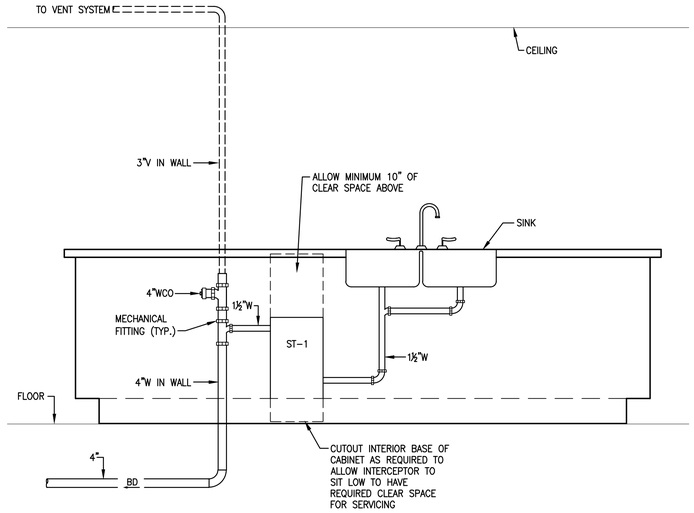

SEDIMENT INTERCEPTOR DETAIL

NOT TO SCALE

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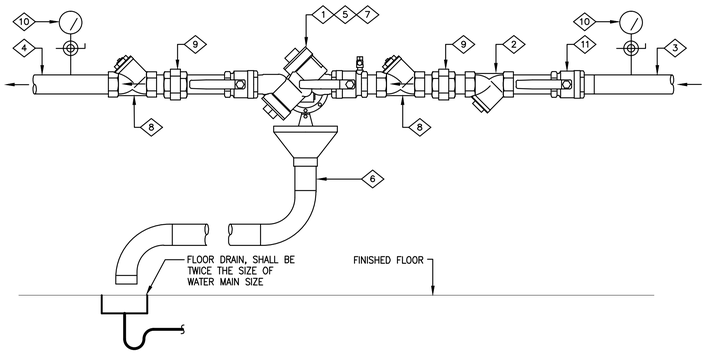
9/18/09



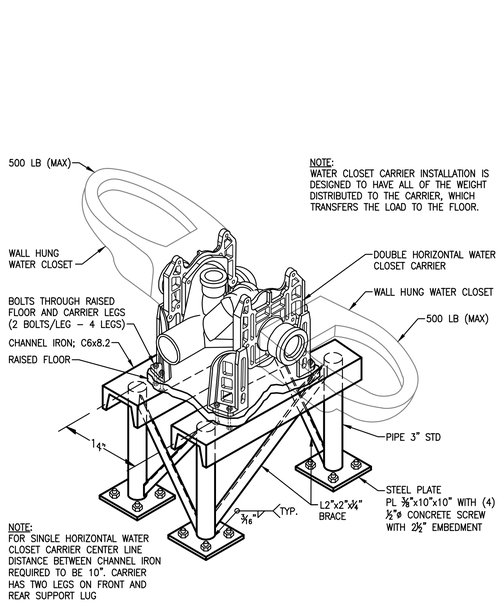
DOMESTIC WATER ENTRY INTERIOR INSTALLATION - REDUCED PRESSURE BACKFLOW PREVENTER DETAIL

NOT TO SCALE (2" AND SMALLER)

221116.34
11/24/09

WORK NOTES:

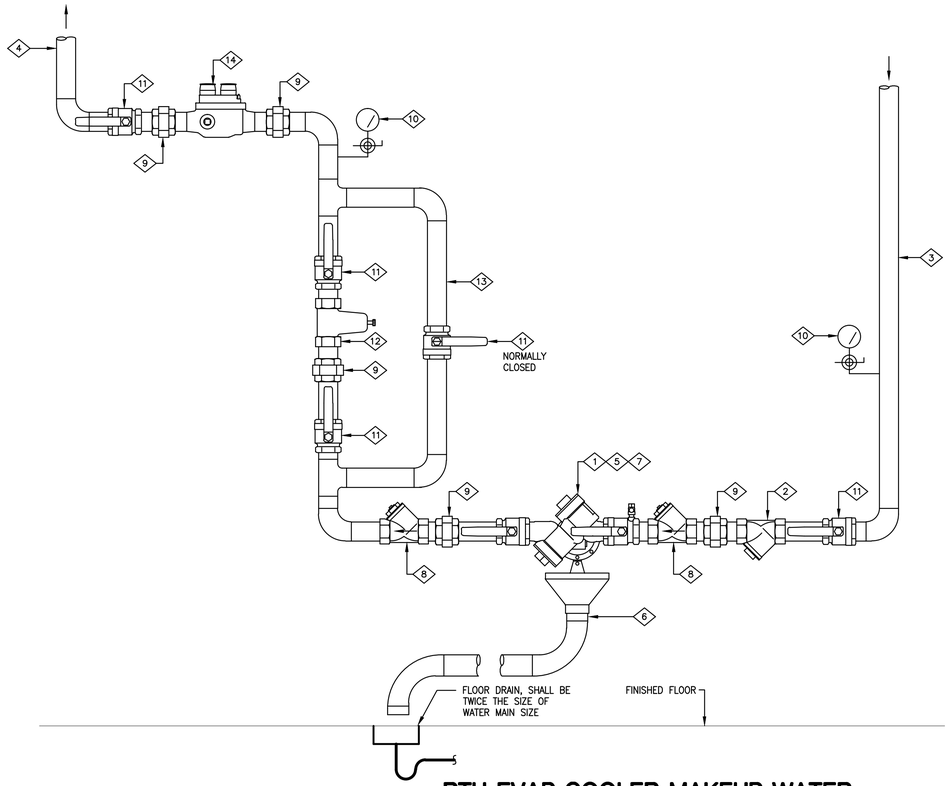
1. 2"BFP-1, REDUCED PRESSURE BACKFLOW PREVENTER ASSEMBLY, FEBCO MODEL 860. PROVIDE WITH FUNNEL AND DRAIN PIPING TO FLOOR DRAIN.
2. WYE STRAINER, FEBCO MODEL 650 WITH BLOW DOWN PLUGGED.
3. 2" DOMESTIC WATER MAIN FROM WATER METER.
4. 2"CW TO PRESSURE REDUCING VALVE STATION.
5. SUPPORT BFP FROM WALL OR FROM PIPE SUPPORTS.
6. FROM AIR GAP FITTING EXTEND INDIRECT DRAIN TO FLOOR DRAIN. INDIRECT DRAIN PIPING SIZE TO MATCH FUNNEL OUTLET. PIPING TO BE BE COPPER WITH SOLDER JOINTS. SUPPORT FROM FLOOR WITH UNISTRUT AND ANCHOR SECURELY TO AVOID MOVEMENT.
7. PROVIDE TESTING AND REPORT ON BACKFLOW PREVENTERS IN ACCORDANCE WITH THE COLORADO CROSS CONNECTION STANDARDS AND STATE PLUMBING CODE REQUIREMENTS.
8. SOFT SEAT BRASS CHECK VALVE.
9. UNION, TYP. LOCATE SO VALVES CAN BE REMOVED FROM PIPING.
10. PRESSURE GAUGE.
11. FULL PORT ISOLATION BALL VALVE (TYPICAL).



WALL MOUNTED WATER CLOSET CARRIER TO RAISED FLOOR DETAIL

NOT TO SCALE

NOTE: URINAL CARRIER TO BE SIMILAR



RTU EVAP COOLER MAKEUP WATER INTERIOR INSTALLATION - REDUCED PRESSURE BACKFLOW PREVENTER DETAIL

NOT TO SCALE (2" AND SMALLER)

221116.35
11/24/09

WORK NOTES:

1. 1¼"REDUCED PRESSURE BACKFLOW PREVENTER ASSEMBLY, FEBCO MODEL 860. PROVIDE WITH FUNNEL AND DRAIN PIPING TO FLOOR DRAIN.
2. WYE STRAINER, FEBCO MODEL 650 WITH BLOW DOWN PLUGGED.
3. 1¼"DOMESTIC WATER FROM BUILDING MAIN.
4. 1¼"NP WATER TO EVAP COOLER.
5. SUPPORT BFP FROM WALL OR FROM PIPE SUPPORTS.
6. FROM AIR GAP FITTING EXTEND INDIRECT DRAIN TO FLOOR DRAIN. INDIRECT DRAIN PIPING SIZE TO MATCH FUNNEL OUTLET. PIPING TO BE BE COPPER WITH SOLDER JOINTS. SUPPORT FROM FLOOR WITH UNISTRUT AND ANCHOR SECURELY TO AVOID MOVEMENT.
7. PROVIDE TESTING AND REPORT ON BACKFLOW PREVENTERS IN ACCORDANCE WITH THE COLORADO CROSS CONNECTION STANDARDS AND STATE PLUMBING CODE REQUIREMENTS.
8. SOFT SEAT BRASS CHECK VALVE.
9. UNION, TYP. LOCATE SO VALVES CAN BE REMOVED FROM PIPING.
10. PRESSURE GAUGE.
11. FULL PORT ISOLATION BALL VALVE (TYPICAL).
12. WATTS 223 PRESSURE REGULATING VALVE. SET OUTLET PRESSURE AT 30 PSI. VERIFY PRESSURE REQUIREMENT WITH SELECTED EQUIPMENT.
13. FULL SIZE BYPASS WITH BALL VALVE (NORMALLY CLOSED).
14. WATER METER. RE: SPECIFICATION FOR METER INFORMATION. PROVIDE DRY CONTACTS FOR CONNECTION TO BAS.

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ISSUE DATE
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RAUL BISCHOFF
28801
1/5/12

PLUMBING DETAILS

P-302

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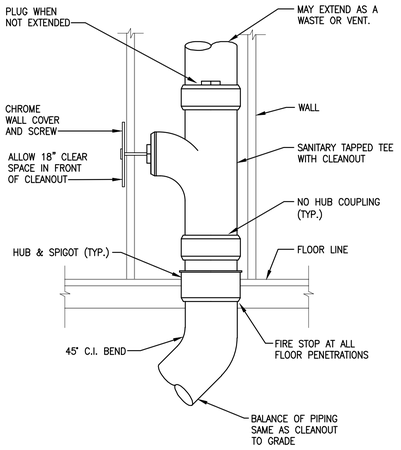
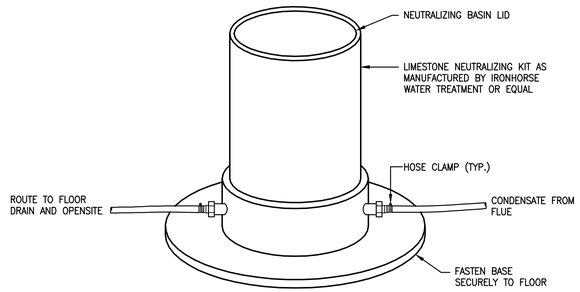


WALL CLEANOUT (WCO) DETAIL

NOT TO SCALE

221319.13
10/5/09

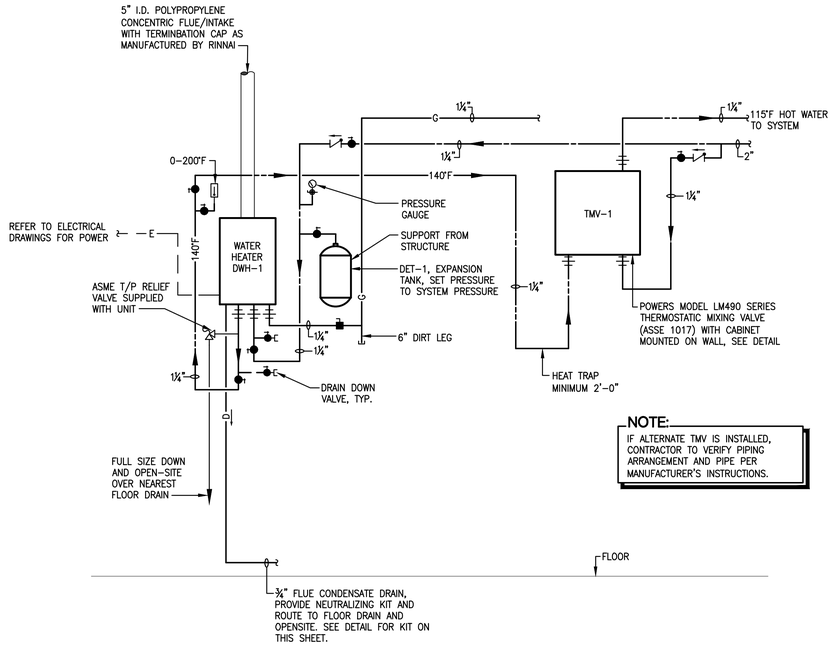


GENERAL NOTES:

1. TEST DOWNSTREAM OF NEUTRALIZING KIT AND IF NECESSARY, ADD ADDITIONAL KITS UNTIL DESIRED RESULTS ARE MET.
2. PROVIDE PRE-MANUFACTURED UNIT AS MANUFACTURED BY AXIOM INDUSTRIES.

LIMESTONE NEUTRALIZING KIT FOR BOILER CONDENSATE DRAIN

NOT TO SCALE



INSTANTANEOUS WATER HEATER PIPING DETAIL

NOT TO SCALE

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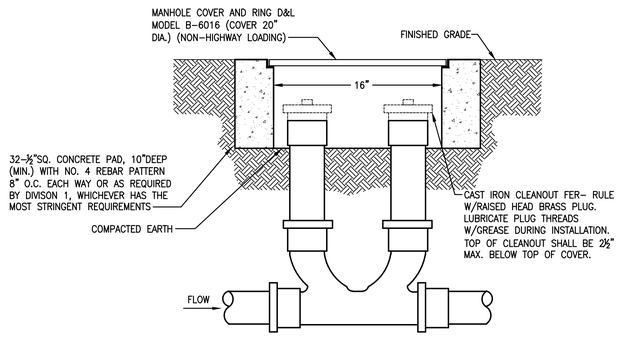
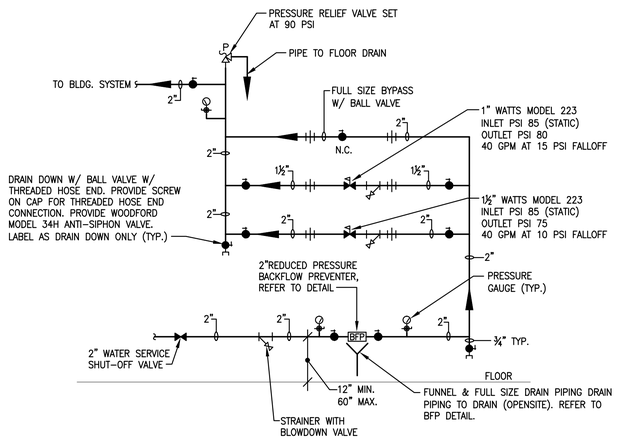
7/20/09



TWO-WAY GRADE CLEANOUT (GCO)

NOT TO SCALE

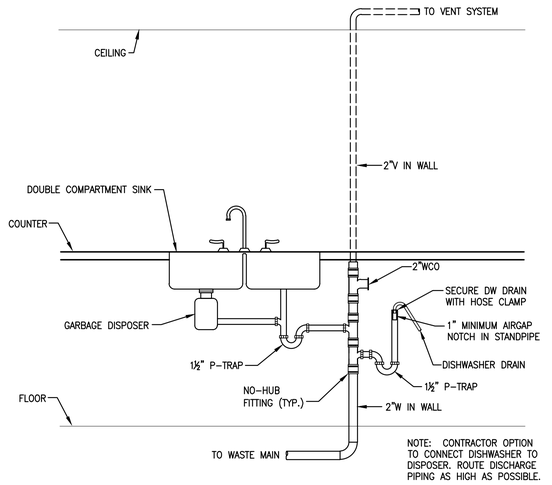
221319.11
10/5/09



WATER PRESSURE REDUCING STATION ASSEMBLY

NOT TO SCALE

221116.10
10/7/09



DISHWASHER AIR GAP DETAIL

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sDC PROJECT NO: 1020.00
CCOD PROJECT NO: CIE 02089

ISSUE DATE 01-12-2012
PHASE 100% CD

PLUMBING DETAILS

P-303

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PROJECT NARRATIVE

FIRE PROTECTION

WET-PIPE FIRE SPRINKLER SYSTEM WILL BE PROVIDED FOR THE ENTIRE BUILDING. A NEW DOUBLE-CHECK BACKFLOW PREVENTER WILL BE PROVIDED AT THE FIRE ENTRY INSIDE THE MECHANICAL/ELECTRICAL ROOM.

LIFE SAFETY LEGEND

ALL SYMBOLS IN LEGEND MAY NOT NECESSARILY BE USED ON THIS PROJECT

FIRE PROTECTION VALVES and FITTINGS

- ELBOW UP
- ELBOW DOWN
- TEE UP
- TEE DOWN
- RISE OR DROP
- BRANCH-TOP CONNECTION
- BRANCH-BOTTOM CONNECTION
- GATE VALVE IN VERTICAL WITH TAMPER SWITCH
- PIPE CAP OR PLUG
- UNION
- EXPANSION JOINT
- PIPE ANCHOR
- PIPE GUIDE
- PIPE HANGER
- FLEXIBLE CONNECTION
- STRAINER
- STRAINER W/BLOWOFF VALVE
- BALL VALVE
- VENTURI
- SOLENOID VALVE
- PRESSURE REDUCING VALVE
- CHECK VALVE
- GLOBE VALVE
- TEMPERATURE/PRESSURE RELIEF VALVE
- MANUAL AIR VENT
- PRESSURE GAUGE WITH GUAGE COCK
- HOSE END BALL VALVE WITH VACUUM BREAKER
- BACKFLOW PREVENTER
- REDUCED PRESSURE BACKFLOW PREVENTER
- FIRE HOSE VALVE CABINET (SURFACE MOUNTED)
- FIRE HOSE VALVE CABINET (RECESSED)
- POST INDICATOR VALVE
- NON-INDICATING VALVE (NON-RISING STEM)
- FIRE DEPARTMENT CONNECTION
- FREE STANDING FIRE DEPARTMENT CONNECTION
- WATER FLOW SWITCH
- PRESSURE SWITCH
- CHECK VALVE
- DRY PIPE VALVE
- DELUGE VALVE
- ANGLE VALVE
- MAIN DRAIN ASSEMBLY
- BUTTERFLY VALVE W/TAMPER SWITCH
- TAMPER SWITCH
- FIRE HOSE RACK

FIRE ALARM

- FIRE ALARM PULL STATION
- SPEAKER/HORN
- SPEAKER/HORN/STROBE
- MINI HORN
- CARBON MONOXIDE DETECTOR WITH AUDIBLE ALARM
- CARBON MONOXIDE DETECTOR
- SPEAKER
- SPEAKER/HORN
- BELL
- STROBE
- FIRE ALARM PHONE
- DUCT DETECTOR
- HEAT DETECTOR
  - R/F – COMBINATION: RATE OF RISE AND FIXED TERMPERATURE
  - R/C – RATE COMPENSATION
  - F – FIXED TEMPERATURE
  - R – RATE OF RISE ONLY
- FLAME DETECTOR
  - F – FLAME
  - UV – ULTRA VIOLET
  - IR – INFRAED
  - VR – VISIBLE RADIATION
- SMOKE DETECTOR
  - P – PHOTOELECTRIC
  - I – IONIZED
  - BT – BEAM TRANSMITTER
  - BR – BEAM RECIEVER
  - ASD – AIR SAMPLING
- MONITOR MODULE
- CONTROL MODULE
- RELEASE MODULE
- FARP – FIRE ALARM RELEASE PANEL
- FSCP – FIRE SYSTEM CONTROL PANEL
- FAA – FIRE ALARM ANNUNCIATOR
- FAP – FIRE ALARM PANEL
- FACP – FIRE ALARM CONTROL PANEL
- FFCP – FIRE FIGHTER CONTROL PANEL
- ABORT SWITCH
- MAGNETIC DOOR HOLDER
- FIRE SMOKE DAMPER

FIRE SPRINKLERS

- UPRIGHT SPRINKLER
- DRY/UPRIGHT SPRINKLER
- DRY/PENDANT SPRINKLER
- PENDANT SPRINKLER C – CONCEALED
- SPRINKLER WITH GUARD
- DRY SPRINKLER WITH GUARD
- SIDEWALL SPRINKLER
- DRY SIDEWALL SPRINKLER
- OUTSIDE SPRINKLER
- DRY/OUTSIDE SPRINKLER
- WATER SPRAY NOZZLE
- WINDOW SPRINKLER

LINE DESIGNATION

- FDC – FIRE DEPT. CONNECTION
- AS – AUTOMATIC SPRINKLER
- DAS – DRY/AUTOMATIC SPRINKLER
- PA – PREACTION AUTOMATIC SPRINKLER
- SP – STANDPIPE
- DSP – DRY/STANDPIPE
- F – FIREMAIN
- SP/AS – COMBINATION STANDPIPE/ AUTOMATIC SPRINKLER
- CA – CLEAN AGENT
- WM – WATERMIST
- D – DELUGE AUTOMATIC SPRINKLER

MISCELLANEOUS

- DIRECTION OF VIEW
- PICTURE DESIGNATION
- SECTION DESIGNATION
- DRAWN ON THIS SHEET
- FIRE STANDPIPE DESIGNATION
- FIRE SPRINKLER RISER DESIGNATION
- LIGHT LINE WEIGHT FOR EQUIPMENT, PIPING, SYMBOLS, TEXT, ETC. INDICATES EXISTING CONDITIONS WITH NEW WORK SHOWN AS DARK
- SCREENING INDICATES EXISTING TO BE REMOVED
- EXISTING TO BE REMOVED
- POINT OF CONNECTION NEW TO EXISTING

ABBREVIATIONS

AFF	ABOVE FINISHED FLOOR
AP	ACCESS PANEL
C	COMMON
CI	CAST IRON
℄ EL.	CENTER LINE ELEVATION
DIA, D	DIAMETER
I.E.	INVERT ELEVATION
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
TYP	TYPICAL
VCP	VITRIFIED CLAY PIPE
VTR	VENT THROUGH ROOF
(N)	NEW
(E)	EXISTING
(R)	RELOCATED

EQUIPMENT ABBREVIATIONS

AB	AIR BLENDER
AC	AIR COMPRESSOR
ACCU	AIR COOLED CONDENSING UNIT
AK	AIR CURTAIN
AHU	AIR HANDLING UNIT
BFP	BACKFLOW PREVENTER
B	BOILER
CH	CHILLER
CWC	COIL – COOLING
DHC	COIL – DUCT HEATING
HRC	COIL – HEAT RECOVERY
HWC	COIL – HEATING
PHC	COIL – PRE-HEAT
RPBFP	REDUCED PRESSURE BACKFLOW PREVENTER
RV	RELIEF VALVE
RH	ROOF HOOD
CRAC	COMPUTER ROOM PACKAGED AIR CONDITIONING UNIT
CT	COOLING TOWER
DWH	DOMESTIC WATER HEATER
EDHC	ELECTRIC DUCT HEATER
EV-CV	EXHAUST VALVE – CONSTANT VOLUME
EV-VV	EXHAUST VALVE – VARIABLE VOLUME
ET	EXPANSION TANK
EF	FAN – EXHAUST
RAF	FAN – RETURN AIR
REF	FAN – RETURN EXHAUST
SAF	FAN – SUPPLY
FCU	FAN COIL UNIT
ESF	FILTER – ELECTROSTATIC
FF	FILTER – FINAL
RTU	ROOFTOP UNIT
SAU	SOUND ATTENTUATOR
HF	FILTER – HEPA
IF	FILTER – INTERMEDIATE
PF	FILTER – PRE
FS	FIRE/SMOKE DAMPER
FURN	FURNACE
HP	HEAT PUMP
IRH	INFARED HEATER
L	LOUVER
MAU	MAKE-UP AIR UNIT
PRV	PRESSURE REDUCING VALVE
FP	PUMP – FIRE
TB	TERMINAL BOX
UH	UNIT HEATER – HOT WATER
FVAV	VARIABLE AIR VOLUME BOX – FAN POWERED
HVAV	VARIABLE AIR VOLUME BOX – FAN POWERED W/ HEATING

FIRE PROTECTION GENERAL NOTES:

1. THE SUCCESSFUL CONTRACTOR WILL BE THE ENGINEER OF RECORD FOR THE DESIGN OF THE FIRE PROTECTION SYSTEM. THE DESIGN AND ENGINEERING OF THE FIRE PROTECTION SYSTEM SHALL BE BY THE FIRE PROTECTION CONTRACTOR. IT IS THE CONTRACTOR'S RESPONSIBILITY THAT THE SYSTEM MEET ALL THE REQUIREMENTS OF NFPA AND THE AUTHORITY HAVING JURISDICTION.
2. FURNISH ALL LABOR, MATERIALS, EQUIPMENT AND SERVICES NECESSARY FOR THE INSTALLATION OF A COMPLETE AND PROPERLY FUNCTIONING FIRE PROTECTION SYSTEM.
3. THE INFORMATION PRESENTED ON THESE DRAWINGS IS DIAGRAMMATIC. IT DOES NOT NECESSARILY REPRESENT ALL ELBOWS, OFFSETS, HANGERS, ETC. REQUIRED FOR A COMPLETE WORKING SYSTEM.
4. ALL FIRE PROTECTION SYSTEMS INSTALLED SHALL BE IN ACCORDANCE WITH NFPA 13 ETC. AND DENVER BUILDING CODES AND ORDINANCES.
5. FIRE PROTECTION CONTRACTOR SHALL COORDINATE THE LOCATION OF ALL NEW FIRE PROTECTION EQUIPMENT AND PIPING WITH ALL OTHER TRADES PRIOR TO SUBMITTAL OF SHOP DRAWINGS AND SYSTEM INSTALLATION, SO AS NOT TO INTERFERE WITH THE ROUTING OF NEW DUCTWORK, PLUMBING, PIPING, ETC. REFER TO SPECIFICATION DIVISION 230000 FOR CEILING CAVITY SPACE ALLOCATION PRIORITY.
6. SEAL ALL PENETRATIONS THROUGH RATED WALLS, CEILINGS AND FLOORS WITH UL LISTED FIRE PROOF MATERIALS AS REQUIRED TO MAINTAIN THE INTEGRITY OF THE RATING.
7. PROVIDE ALL FITTINGS, RISER NIPPLES, ARM-OVERS, HANGERS, ETC. TO MAINTAIN CONFORMANCE WITH APPLICABLE STANDARDS AND TO POSITION THE SPRINKLER HEADS IN THE PROPER LOCATIONS.
8. FIRE SUPPRESSION SYSTEM TO BE HYDRAULICALLY CALCULATED BASED ON NFPA 13 REQUIREMENTS. SPRINKLERS SHALL BE SPACED PER NFPA 13 REGARDING OBSTRUCTIONS, BEAM POCKETS, HVAC DUCTWORK, PENETRATIONS AND ANY OTHER CLEARANCE RELATED ITEMS. CONTRACTOR SHALL VERIFY ALL SPACING AND OBSTRUCTIONS BEFORE INSTALLATION.
9. PROVIDE FIELD COORDINATION OF PIPING AND SPRINKLER HEAD INSTALLATIONS WITH DUCTWORK, LIGHTS, SMOKE DETECTORS, DIFFUSERS, ETC..
10. THE FIRE PROTECTION CONTRACTOR/ENGINEER OF RECORD SHALL SECURE THE SITE FLOW TEST INFORMATION AND DOCUMENTATION FROM THE LOCAL WATER DEPARTMENT PRIOR TO THE DESIGN OF THE FIRE PROTECTION SYSTEM.
11. INSTALL SPRINKLER IN THE CENTER OF CEILING TILES, WHERE APPLICABLE.
12. PROVIDE TAMPER VALVES AND FLOW SWITCHES FOR EACH FIRE ZONE. VERIFY/COORDINATE WITH FIRE ALARM CONTRACTOR FOR WIRING.
13. PROVIDE SPRINKLER PROTECTION A BOTTOM OF ELEVATOR SHAFT PER NFPA 13 AND DENVER AMENDMENTS.
14. FIRE SPRINKLER SHOP DRAWINGS TO LOCATE AND DESCRIBE GUIDES, ANCHORS AND HANGARS FOR ALL PIPING. FIRE SPRINKLER SHOP DRAWINGS TO PROVIDE PROTECTION FOR UNDERNEATH DUCTWORK AND OTHER OBSTRUCTIONS AS NEEDED.
15. PROVIDE DIMENSIONALLY LOCATED PIPE MAINS AND BRANCH LINES TO FACILITIES STRUCTURE SUCH AS COLUMN LINES, WALLS, RECOGNIZED BENCH MARKS, ETC.

BCER CONTACT LIST

010.06
1/12/12

303-422-7400 FAX 303-422-7900

PROJECT ENGINEER	WENDY MERCHANT	EXT 244	wmerchant@bcer.com
PROJECT MANAGER	PAUL MISKOWICZ	EXT 275	pmiskowicz@bcer.com

MINIMUM FIRE SPRINKLER COVERAGE REQUIREMENTS:

1. LIGHT HAZARD OCCUPANCIES – 0.10 GPM/S.F. OVER A REMOTE AREA OF 1500 SQUARE FEET.
   A. OFFICE, EDUCATIONAL, RESTROOMS, LIBRARIES.
2. ORDINARY HAZARD OCCUPANCIES – GROUP 1 – 0.15 GPM/S.F. OVER A REMOTE AREA OF 1500 SQUARE FEET.
   B. MECHANICAL AND STORAGE AREAS.

PRELIMINARY DESIGN INFORMATION
CITY WATER FLOW TEST INFORMATION

INFORMATION PROVIDED BY:	DENVER WATER
MODEL FLOW TEST:	APM2007MD SS
LOCATION:	14TH & IRVING
HYDRANT NO.	2720
DATE:	07/23/2007
STATIC PRESSURE:	79 PSI
RESIDUAL PRESSURE:	69
FLOW RATE (GPM):	1500

FIRE PROTECTION DRAWING LIST

Sheet Number	Sheet Title
FP-000	FIRE PROTECTION LEGEND AND GENERAL INFORMATION
FP-001	FIRE PROTECTION SCHEDULES AND DETAILS
FP-101	LEVEL 1 FIRE PROTECTION PLAN
FP-102	LEVEL 2 FIRE PROTECTION PLAN

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COLORADO REGISTERED PROFESSIONAL ENGINEER PAUL B. MISKOWICZ 28801 1/3/12

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COOD PROJECT NO: CE 02089

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FIRE PROTECTION LEGEND AND GENERAL INFORMATION

FP-000

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GENERAL NOTES:

1. FIRE DEPARTMENT CONNECTION (FDC-1) AND FIRE ENTRY LOCATION/CONFIGURATION SHOWN ON SHEET FP-101.

BACKFLOW PREVENTER ASSEMBLY SCHEDULE

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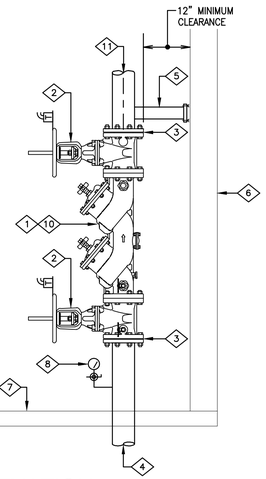
PLAN CODE	TYPE	SYSTEM	MFR.	MODEL	INSTALLED MFR.	INSTALLED MODEL	QUANTITY	LINE SIZE (INCHES)	PRESS. DROP (PSIG)	REMARKS
BFP-2	DOUBLE CHECK	FIRE MAIN	FEBCO	850			1	6	(8)	(2)(4)(7)

(1) COMPLETE ASSEMBLY WITH VALVES, FULL LINE SIZE.
(2) COMPLETE ASSEMBLY WITH UL/FM LISTED OS&Y VALVES.
(3) NOT USED.
(4) PROVIDE TESTING AND CERTIFICATION IN ACCORDANCE WITH COLORADO REQUIREMENTS & DENVER WATER.
(5) PROVIDE WITH BALL VALVE AND UNION.
(6) PROVIDE FUNNEL WITH FULL SIZE DRAIN TO FLOOR DRAIN OR TO EXTERIOR OF BUILDING. OPTION TO PROVIDE SHUT DOWN DEVICE. (OBTAIN APPROVAL BY CODE AUTHORITY)
(7) REFER ALSO TO DETAIL.
(8) PROVIDE DURING SHOP DRAWINGS FOR ACTUAL CALCULATED FLOW RATE.



ELEVATION
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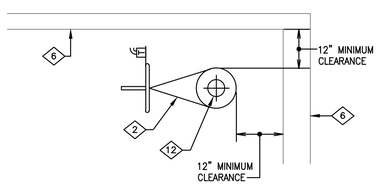

PLAN
NOT TO SCALE

WORK NOTES: (FOR VERTICAL DOUBLE CHECK DETAIL)

1. 6"BFP-2 "IN LINE" DOUBLE CHECK BACK FLOW PREVENTER, "FEBCO" MODEL NO. 850.
2. OS&Y GATE VALVE WITH TAMPER SWITCHES ON EACH VALVE.
3. FLANGE ADAPTER, "VICTAULIC" STYLE 741.
4. FIRE PROTECTION SUPPLY FROM MAIN; RE: DETAIL.
5. CONTRACTOR TO PROVIDE ADEQUATE SUPPORT AND BRACING FOR NEW DOUBLE CHECK BACK FLOW PREVENTER. SUPPORT WITH UNISTRUT FROM STRUCTURE.
6. BUILDING WALL.
7. FINISHED FLOOR.
8. PRESSURE GAUGE.
9. INSTALL PER MANUFACTURERS RECOMMENDATIONS.
10. PROVIDE TESTING AND REPORT IN ACCORDANCE WITH DENVER WATER AND COLORADO CROSS CONNECTION STANDARDS.
11. FIRE PROTECTION SUPPLY TO SYSTEM.

VERTICAL INSTALLATION - DOUBLE CHECK FOR INTERIOR FIRE SERVICE DETAIL
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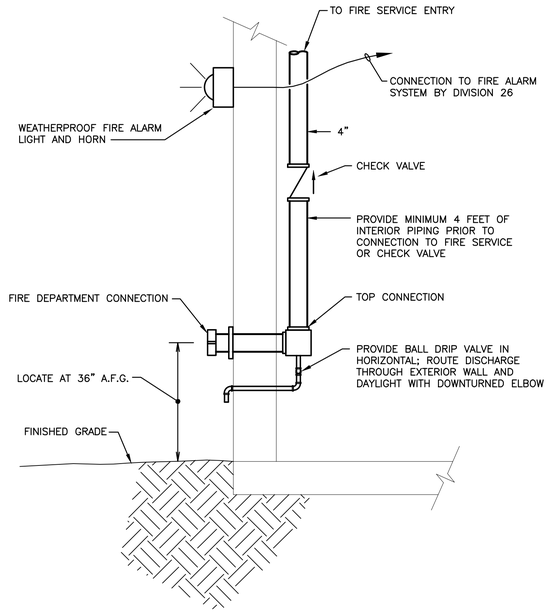

FIRE DEPARTMENT CONNECTION DETAIL
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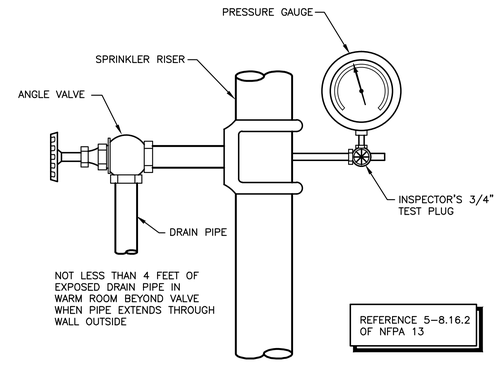

SYSTEM OR MAIN DRAIN CONNECTION
NOT TO SCALE
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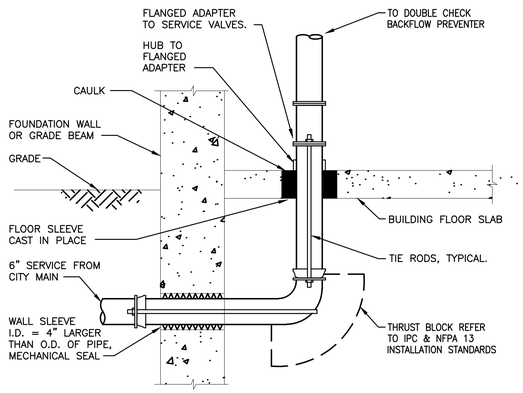
06/03/04

WORK NOTES:

1. PROVISIONS SHALL BE MADE TO PROPERLY DRAIN ALL PARTS OF THE SYSTEM.
2. DRAIN CONNECTIONS FOR SYSTEMS SUPPLY RISERS AND MAINS SHALL BE SIZED AS SHOWN IN TABLE.

DRAIN SIZE TABLE	
RISER OR MAIN SIZE	MINIMUM REQUIRED DRAIN SIZE
UP TO 2"	3/4" OR LARGER
2-1/2", 3" 3-1/2"	1-1/2" OR LARGER
4" OR LARGER	2" ONLY



FIRE MAIN ENTRY THROUGH FOUNDATION DETAIL
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FIRE PROTECTION SCHEDULES AND DETAILS

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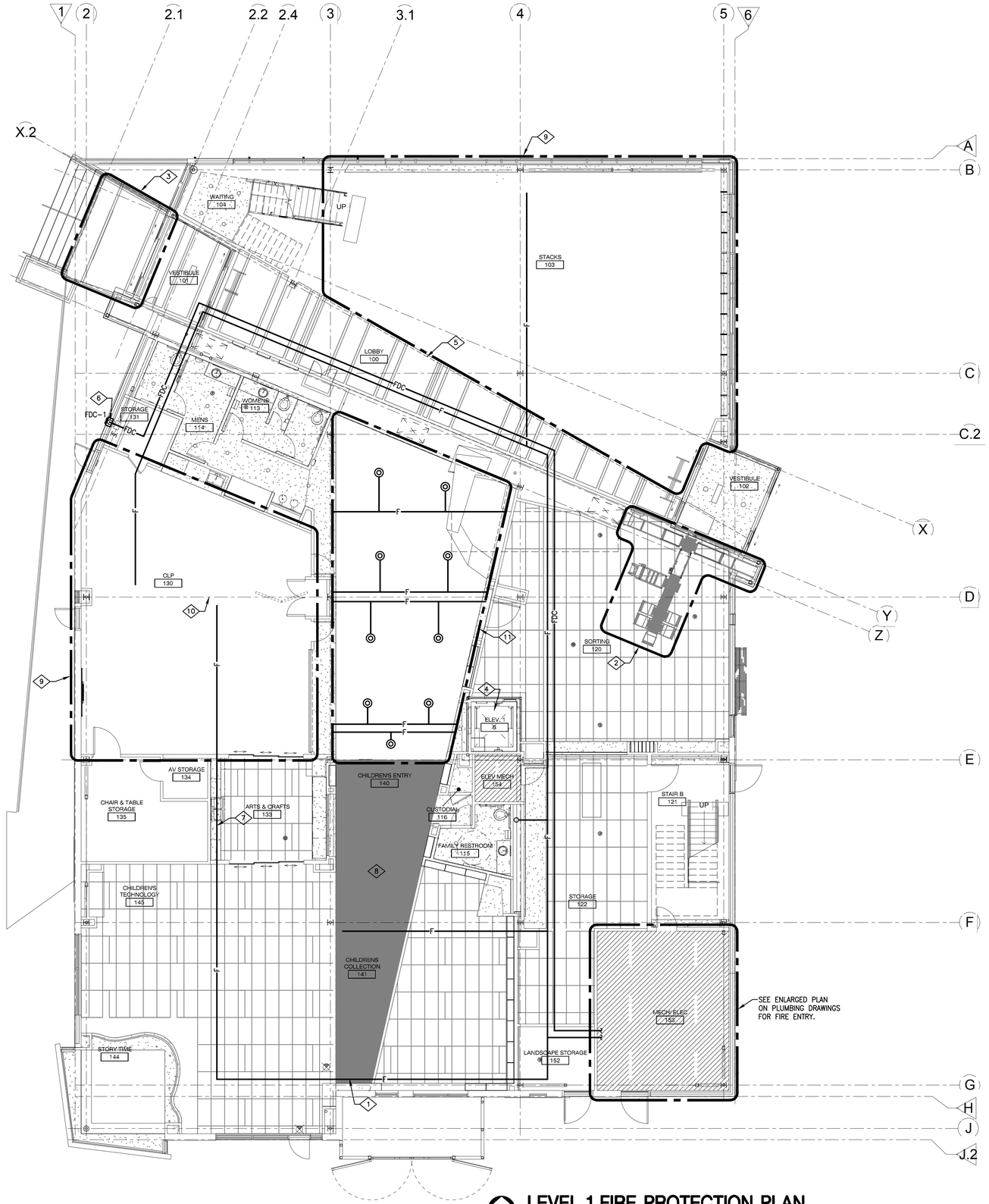
XREFS=(xx-tb) Layouts=(FP-001 FIRE PROTECTION SCHEDULES AND DETAILS)
DIMSCALE=1 F:\438100006\Dwg\West Denver Branch Library\Sheets\Fire Protection\FP-001 FIRE PROTECTION SCHEDULES AND DETAILS.dwg JAN 12, 2012 2:54PM JGT



LEVEL 1 FIRE PROTECTION PLAN

SCALE: 1/8" = 1'-0"

4' 2' 0 4' 8' 16'

GENERAL NOTES:

1. ROUTE MAIN FIRE SPRINKLER PIPING AS SHOWN.
2. PAINT EXPOSED PIPING; COLOR SELECTION BY ARCHITECT.
3. WET SPRINKLER PIPE SHALL NOT BE ROUTED OVER TOP OF ELEC/COMM/IT ROOMS PER CODE.
4. SPRINKLERS SHALL BE CENTERED ON CEILING TILES WHERE DROPPED TILE CEILINGS OCCUR PER SPECIFICATIONS.
5. COORDINATE LOCATION OF EXPOSED SPRINKLER PIPE AND HEADS AT EXPOSED CEILINGS WITH ARCHITECTURAL REFLECTED CEILING PLANS. ALIGN EXPOSED PIPING WITH OTHER PIPING SYSTEMS. COORDINATE WITH ARCHITECT ON ALL AREAS.
6. PROVIDE SPRINKLER HEAD TYPES AS FOLLOWS:
   A. CONCEALED TYPE HEADS IN ALL AREAS WITH A FINISHED CEILING.
   B. UPRIGHT PENDANT AND SIDEWALL IN ALL AREAS WITHOUT A DROPPED CEILING.
7. REFER TO SPECIFICATIONS FOR SPRINKLER HEAD FINISHES.
8. COORDINATE WORK WITH ALL TRADES. REFER TO ARCHITECTURAL DRAWINGS FOR ADDITIONAL REQUIREMENTS INCLUDING SPRINKLER HEAD LOCATIONS.
9. REFER TO ARCHITECTURAL DRAWINGS FOR ADDITIONAL SPRINKLER HEAD PLACEMENT GUIDELINES.
10. CONTRACTOR TO CLOSELY COORDINATE FIRE SPRINKLER PIPING WITH STORM PIPING IN SORTING 120 AND STORAGE 122.

WORK NOTES:

1. ROUTE FIRE SPRINKLER MAIN INSIDE SOFFIT CROSSING CHILDRENS COLLECTION.
2. ROUTE FIRE SPRINKLER PIPING/HEADS AROUND AUTOMATIC SORTING MACHINE WHEN POSSIBLE.
3. PROVIDE DRY SIDEWALL SPRINKLERS TO PROTECT OVERHANG.
4. PROVIDE SPRINKLER HEAD AT BOTTOM OF ELEVATOR SHAFT.
5. PROVIDE SPRINKLER HEADS ABOVE AND BELOW SUSPENDED ACRYLIC CEILING.
6. PROVIDE PIPING DOWN TO FDC-1 TIGHT TO WALL; PROVIDE TOP-INLET TYPE FIRE DEPARTMENT CONNECTION.
7. ROUTE FIRE MAIN ABOVE CABINETS.
8. PROVIDE EXTENDED COVERAGE SIDEWALL HEADS FOR AREA SHADED AT SOUTH END OF THE "CANYON".
9. RUN FIRE SPRINKLER BRANCH PIPING TIGHT TO CEILING AND ABOVE LIGHTS IN THIS AREA.
10. DO NOT CROSS FIRE SPRINKLER MAIN UNDER BEAM IN THIS SPACE.
11. IN THE NORTH PORTION OF THE "CANYON", ROUTE SPRINKLER PIPING MAINS TIGHT TO SIDE OF BEAMS WITH BRANCH PIPING TO HEADS BETWEEN BEAMS. INTENT OF LAYOUT SHOWN ON PLANS; EXACT HEAD LAYOUT BY CONTRACTOR.

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201 W. Colfax Ave.
DENVER, COLROADO 80202

CIVIL ENGINEER
SAN ENGINEERING
6099 Windermere St.
LITTLETON, COLORADO 80120
P. 303.953.9014
F. 303.953.9016
www.sanengineeringllc.com

LANDSCAPE ARCHITECT
MUNDUS BISHOP
333 West Colfax Ave. #350
Denver, Colorado 80204
P. 303.865.5500
F. 303.865.5504
www.mundusbishop.com

STRUCTURAL ENGINEER
STUDIO NYL
2995 Baseline Road, Suite 314
Boulder, Colorado 80303
P. 303.558.3145
F. 303.440.8536
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BCER ENGINEERING
5420 Ward Road, Suite 200
Arvada, Colorado 80002-1838
P. 303.422.7400
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AV-IT-SECURITY
TECHNOLOGY PLUS
2323 S. Troy Street
Aurora, Colorado 80014
P. 303.340.8228
F. 303.340.8233
www.technologyplus.com

ACOUSTICS
K2 AUDIO
4900 Pearl East Circle, Suite 201E
Boulder, Colorado 80301
P. 303.865.5500
F. 303.865.5504
www.k2audio.com

SUSTAINABILITY
AMBIENT ENERGY
130 W. 5th Ave.
Denver, Colorado 80204
P. 303.278.1532
F. 303.278.8533
www.ambient-e.com

PROJECT: WEST DENVER BRANCH LIBRARY
1498 NORTH IRVING STREET
DENVER, COLORADO 80204

COLORADO REGISTERED ARCHITECT MICHAEL B. NISKOWICZ 28801 1/12/12

sDC PROJECT NO: 1020.00
COOD PROJECT NO: CE 02089

ISSUE DATE 01-12-2012
PHASE 100% CD

LEVEL 1 FIRE PROTECTION PLAN

FP-101

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XREFS=(xx-tb, xx-lvl 1, xc-lvl 1 - Fire Protection, xx-lvl 1-rcp) Layouts=(FP-101 LEVEL 1 FIRE PROTECTION PLAN)
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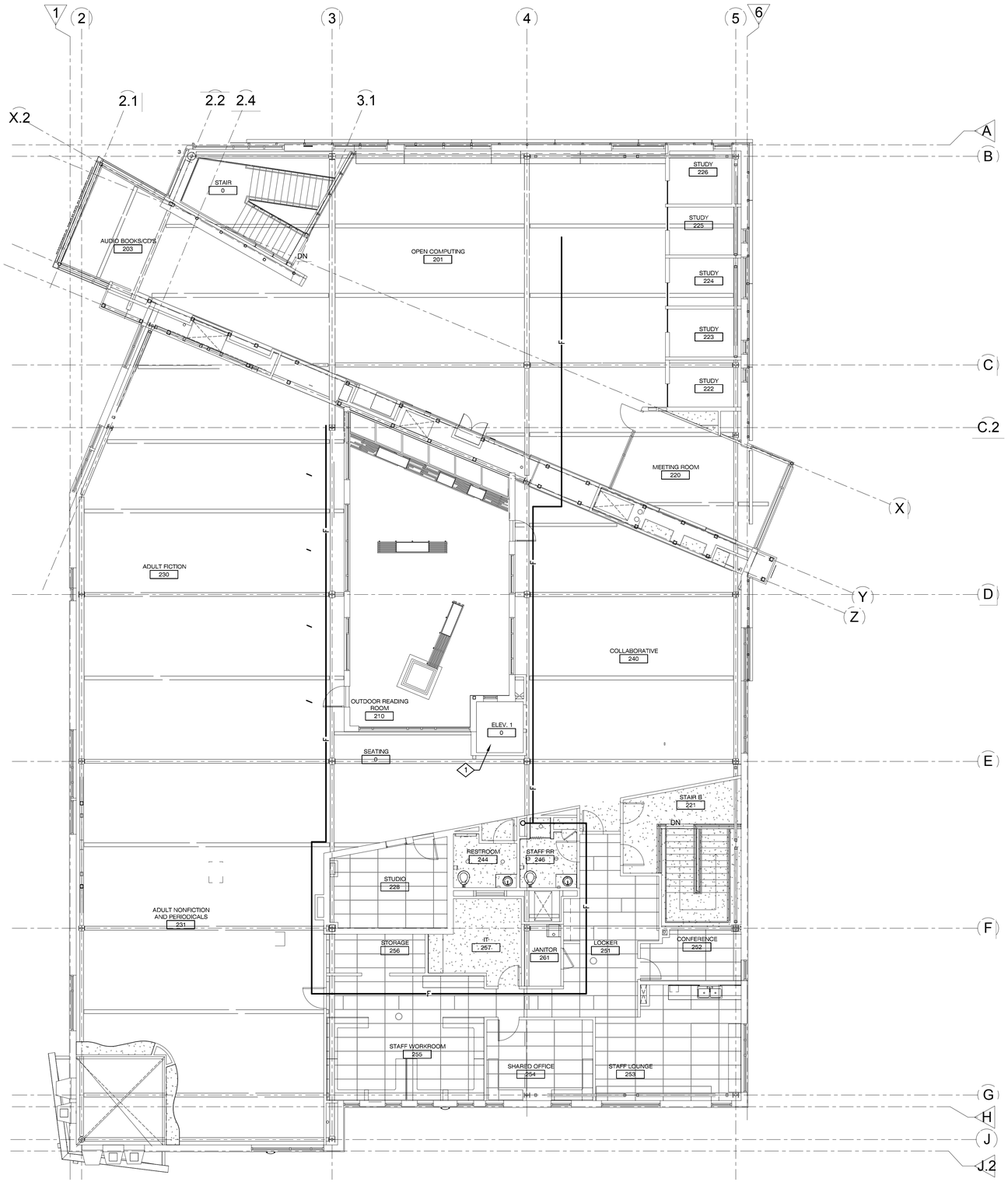

LEVEL 2 FIRE PROTECTION PLAN

SCALE: 1/8" = 1'-0"

4' 2' 0 4' 8' 16'

GENERAL NOTES:

1. ROUTE MAIN FIRE SPRINKLER PIPING AS SHOWN.
2. PAINT EXPOSED PIPING; COLOR SELECTION BY ARCHITECT.
3. WET SPRINKLER PIPE SHALL NOT BE ROUTED OVER TOP OF ELEC/COMM/IT ROOMS PER CODE.
4. SPRINKLERS SHALL BE CENTERED ON CEILING TILES WHERE DROPPED TILE CEILINGS OCCUR PER SPECIFICATIONS.
5. COORDINATE LOCATION OF EXPOSED SPRINKLER PIPE AND HEADS AT EXPOSED CEILINGS WITH ARCHITECTURAL REFLECTED CEILING PLANS. ALIGN EXPOSED PIPING WITH OTHER PIPING SYSTEMS. COORDINATE WITH ARCHITECT ON ALL AREAS.
6. PROVIDE SPRINKLER HEAD TYPES AS FOLLOWS:
   A. CONCEALED TYPE HEADS IN ALL AREAS WITH A FINISHED CEILING.
   B. UPRIGHT PENDANT AND SIDEWALL IN ALL AREAS WITHOUT A DROPPED CEILING.
7. REFER TO SPECIFICATIONS FOR SPRINKLER HEAD FINISHES.
8. COORDINATE WORK WITH ALL TRADES. REFER TO ARCHITECTURAL DRAWINGS FOR ADDITIONAL REQUIREMENTS INCLUDING SPRINKLER HEAD LOCATIONS.
9. REFER TO ARCHITECTURAL DRAWINGS FOR ADDITIONAL SPRINKLER HEAD PLACEMENT GUIDELINES.

WORK NOTES:

1. PROVIDE SPRINKLER HEAD AT TOP OF ELEVATOR SHAFT.

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SCOTT B. MISKONIS
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sDC PROJECT NO: 1020.00
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ISSUE DATE
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LEVEL 2 FIRE PROTECTION PLAN

FP-102

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XREFS=(xx-tb, xc-lvl 2 - Fire Protection, xx-lvl 2, xx-lvl 2-rcp) Layouts=(FP-102 LEVEL 2 FIRE PROTECTION PLAN)
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ELECTRICAL LEGEND

ALL SYMBOLS IN LEGEND MAY NOT NECESSARILY BE USED ON THIS PROJECT

LIGHTING

LUMINAIRES

- CEILING FIXTURE
- WALL MOUNTED FIXTURE
- EXIT SIGN W/ARROW
- BATTERY PACK
- LANDSCAPE FIXTURE
- KEYLESS FIXTURE
- POLE MOUNTED FIXTURE
- WALL WASH
- FLUORESCENT STRIP
- FLUORESCENT FIXTURES
- RECESSED FLUORESCENT FIXTURES
- LIGHT TRACK WITH FIXTURE HEADS
- FIXTURE(S) ON EMERGENCY CIRCUIT

SWITCHES

- SINGLE-POLE SWITCH
- 2 = DOUBLE-POLE SWITCH
- 3 = THREE-WAY SWITCH
- 4 = FOUR-WAY SWITCH
- P = SWITCH AND PILOT LIGHT
- K = KEY OPERATED SWITCH
- D = DIMMER SWITCH
- PHOTOCELL
- LOWER CASE LETTER INDICATES SWITCHING
- SWITCHES GANGED IN SAME BOX
- OS = OCCUPANCY SENSOR
- MD = MOTION DETECTOR
- TC = TIME CLOCK

GENERAL

- ALL FIXTURES IN ROOM ARE THIS TYPE UNLESS NOTED OTHERWISE
- LIGHTING CONTACTOR W/NO OF POLES
- LETTER REFERS TO FIXTURE SCHEDULE

POWER

RECEPTACLES

- SINGLE RECEPTACLE
- DUPLEX RECEPTACLE
- GROUND FAULT CIRCUIT INTERRUPTER RECEPTACLE
- ISOLATED GROUND RECEPTACLE
- DOUBLE DUPLEX RECEPTACLE
- DUPLEX RECEPTACLE SPLIT WIRED
- COMBINATION SWITCH AND DUPLEX RECEPTACLE
- SPECIAL PURPOSE OUTLET
- CEILING SPECIAL PURPOSE OUTLET
- CEILING DUPLEX RECEPTACLE
- FLOOR MOUNTED DUPLEX RECEPTACLE
- MULTI-OUTLET ASSEMBLY (NO. INDICATES RECEPTACLES AND SPACING IN INCHES O.C.)

RACEWAYS

- FEEDER BUS DUCT
- CABLE TRAY WITH DEPTH/LOAD/WIDTH
- CONCEALED RACEWAY
  - S = SURFACE
  - UG = UNDERGROUND
  - W = WIREWAY
- FLEXIBLE CONDUIT
- CAP
- SEAL OFF
- EXTENSION WHIP
- HOME RUN INDICATES NUMBER OF CIRCUITS. WIRES AND CONDUIT SIZE UNLESS OTHERWISE NOTED:
  - (2)#12 & 1#12(G)/3/4"C.
  - (4)#12 & 1#12(G)/3/4"C.
  - (6)#12 & 1#12(G)/3/4"C.
  - (8)#12 & 1#12(G)/3/4"C.
- RACEWAY TURNED UP
- RACEWAY TURNED DOWN

EQUIPMENT/OUTLETS

- PULL BOX
- JUNCTION BOX
- FLOOR MOUNTED JUNCTION BOX
- POWER JUNCTION BOX
- COMMUNICATION JUNCTION BOX
- BLANKED OUTLET
- TRANSFORMER (SEE TRANSFORMER SCHEDULE)
- METER
- TOGGLE DISCONNECT SWITCH 30 AMP
- CIRCUIT BREAKER DISCONNECT W/SIZE
- NON-FUSED DISCONNECT SWITCH W/SIZE
- FUSED DISCONNECT SWITCH W/SIZE
- MOTOR STARTER OR CONTACTOR
- COMBINATION MOTOR STARTER/DISCONNECT SWITCH
- MOTOR
- ELECTRIC DAMPER
- THERMAL OVERLOAD SWITCH
- THERMOSTAT (LINE VOLTAGE)
- RELAY (LOW VOLTAGE)
- SOLENOID (LOW VOLTAGE)
- TIME CLOCK
- PUSH BUTTON
- HORN
- BELL
- BUZZER
- BASEBOARD HEATING STRIP (ELECTRICAL)
- POWER/TELEPHONE POLE

PANEL/SWITCHBOARDS

- BRANCH CIRCUIT PANELBOARD
- MAIN DISTRIBUTION PANEL OR SWITCHBOARD
- CONTROL PANEL
- MOTOR CONTROL CENTER

COMMUNICATIONS

TELEPHONE/COMPUTER

- TELEPHONE TERMINAL CABINET "TTC"
- TTB — TELEPHONE TERMINAL BACKBOARD
- TELEPHONE OUTLET–FLOOR MOUNTED
- TELEPHONE OUTLET W = WALL MOUNTED P = PAY PHONE F = FIREMAN PHONE
- TELEPHONE/DATA OUTLET

PAGING/INTERCOM/TV

- A — AMPLIFIER
- M — MICROPHONE OUTLET
- S — SPEAKER
- S — SPEAKER HORN
- S_S — SPEAKER CALL-IN SWITCH
- V — VOLUME CONTROL
- INTERCOM OUTLET
- V_M — INTERCOM MASTER UNIT
- TELEVISION OUTLET
- CCTV

FIRE ALARM

- FACP — FIRE ALARM CONTROL PANEL
- FAA — FIRE ALARM ANNUNCIATOR
- FABP — FIRE ALARM BOOSTER PANEL
- FARP — FIRE ALARM RELEASE PANEL
- FSCP — FIRESFIGHTER SMOKE CONTROL PANEL
- FFCP — FIRE FIGHTER CONTROL PANEL
- ASFP — AIR SAMPLING CONTROL DETECTION PANEL
- MM — MONITOR MODULE
- CM — CONTROL MODULE
- RM — RELEASE MODULE
- P — MANUAL PULL STATION
- XXcd — STROBE
- HORN/SPEAKER (RE: SPEC)
- XXcd — HORN/SPEAKER/STROBE (RE: SPEC)
- M — MINI HORN
- V — V = BELL VS = BELL/STROBE C = CHIME CS = CHIME/STROBE
- MAGNETIC DOOR HOLD
- RTS — REMOTE LIGHT/TEST SWITCH
- FIRE OR EMERGENCY PHONE
- FIRE OR EMERGENCY PHONE – ACCESSIBLE
- FIRE OR EMERGENCY PHONE – HANDSET
- FIRE OR EMERGENCY PHONE – JACK
- HEAT DETECTOR – THERMAL
- R — R = RATE OF RISE ONLY F = FIXED TEMPERATURE R/F = R OF R & FIXED TEMPERATURE R/C = RATE COMPENSATION
- HEAT DETECTOR – LINE TYPE (CABLE)
- SMOKE DETECTOR
- P — C = COMBINATION SMOKE/HEAT DETECTOR P = PHOTOELECTRIC I = IONIZATION BT = BEAM TRANSMITTER BR = BEAM RECEIVER ASD = AIR SAMPLING
- S — DUCT SMOKE DETECTOR S = SUPPLY AIR R = RETURN AIR
- F — FLAME DETECTOR F = FLAME UV = ULTRAVIOLET IR = INFRARED VR = VISIBLE RADIATION
- VS — VALVE SUPERVISORY SWITCH
- WF — FIRE SPRINKLER FLOW SWITCH
- PS — PRESSURE SWITCH
- AA — LOW AIR PRESSURE ALARM
- FS — FIRE/SMOKE DAMPER
- CO — CARBON MONOXIDE DETECTOR
- CO — CARBON MONOXIDE DETECTOR WITH AUDIBLE ALARM
- ABORT SWITCH

NURSE CALL SYSTEM

- M — MASTER STATION
- 1 — PATIENT STATION – 1 BED
- 2 — PATIENT STATION – 2 BED
- S — STAFF STATION
- D — DUTY STATION
- P — PRESENCE STATION
- E — EMERGENCY STATION
- E — S — EMERGENCY STATION S = SHOWER T = TOILET
- 2 — DOME LIGHT NUMBER INDICATES LAMPS
- B — DOME LIGHT WITH BUZZER
- Z — ZONE DOME LIGHT

CLOCK SYSTEM

- C — CLOCK OUTLET & CLOCK
- C — CLOCK AND SPEAKER UNIT
- C_M — MASTER CLOCK
- C_C — MASTER CLOCK AND PROGRAM CONTROL
- 24 C — 24 HOUR CLOCK
- ET C — ELAPSED TIME CLOCK
- S_R — RESET SWITCH FOR ELAPSED TIME CLOCK

MISCELLANEOUS

- 9 / 4WG100 — NUMBER REFERS TO FEEDER SCHEDULE
- 2 / AHU-1 — REFERS TO EQUIPMENT SCHEDULE
- 9 — WORK NOTE SYMBOL
- 1 / E-5 — NUMBER DESIGNATES DETAIL SHEET ON WHICH DETAIL IS LOCATED
- 2 — REVISION SYMBOL
- 220 — ROOM NUMBER
- HATCHED SYMBOLS DENOTE REMOVAL WORK
- (RR) / 17 — DASHED SYMBOLS DENOTE EXISTING (REMOVE & RELOCATE)
- (R) (RELOCATED)

GROUNDING/LIGHTNING

GROUNDING

- GROUND
- GROUND ROD
- GROUND ROD WITH INSPECTION WELL
- GROUND BUS ON WALL
- GROUNDING CONDUCTOR
- PATIENT GROUNDING POINT

LIGHTNING PROTECTION

- LIGHTNING PROTECTION AIR TERMINAL
- SURGE ARRESTER PLUS GROUND
- EXOTHERMIC CONNECTION
- LP — LIGHTNING PROTECTION BARE CONDUCTOR

ONE-LINE DIAGRAMS

ELECTRICAL

- CIRCUIT BREAKER ≤ 600V
- BREAKER WITH DRAWOUT FEATURE ≤ 600V
- FUSE ≤ 600V
- FUSE AND SWITCH ≤ 600V
- BREAKER WITH DRAWOUT FEATURE > 600V
- FUSE > 600V
- FUSED DISCONNECT SWITCH > 600V
- PRIMARY FUSE CUTOUT OIL TYPE
- SWITCH AIR BREAK
- CIRCUIT BREAKER WITH: ST = SHUNT TRIP K = KEY INTERLOCKED E = ELECTRIC OPERATED
- CABLE TERMINATION
- CAPACITOR
- 2PT — CIRCUIT BREAKER WITH GROUND FAULT PROTECTION
- BATTERY
- T — PAD MOUNTED TRANSFORMER
- CURRENT TRANSFORMER W/RATIO
- 100/5 — POTENTIAL TRANSFORMER W/RATIO
- 600/100
- V — VOLTMETER
- VS — VOLTMETER SELECTOR SWITCH
- A — AMMETER
- AS — AMMETER SELECTOR SWITCH
- AUTOMATIC TRANSFER SWITCH
- MANUAL TRANSFER SWITCH
- T1 — TRANSFORMER (SEE TRANSFORMER SCHEDULE)
- G — ENGINE-GENERATOR UNIT
- PANEL BOARD DESIGNATION INSIDE
- LOAD BREAK ELBOW SEPARABLE CONNECTION

SCHEMATIC

- END OF LINE RESISTOR (EOL)
- R G — RED AND GREEN PILOT LIGHTS
- PUSH-BUTTON– NORMALLY OPEN
- PUSH-BUTTON– NORMALLY CLOSED
- CONTACT NORMALLY OPEN (N.O.)
- CONTACT NORMALLY CLOSED (N.C.)
- OPERATING COIL (LADDER DIAGRAM)
- C — OPERATING COIL (SCHEMATIC DIAGRAM)

ANSI DEVICE FUNCTION NUMBER

27	UNDER VOLTAGE RELAY	52	AC CIRCUIT BREAKER
43	MANUAL SELECTOR SWITCH	59	OVER VOLTAGE RELAY
50	INSTANTANEOUS OVER CURRENT RELAY	63	PRESSURE SWITCH
51	TIME OVER CURRENT RELAY	86	LOCKOUT RELAY
		87	DIFFERENTIAL RELAY

UTILITY SYSTEM

- DOWN GUY AND ANCHOR
- MANHOLE: NUMERAL INDICATES THE ASSIGNED NUMBER AND THE LETTER INDICATES THE TYPE
- UNDERGROUND DUCTS: NUMERAL INDICATES QUANTITY OF DUCTS LETTER INDICATES SYSTEM
- WEATHER HEAD SERVICE ENTRANCE
- 25 — SINGLE PHASE TRANSFORMER: NUMERAL INDICATES RATING IN KVA
- OH — OVERHEAD LINE
- OHG — OVERHEAD GUY
- PRIMARY FUSE CUTOUT AIR TYPE
- SWITCH AIR BREAK, GANG OPERATED

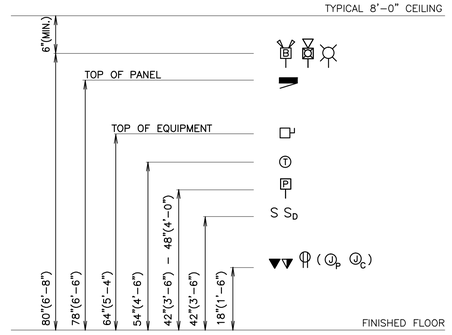
SUPPLEMENTARY SYMBOLS

- PPM — POWER DISTRIBUTION MODULE
- 2 — 2 DUPLEX HCSF ACCESS FLOOR BOX
- 4 — 4 DUPLEX HCSF ACCESS FLOOR BOX

ABBREVIATIONS

+4'–6"	MOUNTING HEIGHT ABOVE FINISHED FLOOR	CT	CURRENT TRANSFORMER	FS	FIRE SUPPRESSION	MCC	MOTOR CONTROL CENTER
A	AMPS	(D)	DEDICATED	G	GROUND	MDP	MAIN DISTRIBUTION PANEL
AC	ALTERNATING CURRENT	DP	DISTRIBUTION PANEL	GFCI	GROUND FAULT CIRCUIT INTERRUPTER	MDS	MAIN DIST. SWITCHBOARD
ac	ABOVE COUNTER	(E)	EXISTING	GRC	GALVANIZED RIGID CONDUIT	MG	MOTOR GENERATOR UNIT
AFCI	ARC FAULT CIRCUIT INTERRUPTER	EC	ELECTRICAL CONTRACTOR	H	PREFIX DENOTING 277/480 PANEL	MH	MANHOLE
AFF	ABOVE FINISHED FLOOR	EF	EXHAUST FAN	HP	HORSE POWER	MTD	MOUNTED
AFG	ABOVE FINISHED GRADE	EOL	END OF LINE RESISTOR	IG	ISOLATED GROUND	MTS	MANUAL TRANSFER SWITCH
AHU	AIR HANDLING UNIT	EM	EMERGENCY	KV	KILOVOLT	N	NEUTRAL
AIC	AMPERE INTERRUPTING CAPACITY	EMT	ELEC. METALLIC TUBING	KVA	KILO VOLT–AMPERE	NC	NORMALLY CLOSED
AF	AMP FRAME	EPO	EMERGENCY POWER OFF	KVAR	KILOVAR	NIC	NOT IN CONTRACT
AT	AMP TRIP	EWC	ELECTRIC WATER COOLER	KW	KILOWATT	NO	NORMALLY OPEN
ATS	AUTO. TRANSFER SWITCH	EX	EXPLOSION–PROOF	L	PREFIX DENOTING 120/208V PANEL	PA	PREACTION SYSTEM
B	BATTERY	F	FUSE OR FIRE	LV	LOW VOLTAGE	PDU	POWER DISTRIBUTION UNIT
BKR	BREAKER	FA	FIRE ALARM	M	MONITOR	PF	POWER FACTOR
C	CONDUIT	FCU	FAN COIL UNIT	MC	MECHANICAL CONTRACTOR	Ø OR PH	PHASE
CKT	CIRCUIT	FDR	FEEDER				
CP	CONTROL PANEL	FI	FILM ILLUMINATOR				

PT	POTENTIAL TRANSFORMER	TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSER
PVC	POLYVINYL CHLORIDE	UC	UNDERCABINET
(R)	RELOCATED	UF	UNDERFLOOR
(RR)	REMOVE & RELOCATE	UG	UNDERGROUND
RM	ROOM	UON	UNLESS OTHERWISE NOTED
RT	RAINTIGHT	UPS	UNINTERRUPTIBLE POWER SUPPLY
RTU	ROOF TOP UNIT	V	VOLTS
SCA	SHORT CIRCUIT CURRENT AVAILABLE	VAC	VOLTS ALTERNATING CURRENT
SRG	SIGNAL REFERENCE GRID	VDC	VOLTS DIRECT CURRENT
ST	SHUNT TRIP	VFD	VARIABLE FREQUENCY DRIVE
SW	SWITCH	WHM	WATTHOUR METER
TS	TEST SWITCH	WP	WEATHERPROOF
TTB	TELEPHONE TERMINAL BOARD	WR	WEATHER RESISTANT
TTC	TELEPHONE TERMINAL CABINET		



TYPICAL DEVICE MOUNTING HEIGHTS

NOT TO SCALE

NOTES:

1. HEIGHTS SHOWN ARE TYPICAL TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE.
2. DEVICES ABOVE DOORS SHALL BE CENTERED BETWEEN TOP OF DOOR TRIM AND CEILING LINE.
3. MOUNTING HEIGHTS SHOWN ON ARCHITECTURAL ELEVATIONS SHALL GOVERN OVER THOSE SHOWN ABOVE.
4. FOR CEILING HEIGHTS HIGHER THAN 7'–2", INSTALL FIRE ALARM NOTIFICATION AUDIO AND VISUAL APPLIANCES SO THAT BOTTOM OF STROBE LENS IS NOT LESS THAN 80" A.F.F., OTHERWISE INSTALL AT 6" BELOW CEILING.

GENERAL NOTES: (APPLICABLE TO ALL DRAWINGS)

1. AS PART OF THE CONSTRUCTION PROCESS, A WALK BETWEEN THE CONTRACTOR(S), OWNER AND ARCHITECT SHALL BE PERFORMED TO ENSURE THAT ALL ELECTRICAL BOXES ARE INSTALLED IN THE CORRECT LOCATION(S).

ELECTRICAL DRAWING LIST

Sheet Number	Sheet Title
E-000	ELECTRICAL LEGEND AND GENERAL INFORMATION
E-001	ELECTRICAL LUMINAIRE SCHEDULE
E-002	COMcheck
ES001	ELECTRICAL SITE PLAN
E-101	LEVEL 1 LIGHTING PLAN
E-102	LEVEL 2 LIGHTING PLAN
E-103	LEVEL 1 POWER PLAN
E-104	LEVEL 2 POWER PLAN
E-105	ROOF LEVEL ELECTRICAL PLAN
E-201	ELECTRICAL ONE–LINE DIAGRAM
E-301	ELECTRICAL PANEL SCHEDULES
E-302	ELECTRICAL PANEL SCHEDULES

BCER CONTACT LIST 010.06 12/28/11

303–422–7400 FAX 303–422–7900

PROJECT ENGINEER	MAIRIN MOLINA	EXT 276	mmolina@bcer.com
PROJECT MANAGER	JOHN LANG	EXT 233	jlang@bcer.com

studiotrope design collective

2942 Walton Street · Denver, CO 80205 · 303.308.1144 · www.studiotrope.com

OWNER
CITY AND COUNTY OF DENVER
201 W. Colfax Ave.
DENVER, COLROADO 80202

CIVIL ENGINEER
SAN ENGINEERING
6099 Windermere St.
LITTLETON, COLORADO 80120
P. 303.953.9014
F. 303.953.9016
www.sanengineeringllc.com

LANDSCAPE ARCHITECT
MUNDUS BISHOP
333 West Colfax Ave. #350
Denver, Colorado 80204
P. 303.865.5500
F. 303.865.5504
www.mundusbishop.com

STRUCTURAL ENGINEER
STUDIO NYL
2995 Baseline Road, Suite 314
Boulder, Colorado 80303
P. 303.558.3145
F. 303.440.8536
www.studionyl.com

MECH/PLUMB ENGINEER
BCER ENGINEERING
5420 Ward Road, Suite 200
Arvada, Colorado 80002-1838
P. 303.422.7400
F. 303.422.7900
www.bcer.com

ELECTRICAL ENGINEER
BCER ENGINEERING
5420 Ward Road, Suite 200
Arvada, Colorado 80002-1838
P. 303.422.7400
F. 303.422.7900
www.bcer.com

AV-IT-SECURITY
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SUSTAINABILITY
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130 W. 5th Ave.
Denver, Colorado 80204
P. 303.278.1532
F. 303.278.8533
www.ambient-e.com

PROJECT: WEST DENVER BRANCH LIBRARY
1498 NORTH IRVING STREET
DENVER, COLORADO 80204

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ELECTRICAL LEGEND AND GENERAL INFORMATION

E-000

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XREFS=(xx-tb) Layouts=(E-000 ELECTRICAL LEGEND AND GENERAL INFORMATION)
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LUMINAIRE SCHEDULE

KEY	LAMPS QTY.	LAMPS NUMBER	BALLAST QTY.	DESCRIPTION	VOLT	FINISH	MOUNTING TYPE	MOUNTING DEPTH	MANUFACTURER	VA	NOTES
A	1	F32T8/ XL/SPX41 /HL/ECO	1	5' PENDANT MOUNTED DIRECT LUMINAIRE WITH BI-LEVEL DIMMING BALLAST	120	COLOR PER ARCHITECT	CABLE TO 9'-0"		STILE: #SIP11728-1F32W-120-MCA-0"-PER ARCHITECT-SYLVANIA QUICKSTEP BI-LEVEL DIMMING BALLAST	28	2,5,6
B	2	F32T8/ XL/SPX41 /HL/ECO	1	2'x4' RECESSED VOLUMETRIC FLUORESCENT LUMINAIRE	120	WHITE	RECESSED GRID	5"	NULITE: #L2D-2-32T8-120-HEIS-GEULTRAMAX-N-RFD LIGHTOUER: #H9S2GLR232UNVHI-841FG-GE ULTRAMAX	55	1,2,5
B1	2	F17T8/ XL/SPX41 /HL/ECO	1	2'x2' RECESSED VOLUMETRIC FLUORESCENT LUMINAIRE	120	WHITE	RECESSED GRID	5"	NULITE: #L2D-2-17T8-120-HEIS-GEULTRAMAX-N-RFD LIGHTOUER: #H9S2GLR217UNVHI-841FG-GE ULTRAMAX	35	1,2,5
B2	2	F32T8/ XL/SPX41 /HL/ECO	2	1'X4' RECESSED VOLUMETRIC FLUORESCENT LUMINAIRE WITH SATIN FLAT CENTER LENS AND ALUMINUM SIDE RAILS, CENTER LENS SHALL MATCH LENS ON TYPES J4-J23 & R1, DUAL LEVEL SWITCHING	120	WHITE	RECESSED GRID	5"	NULITE: #L1D-2-32T8-120-(2)HEIS-GEULTRAMAX-N-RFD LIGHTOUER: #H9S1GLR232UNVHI-GE ULTRAMAX-835F6	55	1,2,5
C	2	F32T8/ XL/SPX41 /HL/ECO	1	4'-0" FLUORESCENT WRAPAROUND.	120	WHITE	SURFACE CEILING	2-3/4"	LITHONIA: #LB-2-32-MVOLT-GE ULTRAMAX LIGHTOUER: #JS4A232UNVP2-GE ULTRAMAX	55	1,2,5
D	2	F32T8/ XL/SPX41 /HL/ECO	1	4'-0" STRIP FLUORESCENT WITH WIRE GUARD, CHAIN HANG AS REQUIRED	120	WHITE	SURFACE OR CHAIN HANG	–	LITHONIA #Z-2-32-MVOLT-GE ULTRAMAX-WGZ48-HC36 (AS REQUIRED) LIGHTOUER: #SW4S232HPFUNV-GE ULTRAMAX-AWG3W CSP-AH5 CSP (AS REQUIRED)	55	1,2,5
F	2	F32T8/ XL/SPX41 /HL/ECO	1	4'-0" FLUORESCENT STRIP MOUNTED IN ARCHITECTURAL COVE	120	WHITE	SURFACE PER ARCH	3"	LITHONIA #Z-2-32-MVOLT-GE ULTRAMAX TUBE LIGHTING PRODUCTS: #TFL-8200-120-232-TB-GE ULTRAMAX	55	1,2,5
F1	2	F25T8/XL/ SPX41/HL/ ECO	2	3'-0" 2-LAMP ADJUSTIBLE STAGGERED STRIP MOUNTED TO BOTTOM OF BEAM WITH DUAL LEVEL SWITCHING	120	WHITE	SURFACE BOTTOM OF BEAM	5"	BIRCHWOOD: #WP-T8-2ST-SAS-120-EB-(2)GE ULTRAMAX-125-HRW TUBE LIGHTING: #TFL-8230-UNV-225-MOD DUAL LEVEL-GE ULTRAMAX	48	1,2,5
F2	2	F32T8/ XL/SPX41 /HL/ECO	2	4'-0" 2-LAMP ADJUSTABLE STAGGERED STRIP MOUNTED TO BOTTOM OF BEAM WITH DUAL LEVEL SWITCHING	120	WHITE	SURFACE BOTTOM OF BEAM	5"	BIRCHWOOD: #WP-T8-2ST-SAS-120-EB-(2)GE ULTRAMAX-132-HRW TUBE LIGHTING: #TFL-8230-UNV-232-MOD DUAL LEVEL-GE ULTRAMAX	55	1,2,5
F2E	2	F32T8/ XL/SPX41 /HL/ECO	2	4'-0" 2-LAMP ADJUSTABLE STAGGERED STRIP MOUNTED TO BOTTOM OF BEAM WITH DUAL LEVEL SWITCHING AND EMERGENCY BATTERY BALLAST	120	WHITE	SURFACE BOTTOM OF BEAM	5"	BIRCHWOOD: #WP-T8-2ST-SAS-120-EB-(2)GE ULTRAMAX-EM-132-HRW TUBE LIGHTING: #TFL-8230-UNV-232-MOD DUAL LEVEL / EM BALLAST-GE ULTRAMAX	55	1,2,5
F3	1	F32T8/ XL/SPX41 /HL/ECO	2	4' 1-LAMP STRIP FOR 2ND FLOOR ART ACCENTING SURFACE MOUNTED IN FLANGE OF BEAM PER ARCHITECT WITH ADJUSTABLE ASYMETRIC REFLECTOR	120	WHITE	SURFACE IN BEAM FLANGE PER ARCH	5"	BIRCHWOOD: #WP-T8-S-120-GE ULTRAMAX-132-HRW-AAR TUBE LIGHTING: #TFL-8100-120-132-MOD ADJUSTIBLE REFLECTOR	28	1,2,5
F8	1	F32T8/ XL/SPX41 /HL/ECO	1	4'-0" FLUORESCENT STRIP MOUNTED VERTICALLY IN WONDER WALL	120	WHITE	SURFACE VERTICALLY PER ARCH	3"	LITHONIA #Z-1-32-MVOLT-GE ULTRAMAX LIGHTOUER: #SW4S132HPFUNV-GE ULTRAMAX	28	1,2,5
F7	2	F17T8/ XL/SPX41 /HL/ECO	2	2'-0" 2-LAMP ADJUSTIBLE STAGGERED STRIP MOUNTED TO BOTTOM OF BEAM WITH DUAL LEVEL SWITCHING	120	WHITE	SURFACE BOTTOM OF BEAM	5"	BIRCHWOOD: #WP-T8-2ST-SAS-120-EB-GE ULTRAMAX-117-HRW TUBE LIGHTING: #TFL-8230-UNV-225-MOD DUAL LEVEL-GE ULTRAMAX	30	1,2,5
F8	1	F17T8/ XL/SPX41 /HL/ECO	1	2'-0" SUSPENDED 1-LAMP STRIP LIGHT WITH BI-LEVEL DIMMING BALLAST ADJACENT LUMINAIRES SHALL BE MOUNTED ON SAME BALLAST HOUSING	120	WHITE	PENDANT PER ARCHITECT	3"	BIRCHWOOD: #WP-T8-M-120-EB-SYLVANIA QUICKSTEP BI-LEVEL DIMMING BALLAST-117-HRW TUBE LIGHTING: #TFL-8100-120-117-MOD BI-LEVEL-SYLVANIA QUICKSTEP DIMMING BALLAST	15	1,2,5
F9	1	F25T8/XL/ SPX41/ECO	1	3'-0" SUSPENDED 1-LAMP STRIP LIGHT WITH BI-LEVEL DIMMING BALLAST ADJACENT LUMINAIRES SHALL BE MOUNTED ON SAME BALLAST HOUSING	120	WHITE	PENDANT PER ARCHITECT	3"	BIRCHWOOD: #WP-T8-M-120-EB-SYLVANIA QUICKSTEP BI-LEVEL DIMMING BALLAST-125-HRW TUBE LIGHTING: #TFL-8100-120-125-MOD BI-LEVEL-SYLVANIA QUICKSTEP DIMMING BALLAST	22	1,2,5
F10	1	F32T8/ XL/SPX41 /HL/ECO	1	4'-0" SUSPENDED 1-LAMP STRIP LIGHT WITH BI-LEVEL DIMMING BALLAST ADJACENT LUMINAIRES SHALL BE MOUNTED ON SAME BALLAST HOUSING	120	WHITE	PENDANT PER ARCHITECT	3"	BIRCHWOOD: #WP-T8-M-120-EB-SYLVANIA QUICKSTEP BI-LEVEL DIMMING BALLAST-132-HRW TUBE LIGHTING: #TFL-8100-120-132-MOD BI-LEVEL-SYLVANIA QUICKSTEP DIMMING BALLAST	28	1,2,5
G	2/4'	F32T8/ XL/SPX41 /HL/ECO	2/8"	6" SQUARE PENDANT MOUNTED LINEAR LUMINAIRE WITH SATIN ACRYLIC LENS AND TWO BALLASTS FOR DUAL LEVEL SWITCHING PROVIDE LENGTHS AS SHOWN ON PLANS	120	ALUMINUM	PENDANT TO 9'-0" AFF	7"	LITECONTROL: #PD---66N-2XT8-FP-ALUMINUM PAINT-(2) GE ULTRAMAX-120-STAGGERED LAMPS AXIS: #BB-S-FL-X-T8-2+S-AP-UNV-GE ULTRAMAX-E-2-CAXX	55/4'	1,2,5
G1	2/4'	F32T8/ XL/SPX41 /HL/ECO	2/8"	6" SQUARE PENDANT MOUNTED LINEAR LUMINAIRE WITH SATIN ACRYLIC LENS AND TWO BALLASTS FOR DUAL LEVEL SWITCHING PROVIDE LENGTHS AS SHOWN ON PLANS	120	SW6702	PENDANT TO 9'-0" AFF		LITECONTROL: #PD---66N-2XT8-FP-SW6702-(2) GE ULTRAMAX-120-STAGGERED LAMPS AXIS: #BB-S-FL-X-T8-2+S-SW6702-UNV-GE ULTRAMAX-E-2-CAXX	55/4'	1,2,5
G2	2/4'	F32T8/ XL/SPX41 /HL/ECO	2/8"	6" SQUARE PENDANT MOUNTED LINEAR LUMINAIRE WITH SATIN ACRYLIC LENS AND TWO BALLASTS FOR DUAL LEVEL SWITCHING PROVIDE LENGTHS AS SHOWN ON PLANS	120	SW6489	PENDANT TO 9'-0" AFF		LITECONTROL: #PD---66N-2XT8-FP-SW6489-(2) GE ULTRAMAX-120 AXIS: #BB-S-FL-X-T8-2+S-SW6489-UNV-GE ULTRAMAX-E-2-CAXX	55/4'	1,2,5
H	1	F26TBX/841/ A/ECO	1	6" RECESSED COMPACT FLUORESCENT DOWN LIGHT WITH CLEAR ALZAK REFLECTOR AND MAXIMUM WATTAGE LABEL OF 26W	120	CLEAR ALZAK	RECESSED	8"	GOTHAM: #AF-1/26TRT-6AR-LD-120-26W MAX LABEL CALCULITE: #9031CCDP-S6132BU-26W MAX LABEL	30	1,5
H1	LED PROVIDED WITH UNIT			2" RECESSED LED DOWNLIGHT WITH 38-DEGREE BEAM SPREAD	120	CLEAR DIFFUSE	RECESSED CEILING	6"	CALCULITE: #C2L-04-DLFT-30K-38-R-1-C2L-DL-CCD-FT-CA2FMR	11	7

LUMINAIRE SCHEDULE

KEY	LAMPS QTY.	LAMPS NUMBER	BALLAST QTY.	DESCRIPTION	VOLT	FINISH	MOUNTING TYPE	MOUNTING DEPTH	MANUFACTURER	VA	NOTES
M	LED PROVIDED WITH UNIT			1300 LUMEN, 4.5" DIAMETER BY 11.8" HIGH DECORATIVE CYLINDRICAL PENDANT WITH 60-DEGREE DISTRIBUTION AND ROUND PATTERNED KNOCKOUTS	120	COLOR AND FINISH PER ARCHITECT	PENDANT PER ARCH		V2 LIGHTING GROUP: #VC3-13-30-80-60-R-XX-XX	24	8
M1	LED PROVIDED WITH UNIT			1300 LUMEN, 4.5" DIAMETER BY 11.8" HIGH DECORATIVE CYLINDRICAL PENDANT WITH 60-DEGREE DISTRIBUTION AND SQUARE PATTERNED KNOCKOUTS	122	COLOR AND FINISH PER ARCHITECT	PENDANT PER ARCH		V2 LIGHTING GROUP: #VC3-13-30-80-60-S-XX-XX	24	8
M2	LED PROVIDED WITH UNIT			1300 LUMEN, 4.5" DIAMETER BY 11.8" HIGH DECORATIVE CYLINDRICAL PENDANT WITH 60-DEGREE DISTRIBUTION AND DUAL PATTERNED KNOCKOUTS	123	COLOR AND FINISH PER ARCHITECT	PENDANT PER ARCH		V2 LIGHTING GROUP: #VC3-13-30-80-60-D-XX-XX	24	8
N	6	F17T8/ XL/SPX41 /HL/ECO	2	2'X2' FABRIC COVERED, SQUARE PENDANT WITH DUAL LEVEL SWITCHING	120	WHITE	PENDANT PER ARCH	4"	ENERGIE: #FLS-22-120-PEN-GE ULTRAMAX-DUAL LEVEL SWITCHING	102	1,2,5,9
N1	6	F17T8/ XL/SPX41 /HL/ECO	2	2'X2' FABRIC COVERED, WALL MOUNTED LUMINAIRE WITH DUAL LEVEL SWITCHING	120	WHITE	WALL PER ARCH	4"	ENERGIE: #FLS-22-120-SUR-GE ULTRAMAX-DUAL LEVEL SWITCHING	102	1,2,5,10
N2	11	F32T8/ XL/SPX41 /HL/ECO	4	4'X4' FABRIC COVERED SQUARE PENDANT WITH DUAL LEVEL SWITCHING	120	WHITE	PENDANT PER ARCH	4"	ENERGIE: #FLS-44-120-PEN-GE ULTRAMAX-DUAL LEVEL SWITCHING	308	1,2,5,11
P	3	F32T8/ XL/SPX41 /HL/ECO	2	4' PENDANT MOUNTED LUMINAIRE WITH ACRYLIC LENS AND 80% DOWNLIGHT DISTRIBUTION WITH DUAL LEVEL SWITCHING	120	WHITE	PENDANT TO 9'-0" AFF	3"	PEERLESS: #BRMV-532-SPR-(2)/80-SSH-4-W4-120-(2)GE ULTRAMAX-DCT-L/LD-F2-XX-C210-DUAL LEVEL SWITCHING AXIS: #CUB-SA-4-T8-3-W-0-3-UNV-(2)GE ULTRAMAX-2-CAXX-80% DOWNLIGHT / 20%UPLIGHT DISTRIBUTION	83	1,2,5
R	1	F32T8/ XL/SPX41 /HL/ECO	1	RECESSED 4" WIDE LUMINAIRE WITH OPAL ACRYLIC LENS, WET LOCATION LISTED.	120	WHITE	RECESSED ACRYLIC PANELS	5"	SELUX: #M125R2-1T8-SD-XX-004-WH-120-CW-GE ULTRAMAX AXIS: #WBR-S-4FT-T8-1-W-UNV-GE ULTRAMAX-1-TF	28	1,2,5
RE	1	F32T8/ XL/SPX41 /HL/ECO	1	RECESSED 4" WIDE LUMINAIRE, SATIN ACRYLIC LENS, WET LOCATION LISTED WITH COLD WEATHER EMERGENCY BALLAST	120	WHITE	RECESSED ACRYLIC PANELS	5"	SELUX: #M125R2-1T8-SD-XX-004-WH-120-EM1-CW-GE ULTRAMAX AXIS: #WBR-S-4FT-T8-1-W-UNV-GE ULTRAMAX-1-TF-BJ	28	1,2,5
R1	8	F32T8/ XL/SPX41 /HL/ECO	4	RECESSED 4" WIDE LUMINAIRE WITH SATIN ACRYLIC LENS, BI-LEVEL DIMMING BALLAST, WALL MOUNTING BRACKETS, WITH 104-DEGREE ILLUMINATED CORNER FOR CONTINUOUS RUN, AND ANGLED ENDCAPS. REFER TO ARCHITECTURAL DETAILS FOR EXACT LENGTH AND CORNER ANGLE	120	WHITE	RECESSED CEILING	5"	AXIS: #BBR-S-FL-SXX-TB-1+S-W-120-SYLVANIA QUICKSTEP BI-LEVEL DIMMING BALLAST-1-DS-C (CUSTOM LENGTH AND CORNER)	220	1,2,5
R2	9	F32T8/ XL/SPX41 /HL/ECO	5	RECESSED 4" X 36'-0" LUMINAIRE WITH SATIN ACRYLIC LENS, STAGGERED LAMPS, AND INTEGRAL PHOTOCELL	120	WHITE	RECESSED CEILING	5"	AXIS: #BBR-S-FL-S36-TB-1+S-W-120-GE ULTRAMAX-1-D-DS	252	1,2,5
T2	LED PROVIDED WITH UNIT			LED TREE UPLIGHT	120	BLACK	LANDSCAPE PER ARCHITECT	10"	COLOR KINETICS: #523-000067-04/106-000004-00/120-000080-05 LIGMAN: #U50205-BLACK	15	1,2,5
AA	2	MVR250/U	1	DOUBLE HEADED POLE MOUNTED HID PARKING LOT LUMINAIRE	208	PER ARCHITECT	25' POLE 27.5' AFG	6-1/4"	LITHONIA: #KSF2-250M-R3-208-SCWA-SPD4-FINISH PER ARCH QUALITY LIGHTING: #SMR-25-3-PMA-XX-2	600	
DD	1	CMH20TCU830/ G8.5	1	10" DIAMETER SOLID CIRCULAR LUMINAIRE WITH EXTERNAL EMERGENCY BATTERY PACK AND 50W QUARTZ EMERGENCY LAMP WITH TIME DELAY	120	PER ARCHITECT	SURFACE PER ARCHITECT	10"	BETA CALCO: #830-7912-COLOR PER ARCHITECT-50W QUARTZ EM LAMP WITH TIME DELAY-EXTERNAL BATTERY PACK	30	
FF	LED PROVIDED WITH UNIT			1' LONG 4000-DEGREE LED FLOODLIGHT WITH 30-DEGREE BY 60-DEGREE BEAM ANGLE	120	BLACK	SURFACE WALL PER ARCH	3"	COLOR KINETICS: #523-000030-05 LIGMAN: #U30665-E-120-01-C	36	
GG	LED PROVIDED WITH UNIT			EXTERIOR LED STEP LIGHT	120	PER ARCHITECT	RECESS WALL @ 18" AFG	3"	WINONA: #LED-STEP03-12-L-001/HO-ND120V-COLOR PER ARCH-WL-STD LIGMAN: #40591S-COLOR PER ARCHITECT	24	1,2
EM	5.4W LAMPS PROVIDED W/UNIT		---	WALL OR CELING MOUNTED, DUAL HEAD EMERGENCY LIGHT WITH BATTERY PACK AND SELF-DIAGNOSTIC ELECTRONICS	120	WHITE	WALL @ +84" OR CEILING MOUNTED PER PLANS	5"	LITHONIA #ELM2-SD EELP: #EM16-LP-12V-50-SD	---	
X1	LED PROVIDED W/UNIT		---	STENCILED SINGLE FACE LED EXIT SIGN, GREEN LETTERS ON WHITE BACKGROUND, BATTERY PACK WITH OR WITHOUT ARROWS	120	WHITE	UNIVERSAL	---	LITHONIA #LQM-S-W-3-G-EL-N-SD EELP #XE20W-SD	---	
X2	LED PROVIDED W/UNIT		---	STENCILED DOUBLE FACE LED EXIT SIGN, GREEN LETTERS ON WHITE BACKGROUND, BATTERY PACK WITH OR WITHOUT ARROWS	120	WHITE	UNIVERSAL	---	LITHONIA #LQM-S-W-3-G-EL-N-SD EELP #XE20W-SD	---	
X3	LED PROVIDED W/UNIT			EDGELIT SINGLE FACE LED EXIT SIGN, GREEN LETTERS, BATTERY PACK AND SELF DIAGNOSTICS WITH OR WITHOUT ARROWS	120	WHITE	UNIVERSAL	---	LITHONIA: #EDG-1-G-EL-SD EELP: #EDG-1-G-C-A-EM-SD	---	
X4	LED PROVIDED W/UNIT		---	EDGELIT DOUBLE FACE LED EXIT SIGN, GREEN LETTERS, BATTERY PACK, AND SELF DIAGNOSTICS WITH OR WITHOUT ARROWS	120	WHITE	UNIVERSAL	---	LITHONIA: #EDG-2-G-EL-SD EELP: #EDG-2-G-S-A-EM-SD	---	
X5	LED PROVIDED W/UNIT		---	EXTERIOR WET LOCATION LISTED LED EXIT SIGN WITH INTERNAL BATTERY HEATER AND TWO EMERGENCY LIGHTING HEADS	120	WHITE	UNIVERSAL	---	BEGHELLI: #WLX-SA-LG-1-W-2LR-6-36-H	---	

NOTES:
1. PROVIDE ELECTRONIC BALLAST WITH LESS THAN 10% THD.
2. PROVIDE WITH SUPER T8 LAMP AND BALLAST COMBINATION (GE ULTRAMAX BALLAST OR EQUAL).
3. NOT USED
4. NOT USED
5. PROVIDE 4100K LAMPS; ALL LAMPS ARE TO BE FROM THE SAME MANUFACTURER FOR THE ENTIRE PROJECT.
6. NO SUBSTITUTION ALLOWED, THE LIGHTING AGENCY HAS GUARANTEED A CONTRACTOR NET PRICE OF $339.90 FOR THIS LUMINAIRE.
7. VISUAL INTEREST HAS GUARANTEED A CONTRACTOR NET PRICE OF $245.00 PLUS FREIGHT FOR THIS LUMINAIRE.
8. NO SUBSTITUTION ALLOWED, THE LIGHTING AGENCY HAS GUARANTEED A CONTRACTOR NET PRICE OF $526.40 FOR THIS LUMINAIRE.
9. NO SUBSTITUTION ALLOWED, THE LIGHTING AGENCY HAS GUARANTEED A CONTRACTOR NET PRICE OF $789.20 FOR THIS LUMINAIRE.
10. NO SUBSTITUTION ALLOWED, THE LIGHTING AGENCY HAS GUARANTEED A CONTRACTOR NET PRICE OF $771.60 FOR THIS LUMINAIRE.
11. NO SUBSTITUTION ALLOWED, THE LIGHTING AGENCY HAS GUARANTEED A CONTRACTOR NET PRICE OF $2,134.10 FOR THIS LUMINAIRE.

studiotrope
design collective
2942 Nelson Street · Denver, CO 80205 · 303.308.1144 · www.studiotrope.com

OWNER
CITY AND COUNTY OF DENVER
201 W. Colfax Ave.
DENVER, COLROADO 80202

CIVIL ENGINEER
SAN ENGINEERING
6099 Windermere St.
LITTLETON, COLORADO 80120
P. 303.953.9014
F. 303.953.9016
www.sanengineeringllc.com

LANDSCAPE ARCHITECT
MUNDUS BISHOP
333 West Colfax Ave. #350
Denver, Colorado 80204
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PROJECT:
WEST DENVER BRANCH LIBRARY
1498 NORTH IRVING STREET
DENVER, COLORADO 80204

COLORADO REGISTERED PROFESSIONAL ENGINEER — 32344 — 1/13/12

sDC PROJECT NO: 1020.00
COOD PROJECT NO: CE 02089

ISSUE DATE
01-12-2012

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ELECTRICAL LUMINAIRE SCHEDULE

E-001

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XREFS=(xx-tb) Layouts=(ELECTRICAL COMcheck & LUMINAIRE SCHEDULE)
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COMcheck Software Version 3.9.0

Interior Lighting Compliance Certificate

2009 IECC

Section 1: Project Information

Project Type: **New Construction**
Project Title : West Denver Branch Library
Construction Site:
1498 North Irving Street
Denver, CO 80204

Owner/Agent:

Designer/Contractor:
BCER Engineering
5420 Ward Road
Suite 200
Arvada, CO 80002
303-422-7400

Section 2: Interior Lighting and Power Calculation

A Area Category	B Floor Area (ft2)	C Allowed Watts / ft2	D Allowed Watts (B x C)
Library	26073	1.3	33895
		Total Allowed Watts =	33895

Section 3: Interior Lighting Fixture Schedule

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
Library (26073 sq.ft.)				
Linear Fluorescent 1: A: 5' Pendant / 48" T8 32W / Electronic	1	25	28	700
Linear Fluorescent 2: B: 2'x4' RECESSED TROFFER / 48" T8 32W / Electronic	2	42	55	2310
Linear Fluorescent 3: B1: 2'x2' RECESSED TROFFER / 24" T8 17W / Electronic	2	8	35	280
Linear Fluorescent 4: B2: 1'x4' RECESSED TROFFER / 48" T8 32W / Electronic	2	29	55	1595
Linear Fluorescent 5: C: 4' ACRYLIC WRAPAROUND / 48" T8 32W / Electronic	2	13	55	715
Linear Fluorescent 6: D: 4' INDUSTRIAL / 48" T8 32W / Electronic	2	10	55	550
Linear Fluorescent 7: F: 4' STRIP-COVE / 48" T8 32W / Electronic	2	8	55	440
Linear Fluorescent 8: F1: 3' ADJUSTABLE STAGGERED STRIP / 36" T8 25W / Electronic	2	3	48	144
Linear Fluorescent 9: F2-F2E: 4' ADJUSTABLE STAGGERED STRIP / 48" T8 32W / Electronic	2	24	55	1320
Linear Fluorescent 12: F5: 4' STRIP / 48" T8 32W / Electronic	1	6	28	168
Linear Fluorescent 13: F6: 4' STRIP MOUNTED VERTICALLY / 48" T8 32W / Electronic	1	18	28	504
Linear Fluorescent 14: F7: 2' ADJUSTABLE STAGGERED STRIP / 24" T8 17W / Electronic	2	2	30	60
Linear Fluorescent 15: F8: 2' PENDANT STRIP / 24" T8 17W / Electronic	1	2	15	30
Linear Fluorescent 16: F9: 3' PENDANT STRIP / 36" T8 25W / Electronic	1	7	22	154
Linear Fluorescent 17: F10: 4' PENDANT STRIP / 48" T8 32W / Electronic	1	7	28	196
Linear Fluorescent 18: G: 4' - 4.75 DIA. PENDANT / 48" T8 32W / Electronic	2	57	55	3135
Linear Fluorescent 19: G1: 4' - 4.75 DIA. PENDANT / 48" T8 32W / Electronic	2	56	55	3080
Linear Fluorescent 20: G2: 4' - 4.75 DIA. PENDANT / 48" T8 32W / Electronic	2	39	55	2145
Compact Fluorescent 1: H: 6" RECESSED DOWNLIGHT / Triple 4-pin 26W / Electronic	1	23	30	690
LED: H1: 2" RECESSED LED DOWNLIGHT / Other	1	13	11	143
LED: M,M1,M2: LED CYLINDER PENDANT / Other	1	16	24	384
Linear Fluorescent 21: N: 2'x2' SQUARE PENDANT / 24" T8 17W / Electronic	1	4	102	408
Linear Fluorescent 22: N1: 2'x2' SQUARE WALL SCONCE / 24" T8 17W / Electronic	1	1	102	102
Linear Fluorescent 23: N2: 4'x4' SQUARE PENDANT / 48" T8 32W / Electronic	1	3	308	924
Linear Fluorescent 24: P: 4' PENDANT / 48" T8 32W / Electronic	3	5	83	415
Linear Fluorescent 25: R,RE: 4" WIDE RECESSED LUMINAIRE / 48" T8 32W / Electronic	1	4	28	112
Linear Fluorescent 26: R1: 4" WIDE RECESSED LUMINAIRE / 48" T8 32W / Electronic	1	1	220	220
Linear Fluorescent 27: R2: 4"W x 36' RECESSED LUMINAIRE / 48" T8 32W / Electronic	1	2	252	504
			Total Proposed Watts =	21428

Section 4: Requirements Checklist

Lighting Wattage:

❑ 1. Total proposed watts must be less than or equal to total allowed watts.

Allowed Watts	Proposed Watts	Complies
33895	21428	YES

Controls, Switching, and Wiring:

❑ 2. Daylight zones under skylights more than 15 feet from the perimeter have lighting controls separate from daylight zones adjacent to vertical fenestration.

❑ 3. Daylight zones have individual lighting controls independent from that of the general area lighting.

Exceptions:

❑ Contiguous daylight zones spanning no more than two orientations are allowed to be controlled by a single controlling device.

❑ Daylight spaces enclosed by walls or ceiling height partitions and containing two or fewer light fixtures are not required to have a separate switch for general area lighting.

❑ 4. Independent controls for each space (switch/occupancy sensor).

Exceptions:

❑ Areas designated as security or emergency areas that must be continuously illuminated.

❑ Lighting in stairways or corridors that are elements of the means of egress.

❑ 5. Master switch at entry to hotel/motel guest room.

❑ 6. Individual dwelling units separately metered.

❑ 7. Medical task lighting or art/history display lighting claimed to be exempt from compliance has a control device independent of the control of the nonexempt lighting.

❑ 8. Each space required to have a manual control also allows for reducing the connected lighting load by at least 50 percent by either controlling all luminaires, dual switching of alternate rows of luminaires, alternate luminaires, or alternate lamps, switching the middle lamp luminaires independently of other lamps, or switching each luminaire or each lamp.

Exceptions:

❑ Only one luminaire in space.

❑ An occupant-sensing device controls the area.

❑ The area is a corridor, storeroom, restroom, public lobby or sleeping unit.

❑ Areas that use less than 0.6 Watts/sq.ft.

❑ 9. Automatic lighting shutoff control in buildings larger than 5,000 sq.ft.

Exceptions:

❑ Sleeping units, patient care areas; and spaces where automatic shutoff would endanger safety or security.

❑ 10. Photocell/astronomical time switch on exterior lights.

Exceptions:

❑ Lighting intended for 24 hour use.

❑ 11. Tandem wired one-lamp and three-lamp ballasted luminaires (No single-lamp ballasts).

Exceptions:

❑ Electronic high-frequency ballasts; Luminaires on emergency circuits or with no available pair.

Interior Lighting PASSES: Design 37% better than code.

Section 5: Compliance Statement

Compliance Statement: The proposed lighting design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed lighting system has been designed to meet the 2009 IECC requirements in COMcheck Version 3.9.0 and to comply with the mandatory requirements in the Requirements Checklist.

Name - Title | Signature | Date

COMcheck Software Version 3.9.0

Exterior Lighting Compliance Certificate

2009 IECC

Section 1: Project Information

Project Type: **New Construction**
Project Title : West Denver Branch Library
Exterior Lighting Zone: **2 (Neighborhood business district)**

Construction Site:
1498 North Irving Street
Denver, CO 80204

Owner/Agent:

Designer/Contractor:
BCER Engineering
5420 Ward Road
Suite 200
Arvada, CO 80002
303-422-7400

Section 2: Exterior Lighting Area/Surface Power Calculation

A Exterior Area/Surface	B Quantity	C Allowed Watts / Unit	D Tradable Wattage	E Allowed Watts (B x C)	F Proposed Watts
Parking area	19861 ft2	0.06	Yes	1192	1250
Other door (not main entry)	21 ft of door width	20	Yes	420	180
Special feature area	910 ft2	0.14	Yes	127	60
Walkway < 10 feet wide	50 ft of walkway length	0.7	Yes	35	144
			Total Tradable Watts* =	1774	1634
			Total Allowed Watts =	1774	
			Total Allowed Supplemental Watts** =	600	

* Wattage tradeoffs are only allowed between tradable areas/surfaces.
** A supplemental allowance equal to 600 watts may be applied toward compliance of both non-tradable and tradable areas/surfaces.

Section 3: Exterior Lighting Fixture Schedule

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
Parking area (19861 ft2): Tradable Wattage				
HID 1: AA: 2-HEAD POLE LIGHT / Metal Halide 250W / Pulse start	2	5	250	1250
Other door (not main entry) (21 ft of door width): Tradable Wattage				
LED: DD: 12" DIA. LED WALL SCONCE W/BATT / Other	1	6	30	180
Special feature area (910 ft2): Tradable Wattage				
LED: FF: 1' LONG LED FLOOD / Other	1	3	15	45
LED: T2: LED TREE UPLIGHT / Other	1	1	15	15
Walkway < 10 feet wide (50 ft of walkway length): Tradable Wattage				
LED: GG: LED STEP LIGHT / Other	1	6	24	144
			Total Tradable Proposed Watts =	1634

Section 4: Requirements Checklist

Lighting Wattage:

❑ 1. Within each non-tradable area/surface, total proposed watts must be less than or equal to total allowed watts. Across all tradable areas/surfaces, total proposed watts must be less than or equal to total allowed watts.

Compliance: Passes.

Controls, Switching, and Wiring:

❑ 2. All exemption claims are associated with fixtures that have a control device independent of the control of the nonexempt lighting.

❑ 3. Lighting not designated for dusk-to-dawn operation is controlled by either a a photosensor (with time switch), or an astronomical time switch.

❑ 4. Lighting designated for dusk-to-dawn operation is controlled by an astronomical time switch or photosensor.

❑ 5. All time switches are capable of retaining programming and the time setting during loss of power for a period of at least 10 hours.

Exterior Lighting Efficacy:

❑ 6. All exterior building grounds luminaires that operate at greater than 100W have minimum efficacy of 60 lumen/watt.

Exceptions:

❑ Lighting that has been claimed as exempt and is identified as such in Section 3 table above.

❑ Lighting that is specifically designated as required by a health or life safety statue, ordinance, or regulation.

❑ Emergency lighting that is automatically off during normal building operation.

❑ Lighting that is controlled by motion sensor.

Exterior Lighting PASSES: Design 31% better than code.

Section 5: Compliance Statement

Compliance Statement: The proposed exterior lighting design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed lighting system has been designed to meet the 2009 IECC requirements in COMcheck Version 3.9.0 and to comply with the mandatory requirements in the Requirements Checklist.

Name - Title | Signature | Date

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201 W. Colfax Ave.
DENVER, COLROADO 80202

CIVIL ENGINEER
SAN ENGINEERING
6099 Windermere St.
LITTLETON, COLORADO 80120
P. 303.953.9014
F. 303.953.9016
www.sanengineeringllc.com

LANDSCAPE ARCHITECT
MUNDUS BISHOP
333 West Colfax Ave. #350
Denver, Colorado 80204
P. 303.865.5500
F. 303.865.5504
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STRUCTURAL ENGINEER
STUDIO NYL
2995 Baseline Road, Suite 314
Boulder, Colorado 80303
P. 303.558.3145
F. 303.440.8536
www.studionyl.com

MECH/PLUMB ENGINEER
BCER ENGINEERING
5420 Ward Road, Suite 200
Arvada, Colorado 80002-1838
P. 303.422.7400
F. 303.422.7900
www.bcer.com

ELECTRICAL ENGINEER
BCER ENGINEERING
5420 Ward Road, Suite 200
Arvada, Colorado 80002-1838
P. 303.422.7400
F. 303.422.7900
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2323 S. Troy Street
Aurora, Colorado 80014
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Denver, Colorado 80204
P. 303.278.1532
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PROJECT:
WEST DENVER BRANCH LIBRARY
1498 NORTH IRVING STREET
DENVER, COLORADO 80204

COLORADO REGISTERED PROFESSIONAL ENGINEER 39041 11/3/12

sDC PROJECT NO: 1020.00
COOD PROJECT NO: CE 02089

ISSUE DATE
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COMCHECK

E-002

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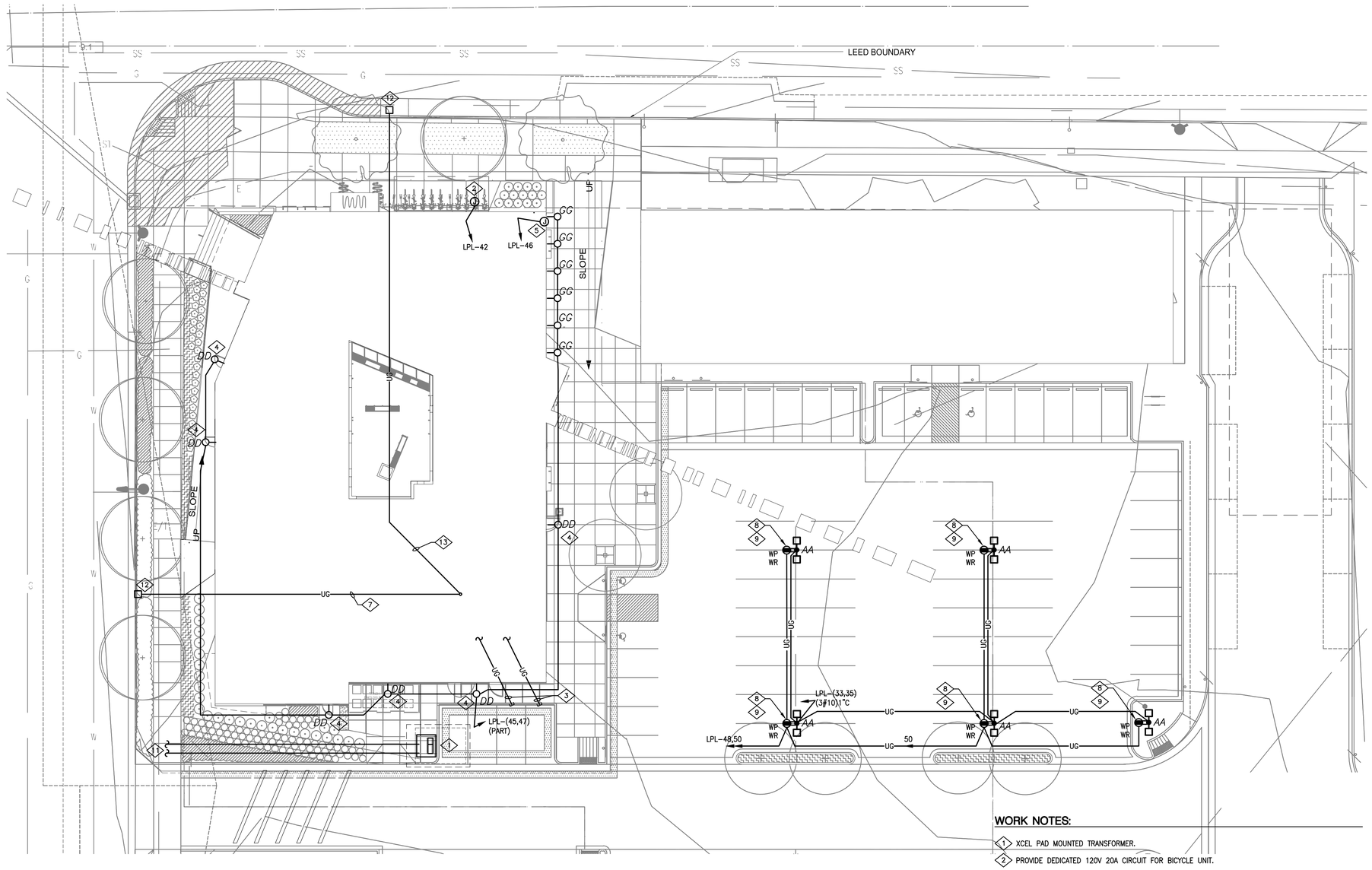

GENERAL NOTES:

1. NEW EXTERIOR LIGHTING SHALL BE CONTROLLED VIA SQUARE D POWER LINK CONTROLLED CIRCUIT BREAKERS.
2. MINIMUM SIZE WIRING TO ALL SITE ELECTRICAL DEVICES TO BE #10AWG UNLESS OTHERWISE NOTED.
3. EACH BRANCH CIRCUIT SHALL HAVE A DEDICATED NEUTRAL. SHARED NEUTRALS ARE NOT PERMITTED IN MULTIPLE CIRCUIT HOMERUNS.

ELECTRICAL SITE PLAN

SCALE: 1/16" = 1'-0"

8' 4' 0 8' 16' 32'

WORK NOTES:

1. XCEL PAD MOUNTED TRANSFORMER.
2. PROVIDE DEDICATED 120V 20A CIRCUIT FOR BICYCLE UNIT.
3. PROVIDE (1) 1-1/2" CONDUIT WITH PULLSTRING TO PANEL "MDS" AND (1) 1" CONDUIT WITH PULLSTRING TO SECOND FLOOR COMMUNICATIONS ROOM FOR POWER AND DATA FOR FUTURE ELECTRIC VEHICLE CHARGING STATION. CONDUITS SHALL BE STUBBED UP AND CAPPED FLUSH WITH FINISHED CONCRETE. COORDINATE EXACT STUB-UP LOCATION WITH CIVIL ENGINEER.
4. REFER TO ARCHITECTURAL ELEVATION DRAWINGS FOR EXACT MOUNTING HEIGHT, AND LOCATION. REMOTE EMERGENCY BATTERY SHALL BE LOCATED IN NEMA 1 ENCLOSURE INSIDE OF BUILDING ON WALL ABOVE DOOR, PAINT ENCLOSURE TO MATCH WALL FINISH. IF GRID CEILING, LOCATE BATTERY PACK ABOVE ACCESSIBLE CEILING.
5. PROVIDE DEDICATED CIRCUIT FOR LIBRARY EXTERIOR LIGHTED SIGN. COORDINATE QUANTITY OF CONNECTIONS AND LOCATIONS WITH SIGN VENDOR.
6. NOT USED.
7. PROVIDE (1) 4" UNDERGROUND CONDUIT FROM SECOND FLOOR IT ROOM TO PROPERTY LINE. CONDUIT SHALL BE CAPPED AND MARKED AT PROPERTY LINE. VERTICAL CONDUIT TO SECOND FLOOR SHALL BE ROUTED IN SHAFT WALL AT APPROXIMATE COLUMN LINE F-4. REFER TO SHEETS TC101 AND TC102 FOR ADDITIONAL INFORMATION.
8. RECEPTACLE SHALL BE MOUNTED ON POLE.
9. POLE BASE AND CONDUIT FROM LIBRARY IS PROVIDED BY DEVELOPER. LUMINAIRE, POLE AND WIRING IS PROVIDED BY THE ELECTRICAL CONTRACTOR.
10. NOT USED.
11. PROVIDE (2) 4" CONDUITS WITH 3' SEPARATION FOR PRIMARY FEED(S) TO XCEL TRANSFORMER. VERIFY EXACT REQUIREMENTS WITH XCEL ENERGY PRIOR TO ROUGH-IN.
12. PROVIDE 24"x24" HAND HOLE FOR COMMUNICATIONS SERVICE TO BUILDING. REFER TO SHEET TC102 FOR ADDITIONAL INFORMATION.
13. PROVIDE (4) 4" UNDERGROUND CONDUIT WITH PULL STRING FROM HAND HOLE TO SECOND FLOOR IT ROOM FOR COMMUNICATIONS SERVICE TO BUILDING. VERTICAL CONDUITS UP TO SECOND FLOOR SHALL BE ROUTED IN SHAFT WALL AT APPROXIMATE COLUMN F-4. REFER TO SHEETS TC101 AND TC102 FOR ADDITIONAL INFORMATION.

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COLORADO REGISTERED PROFESSIONAL ENGINEER 32914 11/30/12

sDC PROJECT NO: 1020.00
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ELECTRICAL SITE PLAN

ES001

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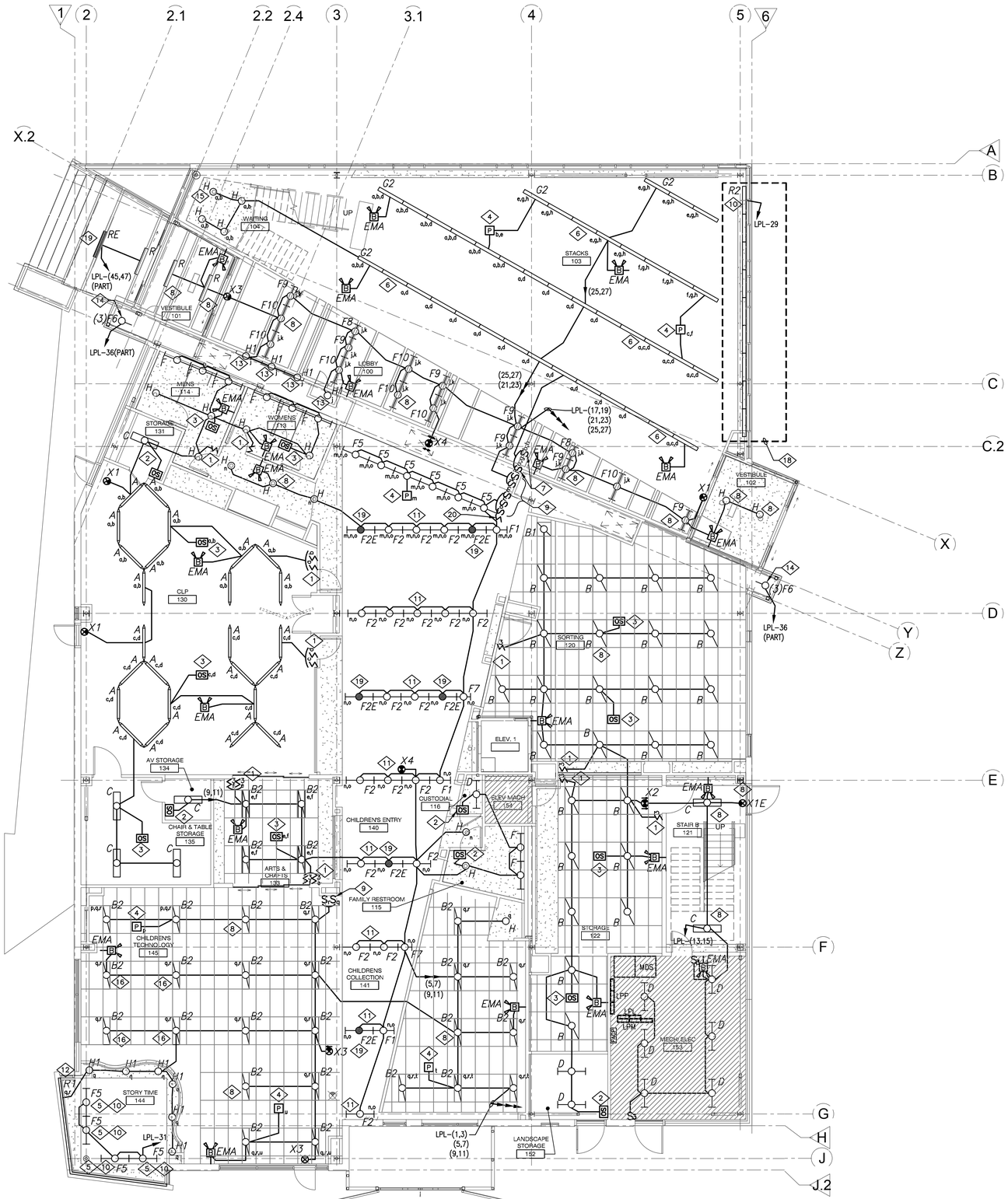

LEVEL 1 LIGHTING PLAN

SCALE: 1/8" = 1'-0"

4' 2' 0 4' 8' 16'

GENERAL NOTES:

1. COORDINATE LUMINAIRE LOCATIONS WITH MECHANICAL DIFFUSERS, DUCTS, ETC..
2. ALL OCCUPANCY SENSORS SHALL BE MANUAL ON/AUTO OFF, UNLESS OTHERWISE NOTED. SET OCCUPANCY SENSOR TIMERS TO 5 MINUTES.
3. EACH BRANCH CIRCUIT SHALL HAVE A DEDICATED NEUTRAL. SHARED NEUTRALS ARE NOT PERMITTED IN MULTIPLE CIRCUIT HOMERUNS.
4. ALL WIRING UNDER ACCESS FLOOR AND IN BACK OF HOUSE CEILING SHALL BE PLENUM RATED.
5. IN AREAS WITHOUT CEILING, CONDUIT SHALL BE MOUNTED TO UNDERSIDE OF EXPOSED DECKING. PRIOR TO START OF WORK, CONTRACTOR SHALL PROVIDE ARCHITECT WITH DRAWING INDICATING THE EXACT ROUTING OF ALL CONDUITS ATTACHED TO THE UNDERSIDE OF EXPOSED DECKING FOR APPROVAL. ALL CONDUITS SHALL BE ROUTED AS NEATLY AS POSSIBLE IN THIS AREA. IF INSTALLATION OF ANY CONDUITS DO NOT MEET ARCHITECTS STANDARDS, CONTRACTOR SHALL REROUTE CONDUITS AT NO ADDITIONAL COST TO THE OWNER.
6. ALL INITIAL LIGHTING CONTROL SHALL BE THROUGH SQUARE D POWER LINK CONTROLLED CIRCUIT BREAKERS. LOCAL AREA CONTROLS SHALL PROVIDE TEMPORARY OVERRIDES.
7. ALL EMERGENCY EGRESS LIGHTING AND NIGHT LIGHTING SHALL BE CONNECTED TO MANUALLY OPERATED PORTION OF CIRCUIT BREAKER.

WORK NOTES:

1. PROVIDE WALL MOUNTED MOMENTARY CONTACT TYPE SWITCH FOR OVERRIDE CONTROL OF CEILING MOUNTED OCCUPANCY SENSOR. OCCUPANCY SENSOR SHALL BE SET FOR MANUAL "ON" AUTOMATIC "OFF" OPERATION WITH A TIME DELAY UNTIL OFF OF 5 MINUTES.
2. PROVIDE WALL MOUNTED PASSIVE INFRARED TYPE OCCUPANCY SENSOR WATTSTOPPER #PW-100. OCCUPANCY SENSOR SHALL BE SET FOR MANUAL "ON" AUTOMATIC "OFF" OPERATION WITH A TIME DELAY UNTIL OFF OF 5 MINUTES.
3. PROVIDE CEILING MOUNTED DUAL TECHNOLOGY TYPE OCCUPANCY SENSOR WATTSTOPPER DT-300 SERIES WITH COMPATIBLE POWER PACK(S).
4. PROVIDE DUAL LEVEL CEILING MOUNTED PHOTOSENSOR, WATTSTOPPER #LS-102, WITH APPROPRIATE POWERPACK(S). SWITCH "ON" WILL TURN ON THE LIGHTS TO 50%, IF ADEQUATE DAYLIGHTING IS REACHED, THE SENSOR WILL NOT ALLOW ADDITIONAL LIGHTS TO TURN ON. IF ADEQUATE DAYLIGHTING IS NOT AVAILABLE, SENSOR WILL AUTOMATICALLY TURN ON LIGHTS TO 100%.
5. LUMINAIRE SHALL BE MOUNTED ON TOP OF BEAM.
6. 4' SECTION OF LUMINAIRE SHALL BE NIGHT LIGHT AND SHALL REMAIN UNSWITCHED. CONNECT TO MANUALLY OPERATED PORTION OF CIRCUIT BREAKER.
7. PROVIDE TWO-POLE SWITCH ASSOCIATED PHOTOSENSOR SHALL BE CONNECTED AFTER SWITCH, VERIFY WIRING REQUIREMENTS WITH SENSOR MANUFACTURER.
8. LUMINAIRE SHALL BE NIGHT LIGHT AND SHALL REMAIN UNSWITCHED. CONNECT TO MANUALLY OPERATED PORTION OF CIRCUIT BREAKER.
9. PHOTOSENSOR SHALL BE CONNECTED AFTER SWITCH, VERIFY WIRING REQUIREMENTS WITH SENSOR MANUFACTURER.
10. ON-OFF CONTROL OF LUMINAIRE SHALL BE PROVIDED BY EXTERIOR PHOTOCELL.
11. LUMINAIRE SHALL BE MOUNTED TO UNDERSIDE OF STRUCTURAL BEAM. CONDUIT TO LUMINAIRE SHALL BE MOUNTED IN FLANGE OF BEAM AND SHALL NOT BE VISIBLE FROM BELOW.
12. REFER TO ARCHITECTURAL DRAWINGS FOR EXACT DIMENSIONS AND MOUNTING OF LUMINAIRE.
13. LUMINAIRE SHALL BE CENTERED IN CEILING OF ART NICHE.
14. MOUNT TOTAL OF THREE TYPE "F6" LUMINAIRES VERTICALLY, END TO END, IN THE WONDERWALL BETWEEN THE FIRST FLOOR AND UNDERSIDE OF SECOND FLOOR DECK. REFER TO ARCHITECTURAL DETAILS FOR ADDITIONAL INFORMATION.
15. ROUTING OF CONDUITS TO LUMINAIRES MOUNTED ON UNDERSIDE OF STAIR CANOPY SHALL BE COORDINATED WITH ARCHITECT PRIOR TO START OF WORK. EXPOSED CONDUIT IS NOT PERMITTED IN THESE AREAS.
16. IF ADD ALTERNATE FOR ADDITIONAL GLAZING IS ACCEPTED, LUMINAIRE SHALL ALSO BE CONTROLLED BY ADJACENT PHOTOSENSOR "p'.
17. NOT USED.
18. INSTALLATION OF LUMINAIRE TYPE "R2" IN THIS AREA SHALL BE ADD ALTERNATE #5.
19. LUMINAIRE SHALL HAVE EMERGENCY BATTERY PACK. CONNECT TO MANUALLY OPERATED PORTION OF CIRCUIT BREAKER.
20. PROVIDE LOW VOLTAGE SWITCH CONNECTED TO POWERLINK CONTROL PANEL FOR ON-OFF CONTROL OF ALL LUMINAIRES ON THE FLOOR. COORDINATE EXACT LOCATION WITH OWNER PRIOR TO START OF WORK.

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DENVER, COLORADO 80204

sDC PROJECT NO: 1020.00
COOD PROJECT NO: CE 02089

REGISTERED PROFESSIONAL ENGINEER — COLORADO — 32944 — 1/13/12

ISSUE DATE 01-12-2012

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LEVEL 1 LIGHTING PLAN

E-101

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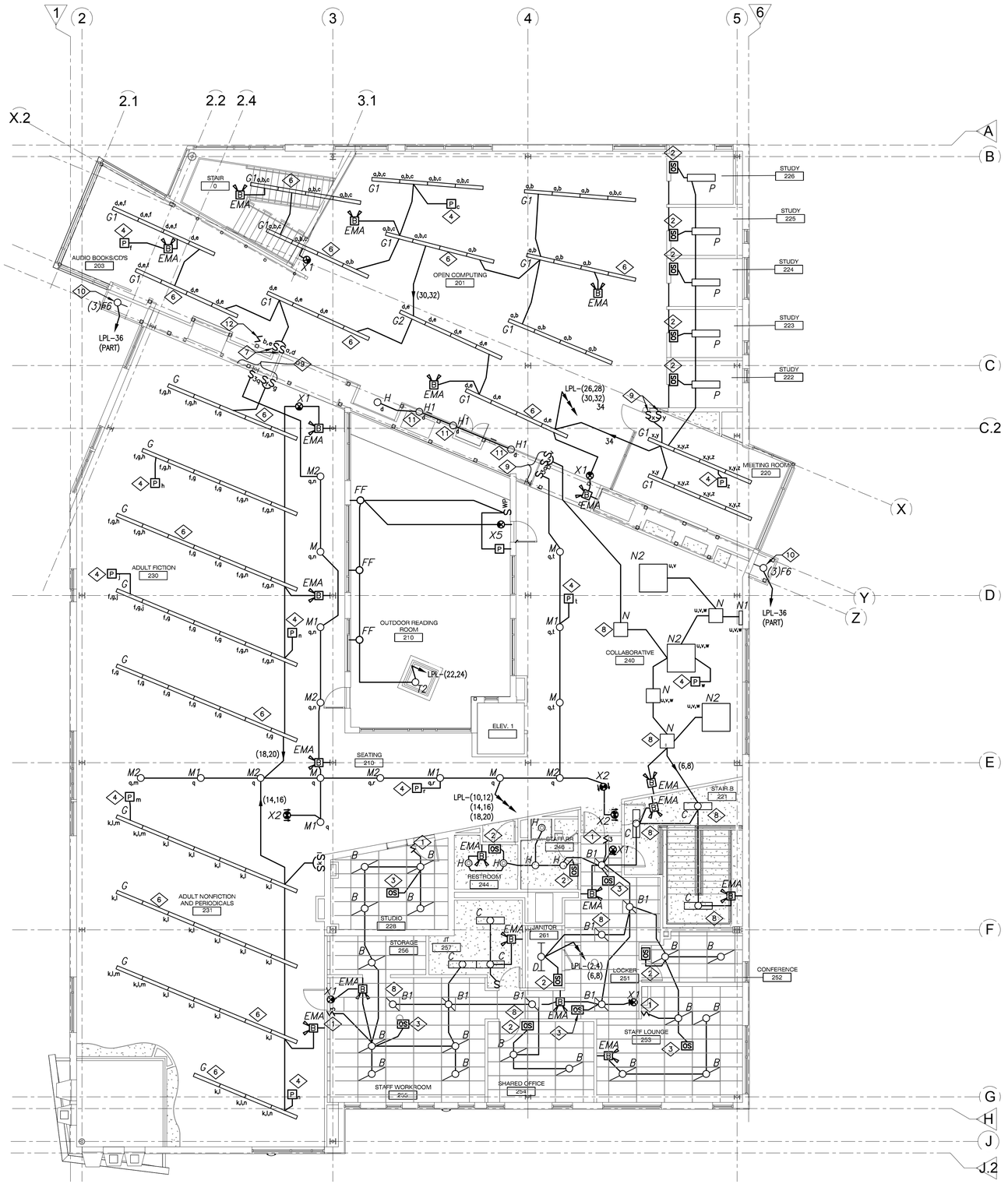

LEVEL 2 LIGHTING PLAN

SCALE: 1/8" = 1'-0"

4' 2' 0 4' 8' 16'

GENERAL NOTES:

1. COORDINATE LUMINAIRE LOCATIONS WITH MECHANICAL DIFFUSERS, DUCTS, ETC..
2. ALL OCCUPANCY SENSORS SHALL BE MANUAL ON/AUTO OFF, UNLESS OTHERWISE NOTED. SET OCCUPANCY SENSOR TIMERS TO 5 MINUTES.
3. EACH BRANCH CIRCUIT SHALL HAVE A DEDICATED NEUTRAL. SHARED NEUTRALS ARE NOT PERMITTED IN MULTIPLE CIRCUIT HOMERUNS.
4. ALL WIRING UNDER ACCESS FLOOR AND IN BACK OF HOUSE CEILING SHALL BE PLENUM RATED.
5. IN AREAS WITHOUT CEILING, CONDUIT SHALL BE MOUNTED TO UNDERSIDE OF EXPOSED DECKING. PRIOR TO START OF WORK, CONTRACTOR SHALL PROVIDE ARCHITECT WITH DRAWING INDICATING THE EXACT ROUTING OF ALL CONDUITS ATTACHED TO THE UNDERSIDE OF EXPOSED DECKING FOR APPROVAL. ALL CONDUITS SHALL BE ROUTED AS NEATLY AS POSSIBLE IN THIS AREA. IF INSTALLATION OF ANY CONDUITS DO NOT MEET ARCHITECTS STANDARDS, CONTRACTOR SHALL REROUTE CONDUITS AT NO ADDITIONAL COST TO THE OWNER.
6. ALL INITIAL LIGHTING CONTROL SHALL BE THROUGH SQUARE D POWER LINK CONTROLLED CIRCUIT BREAKERS. LOCAL AREA CONTROLS SHALL PROVIDE TEMPORARY OVERRIDES.
7. ALL EMERGENCY EGRESS LIGHTING AND NIGHT LIGHTING SHALL BE CONNECTED TO MANUALLY OPERATED PORTION OF CIRCUIT BREAKER.

WORK NOTES:

1. PROVIDE WALL MOUNTED MOMENTARY CONTACT TYPE SWITCH FOR OVERRIDE CONTROL OF CEILING MOUNTED OCCUPANCY SENSOR. OCCUPANCY SENSOR SHALL BE SET FOR MANUAL "ON" AUTOMATIC "OFF" OPERATION WITH A TIME DELAY UNTIL OFF OF 5 MINUTES.
2. PROVIDE WALL MOUNTED PASSIVE INFRARED TYPE OCCUPANCY SENSOR WATTSTOPPER #PW-100. OCCUPANCY SENSOR SHALL BE SET FOR MANUAL "ON" AUTOMATIC "OFF" OPERATION WITH A TIME DELAY UNTIL OFF OF 5 MINUTES.
3. PROVIDE CEILING MOUNTED DUAL TECHNOLOGY TYPE OCCUPANCY SENSOR WATTSTOPPER DT-300 SERIES WITH COMPATIBLE POWER PACK(S).
4. PROVIDE DUAL LEVEL CEILING MOUNTED PHOTOSENSOR, WATTSTOPPER #LS-102, WITH APPROPRIATE POWERPACK(S). SWITCH "ON" WILL TURN ON THE LIGHTS TO 50%, IF ADEQUATE DAYLIGHTING IS REACHED, THE SENSOR WILL NOT ALLOW ADDITIONAL LIGHTS TO TURN ON. IF ADEQUATE DAYLIGHTING IS NOT AVAILABLE, SENSOR WILL AUTOMATICALLY TURN ON LIGHTS TO 100%.
5. INSTALLATION OF LUMINAIRE TYPE "F5" IN THIS AREA SHALL BE ADD ALTERNATE #9c.
6. 4' SECTION OF LUMINAIRE SHALL BE NIGHT LIGHT AND SHALL REMAIN UNSWITCHED. CONNECT TO MANUALLY OPERATED PORTION OF CIRCUIT BREAKER.
7. PROVIDE TWO-POLE SWITCH ASSOCIATED PHOTOSENSOR SHALL BE CONNECTED AFTER SWITCH, VERIFY WIRING REQUIREMENTS WITH SENSOR MANUFACTURER.
8. LUMINAIRE SHALL BE NIGHT LIGHT AND SHALL REMAIN UNSWITCHED. CONNECT TO MANUALLY OPERATED PORTION OF CIRCUIT BREAKER.
9. PHOTOSENSOR SHALL BE CONNECTED AFTER SWITCH, VERIFY WIRING REQUIREMENTS WITH SENSOR MANUFACTURER.
10. MOUNT TOTAL OF THREE TYPE "F6" LUMINAIRES VERTICALLY, END TO END, IN THE WONDERWALL BETWEEN THE SECOND FLOOR AND UNDERSIDE OF ROOF DECK. REFER TO ARCHITECTURAL DETAILS FOR ADDITIONAL INFORMATION.
11. LUMINAIRE SHALL BE CENTERED IN CEILING OF ART NICHE.
12. PROVIDE LOW VOLTAGE SWITCH CONNECTED TO POWERLINK CONTROL PANEL FOR ON-OFF CONTROL OF ALL LUMINAIRES ON THE FLOOR. COORDINATE EXACT LOCATION WITH OWNER PRIOR TO START OF WORK.

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LEVEL 2 LIGHTING PLAN

E-102

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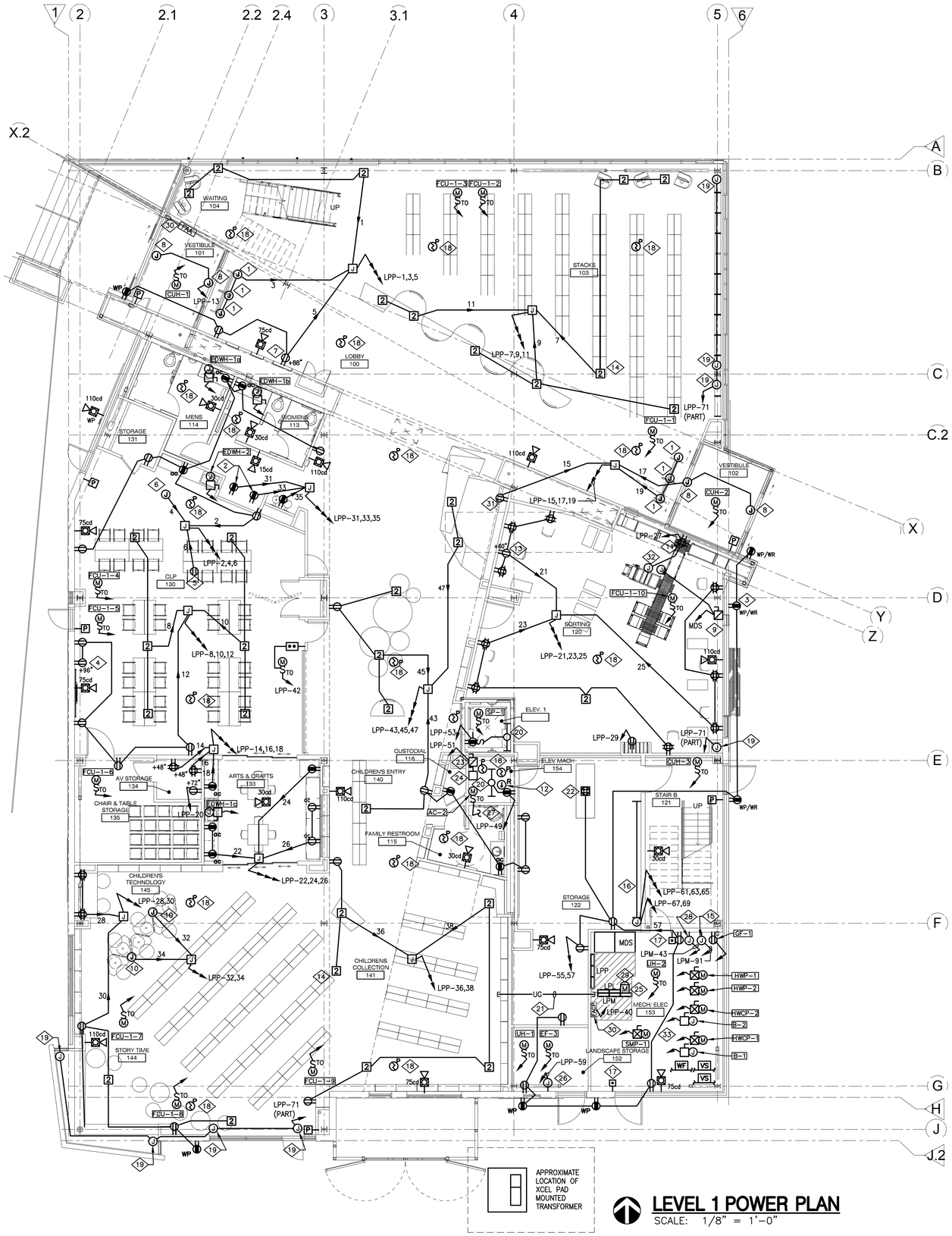

LEVEL 1 POWER PLAN

SCALE: 1/8" = 1'-0"

4' 2' 0 4' 8' 16'

GENERAL NOTES:

1. VERIFY DEVICE MOUNTING HEIGHTS AND LOCATIONS WITH ARCHITECTURAL ELEVATIONS/ARCHITECT.
2. PROVIDE FIRE ALARM INTERFACE FOR FIRE PROTECTION SYSTEM. COORDINATE EXACT REQUIREMENTS WITH FIRE PROTECTION CONTRACTOR.
3. REFER TO MECHANICAL AND PLUMBING DRAWINGS FOR EXACT LOCATIONS AND ELECTRICAL REQUIREMENTS OF EQUIPMENT.
4. REFER TO MECHANICAL EQUIPMENT SCHEDULE ON SHEET E-201 FOR ELECTRICAL REQUIREMENTS AND BRANCH CIRCUITING INFORMATION FOR ALL MECHANICAL EQUIPMENT.
5. EACH BRANCH CIRCUIT SHALL HAVE A DEDICATED NEUTRAL. SHARED NEUTRALS ARE NOT PERMITTED IN MULTIPLE CIRCUIT HOMERUNS.
6. WHEN TWO (2) OR MORE CIRCUITS ARE FEEDING A SINGLE RACEWAY STRIP ALTERNATE CIRCUITING TO RECEPTACLES.
7. REFER TO SECURITY, AUDIO VISUAL AND TELECOMMUNICATIONS DRAWINGS FOR EXACT REQUIREMENTS OF DEVICES TO BE PROVIDED BY ELECTRICAL CONTRACTOR.
8. ELECTRICAL CONTRACTOR TO PROVIDE CONDUITS, SLEEVES, BACKBOXES, FIRESTOP PENTRATIONS AND FIRESTOP CONDUIT AND SLEEVES FOR THE TELECOM SYSTEM. SEE TELECOM DRAWINGS FOR EXACT DETAILS.
9. THE ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING A COMPLETE UNDERFLOOR MODULAR WIRING SYSTEM FROM PANELBOARDS TO FINAL CONNECTION; RAISED FLOOR BOX OR OTHER END-POINT POWER DEVICE. SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION, DETAILS AND REQUIREMENTS.
10. MODULAR WIRING HOMERUNS AND BRANCH CIRCUITS SHALL BE ROUTED TO THE GREATEST EXTENT POSSIBLE BENEATH OPEN AREAS TO MAINTAIN MAXIMUM FUTURE FLEXIBILITY.
11. ALL RAISED FLOOR BOXES SHALL HAVE 10' OF EXCESS CABLE FOR EASE OF MOVEMENT.
12. LOCATION OF FLOOR BOXES IS FURNITURE DEPENDANT, CONTRACTOR SHALL RELOCATE ANY FLOOR BOX REQUESTED BY OWNER/ARCHITECT DURING CONSTRUCTION WITHIN 10' OF INSTALLED LOCATION AT NO ADDITIONAL COST TO THE OWNER.
13. WHERE CIRCUITRY AND ACCESS ALLOWS CONNECT WALL MOUNTED DUPLEX RECEPTACLES TO THE UNDER ACCESS FLOOR MODULAR WIRING SYSTEM.
14. RAISED ACCESS FLOOR SHALL BE GROUNDED PER MANUFACTURER'S RECOMMENDATIONS.
15. ALL BOXES MOUNTED IN RAISED FLOOR TILES SHALL BE CENTERED IN THE CORNER OF THE TILES.
16. PROVIDE FOR UNDERFLOOR WIRING SYSTEM:
    - [J] 4" SQUARE JUNCTION BOX LOCATED BELOW RAISED FLOOR. WALKERFLEX WIRE CONNECTORS SHALL BE PROVIDED FOR INCOMING AND OUTGOING POWER CIRCUITING. A MAXIMUM OF THREE BRANCH CIRCUITS SHALL BE ROUTED THROUGH EACH JUNCTION BOX. JUNCTION BOXES SHALL BE ASSEMBLED BY THE ELECTRICAL CONTRACTOR UTILIZING PARTS PURCHASED FROM WIREMOLD.
    - [2] 10" DIAMETER RAISED FLOOR BOX WITH TWO DUPLEX RECEPTACLES IN POSITIONS 1 & 2 AND BLANK COVERPLATES IN POSITIONS 3 & 4 WIREMOLD #CRFB-CRFBBTCNK-CRFB-D-1-CRFB-D-2- CRFB-B-3-CRFB-B-4. REFER TO TELECOMMUNICATIONS AND AUDIO/VISUAL DRAWINGS FOR ADDITIONAL DEVICE/FACEPLATE REQUIREMENTS IN POSITIONS 3 & 4.
    - [3] 10" DIAMETER RAISED FLOOR BOX WITH THREE DUPLEX RECEPTACLES IN POSITIONS 1, 2 & 3 AND BLANK COVERPLATE IN POSITION 4 WIREMOLD #CRFB-CRFBBTCNK-CRFB-D-1-CRFB-D-2- CRFB-D-3-CRFB-B-4. REFER TO TELECOMMUNICATIONS AND AUDIO/VISUAL DRAWINGS FOR ADDITIONAL DEVICE/FACEPLATE REQUIREMENTS IN POSITION 4.
17. IN AREAS WITHOUT CEILING, CONDUIT SHALL BE MOUNTED TO UNDERSIDE OF EXPOSED DECKING. PRIOR TO START OF WORK, CONTRACTOR SHALL PROVIDE ARCHITECT WITH DRAWING INDICATING THE EXACT ROUTING OF ALL CONDUITS ATTACHED TO THE UNDERSIDE OF EXPOSED DECKING FOR APPROVAL. ALL CONDUITS SHALL BE ROUTED AS NEATLY AS POSSIBLE IN THIS AREA. IF INSTALLATION OF ANY CONDUITS DO NOT MEET ARCHITECTS STANDARDS, CONTRACTOR SHALL REROUTE CONDUITS AT NO ADDITIONAL COST TO THE OWNER.
18. RECEPTACLES SHALL BE LOCATED WITHIN 9" OF WALL MOUNTED TELECOMMUNICATIONS AND AUDIOVISUAL OUTLETS. CONTRACTOR SHALL RELOCATE ASSOCIATED DEVICE(S) WHICH ARE NOT INSTALLED WITHIN 9" OF EACH OTHER AT THE REQUEST OF THE ARCHITECT AND/OR THE ENGINEER AT NO ADDITIONAL COST TO THE OWNER. REFER TO TELECOMMUNICATIONS AND AUDIOVISUAL DRAWINGS FOR ADDITIONAL INFORMATION.

WORK NOTES:

1. PROVIDE 120V POWER CONNECTION TO SECURITY GATES. VERIFY WITH SECURITY GATE VENDOR EXACT LOCATION OF UNDERFLOOR JUNCTION BOXES AND ELECTRICAL REQUIREMENTS PRIOR TO ROUGH-IN.
2. GFCI TYPE RECEPTACLE FOR VENDING MACHINE SHALL BE MOUNTED ABOVE VENDING MACHINE AND SHALL BE ACCESSIBLE WHEN VENDING MACHINE IS INSTALLED.
3. PROVIDE WP/WR GFCI DUPLEX RECEPTACLE FOR EXTERIOR WIRELESS ACCESS POINT. PROVIDE AN ADDITIONAL WP BACKBOX FOR THE DATA OUTLET WITH 1" CONDUIT AND PULLSTRING TO ACCESSIBLE CEILING SPACE. COORDINATE WITH TELECOM VENDOR FOR EXACT LOCATION.
4. PROVIDE RECEPTACLE FOR DIGITAL WHITE BOARD. REFER TO A/V DRAWINGS FOR EXACT MOUNTING HEIGHTS. COORDINATE WITH A/V CONTRACTOR.
5. PROVIDE CEILING MOUNTED DUPLEX RECEPTACLE FOR PROJECTOR. COORDINATE EXACT LOCATION WITH A/V CONTRACTOR.
6. PROVIDE 120V POWER FOR CEILING MOUNTED MOTORIZED SCREEN. COORDINATE SWITCH LOCATION WITH A/V CONTRACTOR.
7. PROVIDE RECEPTACLE FOR LCD. VERIFY EXACT LOCATION WITH A/V CONTRACTOR.
8. PROVIDE 120V POWER FOR AUTOMATIC MOTORIZED DOORS. COORDINATE EXACT REQUIREMENTS AND CONNECTION LOCATION WITH ARCHITECT PRIOR TO START OF WORK.
9. PROVIDE 100A 3P FUSIBLE DISCONNECT SWITCH WITH 80A FUSES FOR BOOK SORTER. COORDINATE LOCATIONS OF ALL ELECTRICAL OUTLETS FOR BOOK SORTER AND VERIFY CONNECTIONS TO CONTROL PANEL AND SMART BINS WITH VENDOR. REFER TO ELECTRICAL ONE-LINE DIAGRAM ON SHEET E-201 FOR FEEDER INFORMATION.
10. PROVIDE JUNCTION BOX LOCATED UNDER RAISED FLOOR FOR HARDWIRED CONNECTION TO POWERED FURNITURE PEDESTAL. ELECTRICAL CONTRACTOR SHALL PROVIDE FINAL CONNECTION TO AND ALL REQUIRED WIRING WITHIN FURNITURE.
11. PROVIDE DOUBLE DUPLEX RECEPTACLE AND DATA OUTLET FOR BOOK SORTER PC CONNECTION. COORDINATE EXACT LOCATION WITH BOOK SORTER VENDOR.
12. HEAT DETECTOR(S) SHALL BE LOCATED ADJACENT TO EACH SPRINKLER HEAD IN ROOM, TEMPERATURE RATING OF DETECTOR SHALL BE LESS THAN SPRINKLER HEAD. COORDINATE WITH SPRINKLER CONTRACTOR.
13. PROVIDE RECEPTACLE FOR SECURITY MONITOR. COORDINATE EXACT LOCATION WITH SECURITY CONTRACTOR.
14. FLOOR BOX IS FOR LOOKUP STATION LOCATED AT THE END OF THE BOOK STACK.
15. PROVIDE 120V POWER TO LEAK DETECTION CONTROL PANEL. COORDINATE WITH MECHANICAL CONTRACTOR.
16. PROVIDE WIREMOLD 3000 SERIES RACEWAY WITH 5 DUPLEX RECEPTACLES SPACED EVERY 22" AT +48" AFF FOR SMART BINS. CONNECT TWO DUPLEX RECEPTACLES PER CIRCUIT. VERIFY WITH OWNER/ARCHITECT PRIOR TO ORDERING FOR EXACT REQUIREMENTS.
17. PROVIDE EMERGENCY POWER OFF PUSH BUTTON (EPO) TO TURN OFF POWER TO HOT WATER BOILER. CONNECT TO SHUNT TRIP BREAKER FEEDING BOILER. COORDINATE WITH MECHANICAL/PLUMBING CONTRACTOR.
18. SMOKE DETECTOR SHALL BE INSTALLED UNDER RAISED ACCESS FLOOR.
19. PROVIDE 120V CONNECTION TO MOTORIZED SHADES. COORDINATE WITH SHADE VENDOR.
20. PROVIDE LUMINAIRE TYPE "D". CONNECT LIGHT AHEAD OF GFI PROTECTION OF THE RECEPTACLE PER CODE.
21. PROVIDE UNDERGROUND CONDUITS AS REQUIRED FOR BRANCH CIRCUITING BETWEEN ELECTRICAL ROOM AND RAISED FLOOR AREA. PROVIDE (10) SPARE 1" CONDUITS UNDERGROUND BETWEEN ELECTRICAL ROOM AND RAISED FLOOR AREA FOR FUTURE WIRING. CONDUITS SHALL SUTB-UP IN ELECTRICAL ROOM AND UNDER RAISED FLOORING. CONTRACTOR SHALL SEAL ALL UNUSED CONDUITS WITH EASILY REMOVABLE MATERIAL.
22. PROVIDE THREE GANG FLUSH MOUNTED FLOOR BOX WITH TWO 20A DUPLEX RECEPTACLES AND ONE GFCI DEVICE OPENING FOR COMMUNICATIONS CABLING WIREMOLD #(3)880MP-(3)880MPA-838TCAL-(3)828GFITCAL OR APPROVED EQUAL. PROVIDE 1" CONDUIT FROM COMMUNICATIONS SECTION TO ABOVE ACCESSIBLE CEILING FOR COMMUNICATIONS WIRING. COORDINATE FLANGE REQUIREMENT WITH FLOOR FINISH.
23. PROVIDE 120V POWER FOR ELEVATOR CAB LIGHTING AND CONTROL PANEL. PROVIDE 20A1P FUSIBLE, LOCKABLE DISCONNECT FOR OVERCURRENT PROTECTION OF THE 120V CIRCUIT PER NEC 620.53.
24. PROVIDE LOCKABLE DISCONNECTS WITH AUXILIARY CONTACTS FOR CONNECTION TO ELEVATOR CONTROLLER. WHEN DISCONNECT IS IN THE "OFF" POSITION THE ELEVATOR WILL DISABLE THE "EM" MODE. REFER TO ONE-LINE DIAGRAM ON SHEET E-201 FOR FEEDER INFORMATION.
25. PANELS SHALL BE MOUNTED BACK TO BACK ON UNISTRUT RACK FABRICATED BY ELECTRICAL CONTRACTOR.
26. PROVIDE 120V CONNECTION FOR IRRIGATION CONTROLLER, COORDINATE WITH IRRIGATION CONTRACTOR.
27. POWER TO FAN COIL UNIT PROVIDED FROM CONDENSING UNIT MOUNTED ON ROOF. ELECTRICAL CONTRACTOR SHALL PROVIDE ALL REQUIRED INTERCONNECTION WIRING. COORDINATE EXACT REQUIREMENTS WITH MECHANICAL CONTRACTOR.
28. PROVIDE 120V POWER TO MECHANICAL CONTROL PANEL. COORDINATE WITH MECHANICAL CONTRACTOR.
29. OWNER METERS SHALL BE MOUNTED TO UNISTRUT RACK. REFER TO ONE-LINE DIAGRAM FOR ADDITIONAL INFORMATION.
30. CONFIRM LOCATION WITH CITY OF DENVER FIRE DEPARTMENT.
31. COORDINATE EXACT LOCATION AND MOUNTING HEIGHT WITH CASEWORK SHOP DRAWINGS.
32. PROVIDE 120V POWER TO BOOK SORTER. COORDINATE WITH VENDOR.
33. CONDUITS ASSOCIATED WITH PHOTOVOLTAIC SYSTEM SHALL BE INCLUDED IN BASE BID. PROVIDE ALL CONDUITS BETWEEN THE SYSTEM, INVERTER, AND SWITCHBOARD AS REQUIRED FOR A COMPLETE AND OPERABLE PHOTOVOLTAIC SYSTEM.

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LEVEL 1 POWER PLAN

E-103

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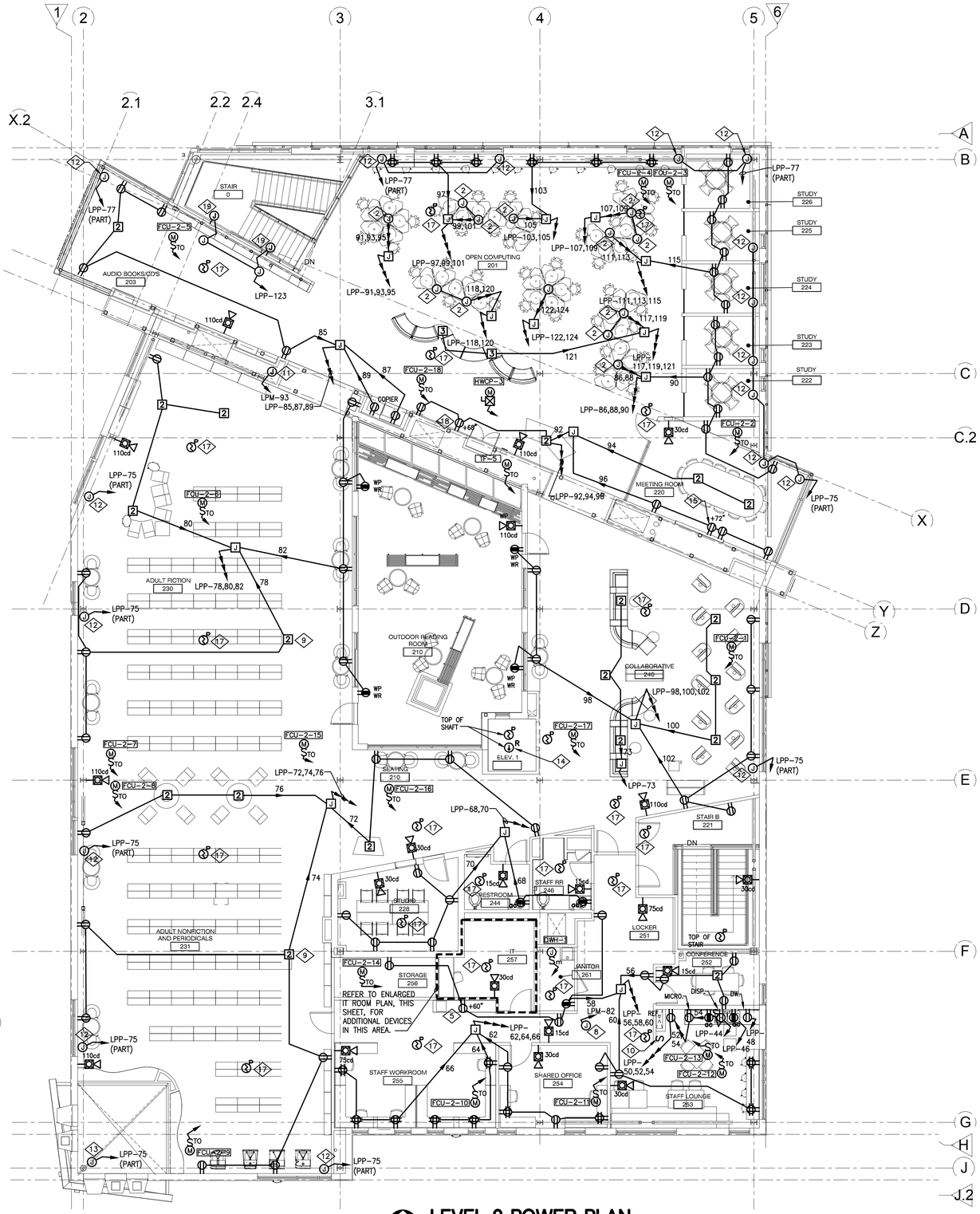
XREFS=(xx-tb, xx-lvl 1, xc-lvl 1 - p) Layouts=(E-103 LEVEL 1 POWER PLAN)
DIMSCALE=1 F:\43810006\Dwg\West Denver Branch Library\Sheets\Electrical\E-103 LEVEL 1 POWER PLAN.dwg DEC 1, 2011 9:54AM LGC

ENLARGED IT ROOM
SCALE: 1/4" = 1'-0"

2' 1' 0 2' 4' 8'



LEVEL 2 POWER PLAN
SCALE: 1/8" = 1'-0"

4' 2' 0 4' 8' 16'

GENERAL NOTES:

1. VERIFY DEVICE MOUNTING HEIGHTS AND LOCATIONS WITH ARCHITECTURAL ELEVATIONS.
2. PROVIDE FIRE ALARM INTERFACE FOR FIRE PROTECTION SYSTEM. COORDINATE EXACT REQUIREMENTS WITH FIRE PROTECTION CONTRACTOR.
3. REFER TO MECHANICAL AND PLUMBING DRAWINGS FOR EXACT LOCATIONS AND ELECTRICAL REQUIREMENTS OF EQUIPMENT.
4. REFER TO MECHANICAL EQUIPMENT SCHEDULE ON SHEET E-201 FOR ELECTRICAL REQUIREMENTS AND BRANCH CIRCUITING INFORMATION FOR ALL MECHANICAL EQUIPMENT.
5. EACH BRANCH CIRCUIT SHALL HAVE A DEDICATED NEUTRAL. SHARED NEUTRALS ARE NOT PERMITTED IN MULTIPLE CIRCUIT HOMERUNS.
6. WHEN TWO (2) OR MORE CIRCUITS ARE FEEDING A SINGLE RACEWAY STRIP ALTERNATE CIRCUITING TO RECEPTACLES.
7. REFER TO SECURITY, AUDIO VISUAL AND TELECOMMUNICATIONS DRAWINGS FOR EXACT REQUIREMENTS OF DEVICES TO BE PROVIDED BY ELECTRICAL CONTRACTOR.
8. ELECTRICAL CONTRACTOR TO PROVIDE CONDUITS, SLEEVES, BACKBOXES, FIRESTOP PENTRATIONS AND FIRESTOP CONDUIT AND SLEEVES FOR THE TELECOM SYSTEM. SEE TELECOM DRAWINGS FOR EXACT DETAILS.
9. THE ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING A COMPLETE UNDERFLOOR MODULAR WIRING SYSTEM FROM PANELBOARDS TO FINAL CONNECTION; RAISED FLOOR BOX OR OTHER END-POINT POWER DEVICE. SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION, DETAILS AND REQUIREMENTS.
10. MODULAR WIRING HOMERUNS AND BRANCH CIRCUITS SHALL BE ROUTED TO THE GREATEST EXTENT POSSIBLE BENEATH OPEN AREAS TO MAINTAIN MAXIMUM FUTURE FLEXIBILITY.
11. ALL RAISED FLOOR BOXES SHALL HAVE 10' OF EXCESS CABLE FOR EASE OF MOVEMENT WHEN NEEDED.
12. WHERE CIRCUITRY AND ACCESS ALLOWS CONNECT WALL MOUNTED DUPLEX RECEPTACLES TO THE UNDER ACCESS FLOOR MODULAR WIRING SYSTEM.
13. RAISED ACCESS FLOOR SHALL BE GROUNDED PER MANUFACTURER'S RECOMMENDATIONS.
14. ALL BOXES MOUNTED IN RAISED FLOOR TILES SHALL BE CENTERED IN THE CORNER OF THE TILES.
15. PROVIDE FOR UNDERFLOOR WIRING SYSTEM:

    [J] 4" SQUARE JUNCTION BOX LOCATED BELOW RAISED FLOOR. WALKERFLEX WIRE CONNECTORS SHALL BE PROVIDED FOR INCOMING AND OUTGOING POWER CIRCUITING. A MAXIMUM OF THREE BRANCH CIRCUITS SHALL BE ROUTED THROUGH EACH JUNCTION BOX. JUNCTION BOXES SHALL BE ASSEMBLED BY THE ELECTRICAL CONTRACTOR UTILIZING PARTS PURCHASED FROM WIREMOLD.

    [2] 10" DIAMETER RAISED FLOOR BOX WITH TWO DUPLEX RECEPTACLES IN POSITIONS 1 & 2 AND BLANK COVERPLATES IN POSITIONS 3 & 4 WIREMOLD #CRFB-CRFBBTCNK-CRFB-D-1-CRFB-D-2-CRFB-B-3-CRFB-B-4. REFER TO TELECOMMUNICATIONS AND AUDIO/VISUAL DRAWINGS FOR ADDITIONAL DEVICE/FACEPLATE REQUIREMENTS IN POSITIONS 3 & 4.

    [3] 10" DIAMETER RAISED FLOOR BOX WITH THREE DUPLEX RECEPTACLES IN POSITIONS 1, 2 & 3 AND BLANK COVERPLATE IN POSITION 4 WIREMOLD #CRFB-CRFBBTCNK-CRFB-D-1-CRFB-D-2-CRFB-D-3-CRFB-B-4. REFER TO TELECOMMUNICATIONS AND AUDIO/VISUAL DRAWINGS FOR ADDITIONAL DEVICE/FACEPLATE REQUIREMENTS IN POSITION 4.

16. IN AREAS WITHOUT CEILING, CONDUIT SHALL BE MOUNTED TO UNDERSIDE OF EXPOSED DECKING. PRIOR TO START OF WORK, CONTRACTOR SHALL PROVIDE ARCHITECT WITH DRAWING INDICATING THE EXACT ROUTING OF ALL CONDUITS ATTACHED TO THE UNDERSIDE OF EXPOSED DECKING FOR APPROVAL. ALL CONDUITS SHALL BE ROUTED AS NEATLY AS POSSIBLE IN THIS AREA. IF INSTALLATION OF ANY CONDUITS DO NOT MEET ARCHITECTS STANDARDS, CONTRACTOR SHALL REROUTE CONDUITS AT NO ADDITIONAL COST TO THE OWNER.
17. RECEPTACLES SHALL BE LOCATED WITHIN 9" OF WALL MOUNTED TELECOMMUNICATIONS AND AUDIOVISUAL OUTLETS. CONTRACTOR SHALL RELOCATE ASSOCIATED DEVICE(S) WHICH ARE NOT INSTALLED WITHIN 9" OF EACH OTHER AT THE REQUEST OF THE ARCHITECT AND/OR ENGINEER AT NO ADDITIONAL COST TO THE OWNER. REFER TO TELECOMMUNICATIONS AND AUDIOVISUAL DRAWINGS FOR ADDITIONAL INFORMATION.

WORK NOTES:

1. APPROXIMATE STUB-UP LOCATION OF COMMUNICATIONS CONDUITS FOR FUTURE VEHICLE CHARGING STATION. REFER TO ELECTRICAL SITE PLAN FOR ADDITIONAL INFORMATION.
2. PROVIDE JUNCTION BOX LOCATED UNDER RAISED FLOOR FOR HARDWIRED CONNECTION TO POWERED FURNITURE PEDESTAL. ELECTRICAL CONTRACTOR SHALL PROVIDE FINAL CONNECTION TO AND ALL REQUIRED WIRING WITHIN FURNITURE.
3. PROVIDE 18" LONG X 4" WIDE GROUNDING BUSBAR AT 18" AFF. CONNECT BUSBAR TO MAIN GROUNDING ELECTRODE SYSTEM, REFER TO ONE-LINE DIAGRAM ON SHEET E-201.
4. POWER TO FAN COIL UNIT PROVIDED FROM CONDENSING UNIT MOUNTED ON ROOF. ELECTRICAL CONTRACTOR SHALL PROVIDE ALL REQUIRED INTERCONNECTION WIRING. COORDINATE EXACT REQUIREMENTS WITH MECHANICAL CONTRACTOR.
5. PROVIDE RECEPTACLE FOR SECURITY MONITOR. COORDINATE EXACT LOCATION WITH SECURITY CONTRACTOR.
6. PROVIDE 120V POWER FOR SECURITY EQUIPMENT. REFER TO SHEET TC400. VERIFY EXACT LOCATION AND REQUIREMENTS WITH SECURITY CONTRACTOR PRIOR TO ROUGH-IN.
7. RECEPTACLE SHALL BE MOUNTED TO SIDE OF CABLETRAY. REFER TO DETAIL ON SHEET TC400. COORDINATE EXACT LOCATION WITH LOW VOLTAGE CONTRACTOR.
8. PROVIDE 120V POWER TO MECHANICAL CONTROL PANEL LOCATED ABOVE ACCESSIBLE CEILING. COORDINATE EXACT LOCATION WITH MECHANICAL CONTRACTOR.
9. FLOOR BOX IS FOR LOOKUP STATION LOCATED AT THE END OF THE BOOK STACK.
10. PROVIDE SWITCH AND ALL REQUIRED WIRING FOR CONTROL OF EF-1 LOCATED ON ROOF.
11. PROVIDE CONNECTION TO HEAT TRACE IN WONDER WALL ABOVE ROOF LINE. APPROXIMATELY 8' COORDINATE WITH MECHANICAL CONTRACTOR.
12. PROVIDE 120V CONNECTION TO MOTORIZED SHADES. COORDINATE WITH SHADE VENDOR.
13. PROVIDE A TOTAL OF SEVEN 120V CONNECTIONS TO MOTORIZED SHADES IN ART WALL. COORDINATE WITH SHADE VENDOR AND ARCHITECT.
14. HEAT DETECTOR(S) SHALL BE LOCATED ADJACENT TO EACH SPRINKLER HEAD(S) AT TOP OF SHAFT. TEMPERATURE RATING OF DETECTOR SHALL BE LESS THAN SPRINKLER HEAD. COORDINATE WITH SPRINKLER CONTRACTOR.
15. PROVIDE RECEPTACLE FOR DIGITAL WHITE BOARD. REFER TO A/V DRAWINGS FOR EXACT MOUNTING HEIGHTS. COORDINATE WITH A/V CONTRACTOR.
16. NOT USED.
17. SMOKE DETECTOR SHALL BE INSTALLED UNDER RAISED ACCESS FLOOR.
18. PROVIDE DUPLEX RECEPTACLE MOUNTED AT 68"AFF FOR LCD. VERIFY EXACT LOCATION WITH A/V CONTRACTOR.
19. PROVIDE EMPTY JUNCTION BOX IN WALL WITH 3/4" CONDUIT TO JUNCTION BOX LOCATED BELOW RAISED FLOOR FOR FUTURE WALL MOUNTED LCD SCREENS. WALL MOUNTED JUNCTION BOX SHALL BE PLASTERED OVER SO THAT THERE IS NO INDICATION OF JUNCTION BOX IN FINISHED WALL. BRANCH CIRCUIT CONDUCTORS SHALL BE CAPPED IN JUNCTION BOX LOCATED BELOW FLOOR FOR FUTURE EXTENSION TO FUTURE RECEPTACLE LOCATED IN WALL MOUNTED JUNCTION BOX. VERIFY EXACT LOCATION OF WALL MOUNTED JUNCTION BOX WITH ARCHITECT AND A/V CONTRACTOR PRIOR TO ROUGH-IN.

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201 W. Colfax Ave.
DENVER, COLROADO 80202

CIVIL ENGINEER
SAN ENGINEERING
6099 Windermere St.
LITTLETON, COLORADO 80120
P. 303.953.9014
F. 303.953.9016
www.sanengineeringllc.com

LANDSCAPE ARCHITECT
MUNDUS BISHOP
333 West Colfax Ave. #350
Denver, Colorado 80204
P. 303.865.5500
F. 303.865.5504
www.mundusbishop.com

STRUCTURAL ENGINEER
STUDIO NYL
2995 Baseline Road, Suite 314
Boulder, Colorado 80303
P. 303.558.3145
F. 303.440.8536
www.studionyl.com

MECH/PLUMB ENGINEER
BCER ENGINEERING
5420 Ward Road, Suite 200
Arvada, Colorado 80002-1838
P. 303.422.7400
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www.bcer.com

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AV-IT-SECURITY
TECHNOLOGY PLUS
2323 S. Troy Street
Aurora, Colorado 80014
P. 303.340.8228
F. 303.340.8233
www.technologyplus.com

ACOUSTICS
K2 AUDIO
4900 Pearl East Circle, Suite 201E
Boulder, Colorado 80301
P. 303.865.5500
F. 303.865.5504
www.k2audio.com

SUSTAINABILITY
AMBIENT ENERGY
130 W. 5th Ave.
Denver, Colorado 80204
P. 303.278.1532
F. 303.278.8533
www.ambient-e.com

PROJECT:
WEST DENVER BRANCH LIBRARY
1498 NORTH IRVING STREET
DENVER, COLORADO 80204

COLORADO REGISTERED LANDSCAPE ARCHITECT 2944 PROFESSIONAL ENGINEER 11/12/12

sDC PROJECT NO: 1020.00
COCD PROJECT NO: CE 02089

ISSUE DATE	PHASE
01-12-2012	100% CD

LEVEL 2 POWER PLAN

E-104

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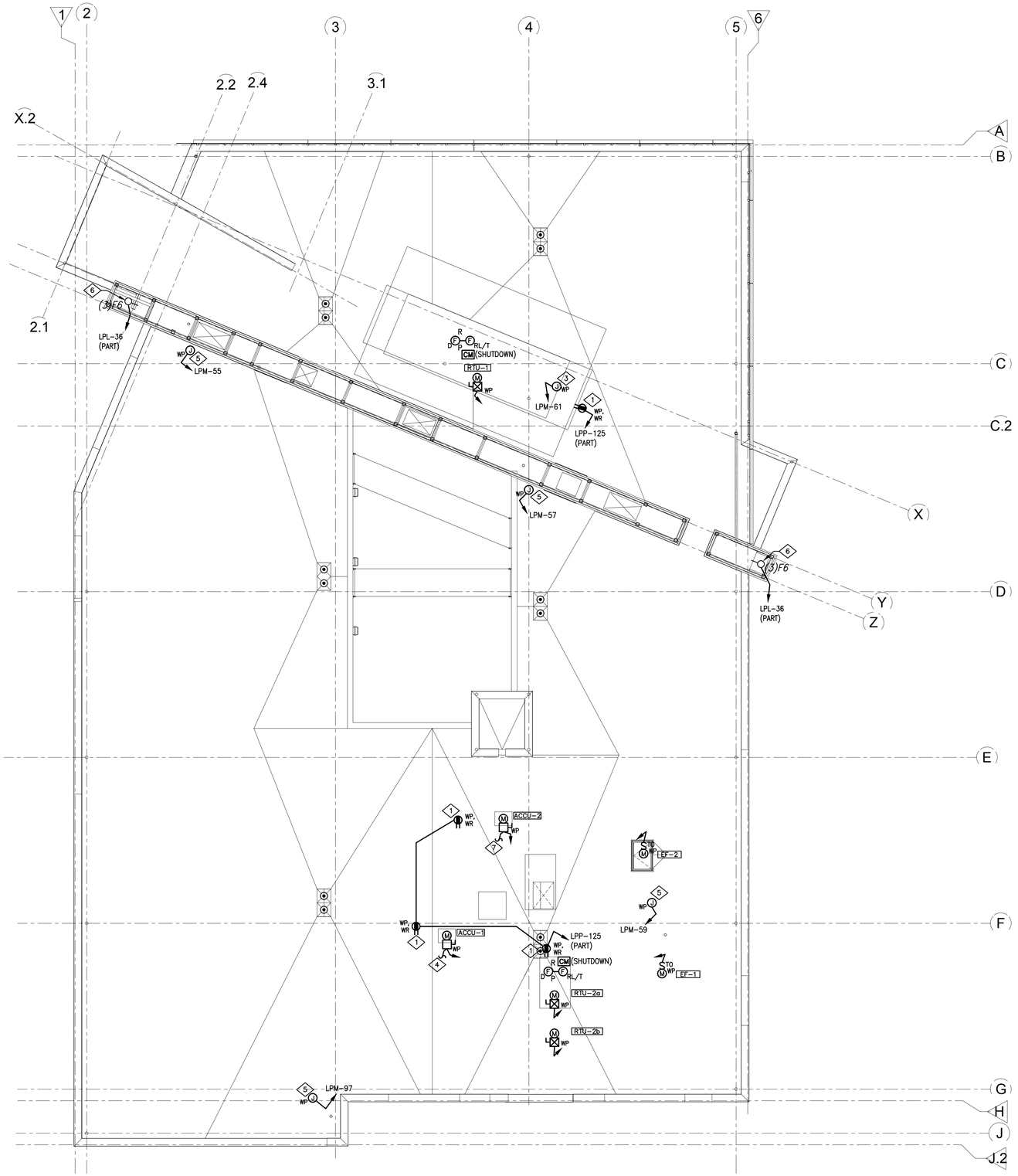

ROOF LEVEL ELECTRICAL PLAN

SCALE: 1/8" = 1'-0"

4' 2' 0 4' 8' 16'

GENERAL NOTES:

1. REFER TO MECHANICAL AND PLUMBING DRAWINGS FOR EXACT LOCATIONS AND ELECTRICAL REQUIREMENTS OF EQUIPMENT.
2. REFER TO MECHANICAL EQUIPMENT SCHEDULE ON SHEET E-201 FOR ELECTRICAL REQUIREMENTS AND BRANCH CIRCUITING INFORMATION FOR ALL MECHANICAL EQUIPMENT.
3. EACH BRANCH CIRCUIT SHALL HAVE A DEDICATED NEUTRAL. SHARED NEUTRALS ARE NOT PERMITTED IN MULTIPLE CIRCUIT HOMERUNS.

WORK NOTES:

1. RECEPTACLE SHALL BE MOUNTED ON UNISTRUT ADJACENT TO MECHANICAL EQUIPMENT.
2. NOT USED.
3. PROVIDE 120V POWER TO ROOF TOP UNIT INTERIOR RECEPTACLES AND LIGHTING.
4. DOWN TO UNIT AC-1 IN I.T. ROOM 257. REFER TO SHEET E-104 FOR LOCATION.
5. PROVIDE 120V POWER FOR SUB-SLAB VENTILATION SYSTEM FAN. COORDINATE EXACT REQUIREMENTS AND LOCATION WITH SYSTEM INSTALLER PRIOR TO ROUGH-IN.
6. MOUNT TOTAL OF THREE TYPE "F6" LUMINAIRES VERTICALLY, END TO END, IN THE WONDERWALL BETWEEN THE ROOF DECK AND TOP OF WONDERWALL. REFER TO ARCHITECTURAL DETAILS FOR ADDITIONAL INFORMATION.
7. DOWN TO UNIT AC-2 IN ELEVATOR MACHINE ROOM. REFER TO SHEET E-103 FOR LOCATION.

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F. 303.422.7900
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01-12-2012

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ROOF LEVEL ELECTRICAL PLAN

E-105

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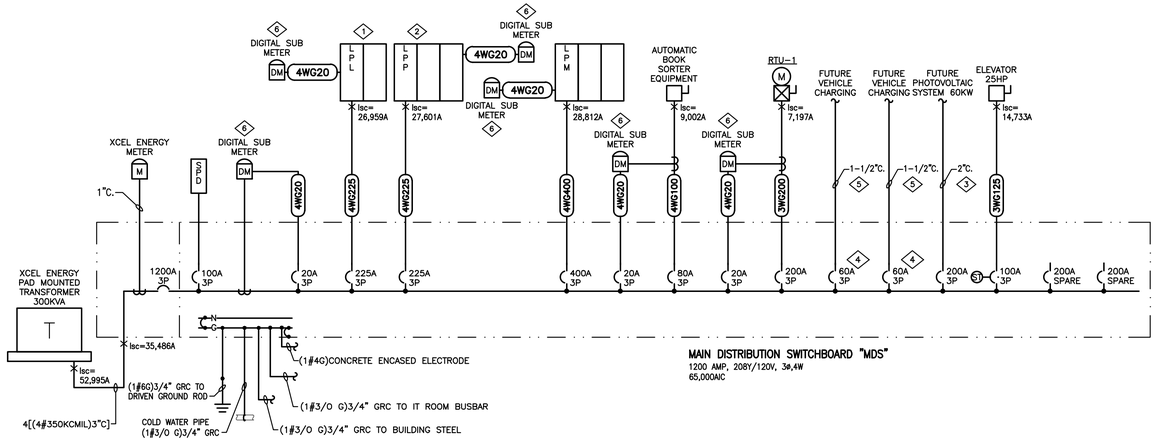
MECHANICAL EQUIPMENT SCHEDULE

MECH. DESIGNATION	EQUIPMENT DESCRIPTION	VOLTS	PH	HP	FLA	KW	KVA	DISC. SIZE	PANEL DESIGNATION	CB SIZE	FEEDER SIZE	REMARKS
AC-1	AIR CONDITIONING UNIT	208	1		1		0.208	STO	POWER FROM ACCU-1		(2#12 & 1#12G)1/2"C.	PROVIDE POWER CONNECTION FROM EXTERIOR CONDENSING UNIT
AC-2	AIR CONDITIONING UNIT	208	1		1		0.208	STO	POWER FROM ACC		(2#12 & 1#12G)1/2"C.	PROVIDE POWER CONNECTION FROM EXTERIOR CONDENSING UNIT
ACCU-1	AIR COOLED CONDENSING UNIT	208	1		13		2.704	30/2	LPM-(75,77)	15	(3#12 & 1#12G)1/2"C.	PROVIDE POWER TO INDOOR AIR CONDITIONING UNIT
ACCU-1	AIR COOLED CONDENSING UNIT	208	1		13		2.704	30/2	LPM-(79,81)	15	(3#12 & 1#12G)1/2"C.	PROVIDE POWER TO INDOOR AIR CONDITIONING UNIT
B-1	BOILER	208	1		12		2.496	30/2	LPM-(30,32)	20	(3#12 & 1#12G)1/2"C.	
B-2	BOILER	208	1		12		2.496	30/2	LPM-(18,20)	20	(3#12 & 1#12G)1/2"C.	
CUH-1	CABINET UNIT HEATER	120	1			0.042	0.042	---	LPM-42	20	(2#12 & 1#12G)1/2"C.	
CUH-2	CABINET UNIT HEATER	120	1			0.042	0.042	---	LPM-27	20	(2#12 & 1#12G)1/2"C.	
CUH-3	CABINET UNIT HEATER	120	1			0.030	0.030	---	LPM-25	20	(2#12 & 1#12G)1/2"C.	
DWH-1	DOMESTIC WATER HEATER	120	1			0.063	0.063	SM	LPM-84	20	(2#12 & 1#12G)1/2"C.	
EDWH-1a	ELECTRIC WATER HEATER	208	1			4.9	4.900	30/2	LPM-(31,33)	30	(2#10 & 1#10G)3/4"C.	
EDWH-1b	ELECTRIC WATER HEATER	208	1			4.9	4.900	30/2	LPM-(35,37)	30	(2#10 & 1#10G)3/4"C.	
EDWH-1c	ELECTRIC WATER HEATER	208	1			4.9	4.900	30/2	LPM-(2,4)	30	(2#10 & 1#10G)3/4"C.	
EDWH-2	ELECTRIC WATER HEATER	208	1			7.2	7.200	60/2	LPM-(39,41)	50	(2#6 & 3#10G)3/4"C.	
EF-1	EXHAUST FAN	120	1	1/4			0.696	STO	LPM-85	20	(2#12 & 1#12G)1/2"C.	
EF-2	EXHAUST FAN	120	1	1/4			0.696	STO	LPM-87	20	(2#12 & 1#12G)1/2"C.	
EF-3	EXHAUST FAN	120	1			0.113	0.113	STO	LPM-21	20	(2#12 & 1#12G)1/2"C.	
EF-4	EXHAUST FAN	120	1	1/4			0.696	STO	LPM-29	20	(2#12 & 1#12G)1/2"C.	
FCU-1-1	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-1	20	(2#12 & 1#12G)1/2"C.	
FCU-1-2	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-3	20	(2#12 & 1#12G)1/2"C.	
FCU-1-3	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-5	20	(2#12 & 1#12G)1/2"C.	
FCU-1-4	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-7	20	(2#12 & 1#12G)1/2"C.	
FCU-1-5	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-9	20	(2#12 & 1#12G)1/2"C.	
FCU-1-6	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-11	20	(2#12 & 1#12G)1/2"C.	
FCU-1-7	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-13	20	(2#12 & 1#12G)1/2"C.	
FCU-1-8	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-15	20	(2#12 & 1#12G)1/2"C.	
FCU-1-9	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-17	20	(2#12 & 1#12G)1/2"C.	
FCU-1-10	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-19	20	(2#12 & 1#12G)1/2"C.	
FCU-2-1	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-44	20	(2#12 & 1#12G)1/2"C.	
FCU-2-2	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-46	20	(2#12 & 1#12G)1/2"C.	
FCU-2-3	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-48	20	(2#12 & 1#12G)1/2"C.	
FCU-2-4	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-50	20	(2#12 & 1#12G)1/2"C.	
FCU-2-5	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-52	20	(2#12 & 1#12G)1/2"C.	
FCU-2-6	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-54	20	(2#12 & 1#12G)1/2"C.	
FCU-2-7	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-56	20	(2#12 & 1#12G)1/2"C.	
FCU-2-8	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-58	20	(2#12 & 1#12G)1/2"C.	
FCU-2-9	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-60	20	(2#12 & 1#12G)1/2"C.	
FCU-2-10	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-62	20	(2#12 & 1#12G)1/2"C.	
FCU-2-11	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-64	20	(2#12 & 1#12G)1/2"C.	
FCU-2-12	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-66	20	(2#12 & 1#12G)1/2"C.	
FCU-2-13	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-68	20	(2#12 & 1#12G)1/2"C.	
FCU-2-14	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-70	20	(2#12 & 1#12G)1/2"C.	
FCU-2-15	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-72	20	(2#12 & 1#12G)1/2"C.	
FCU-2-16	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-74	20	(2#12 & 1#12G)1/2"C.	
FCU-2-17	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-76	20	(2#12 & 1#12G)1/2"C.	
FCU-2-18	FAN COIL UNIT	120	1	1/2			1.176	STO	LPM-78	20	(2#12 & 1#12G)1/2"C.	
GF-1	GLYCOL FEEDER	120	1		15.0		1.800	---	LPM-45	20	(2#12 & 1#12G)1/2"C.	
HWCP-1	HOT WATER CIRCULATION PUMP	208	3	3/4			1.260	30/3	LPM-(36,38,40)	15	(3#12 & 1#12G)1/2"C.	
HWCP-2	HOT WATER CIRCULATION PUMP	208	3	3/4			1.260	30/3	LPM-(24,26,28)	15	(3#12 & 1#12G)1/2"C.	
HWCP-3	HOT WATER CIRCULATION PUMP	208	3	3/4			1.260	30/3	LPM-(49,51,53)	15	(3#12 & 1#12G)1/2"C.	
HWP-1	HEATING WATER PUMP	208	3	5			6.016	60/3	LPM-(6,8,10)	40	(3#10 & 1#10G)3/4"C.	
HWP-2	HEATING WATER PUMP	208	3	5			6.016	60/3	LPM-(12,14,18)	40	(3#10 & 1#10G)3/4"C.	
RTU-1	ROOF TOP UNIT	208	3		142.0		51.157	200/3	REFER TO ONE-LINE			
RTU-2a	ROOF TOP UNIT	208	3		33.9		12.213	60/3	LPM-(63,65,67)	50	(3#8 & 1#10G)3/4"C.	
RTU-2b	ROOF TOP UNIT POWERED EXHAUST	208	3		9.1		3.278	30/3	LPM-(69,71,73)	20	(3#12 & 1#12G)1/2"C.	
SMP-1	SNOW MELT PUMP	208	3	1 1/2			2.377	30/3	LPM-(86,88,90)	15	(3#12 & 1#12G)1/2"C.	PUMP SHALL BE INCLUDED IN ADD ALTERNATE #3
SP-1	SUMP PUMP	120	1	3/4			1.656	STO	LPM-89	30	(2#12 & 1#12G)1/2"C.	
TF-5	TRANSFER EXHAUST FAN	120	1	1/4			0.696	STO	LPM-80	20	(2#12 & 1#12G)1/2"C.	
UH-1	UNIT HEATER	120	1	1/4			0.696	STO	LPM-23	20	(2#12 & 1#12G)1/2"C.	
UH-2	UNIT HEATER	120	1	1/4			0.696	STO	LPM-47	20	(2#12 & 1#12G)1/2"C.	

WORK NOTES:

1. PROVIDE SQUARE D POWER LINK MASTER PANEL WITH NF3000G3 LCD CONTROLLER FOR CONTROL OF LIGHTING AND PHANTOM LOADS. PROVIDE WITH ALL MODULES FOR FUTURE CONNECTION TO BUILDING AUTOMATION SYSTEM.
2. PROVIDE SQUARE D POWER LINK SLAVE PANEL FOR CONTROL OF PHANTOM LOADS.
3. PROVIDE CONDUIT WITH PULLSTRING TO ROOF FOR FUTURE PHOTOVOLTAIC SYSTEM. CAPE AND SEAL CONDUIT. COORDINATE EXACT LOCATION WITH ARCHITECT.
4. CIRCUIT BREAKER SHALL BE ABLE TO ACCOMMODATE INTERCHANGEABLE TRIP UNITS DOWN TO 20A.
5. REFER TO ELECTRICAL SITE PLAN FOR ADDITIONAL INFORMATION.
6. PROVIDE ELECTRONIC DIGITAL METER WITH LCD DISPLAY, E-MON D-MON CLASS 3400 METER. METER REQUIRES A 20A, 208V, 3-PHASE DEDICATED BRANCH CIRCUIT FOR OPERATION. REFER TO OWNER METERING REQUIREMENTS NARRATIVE, THIS SHEET, AND SUB METER CONTROL DIAGRAM ON SHEET M-304 FOR ADDITIONAL INFORMATION.



ELECTRICAL ONE-LINE DIAGRAM

NOT TO SCALE

FEEDER TABLE

OVERCURRENT DEVICE SETTINGS	THREE WIRE + GROUND		FOUR WIRE + GROUND	
	FEEDER IDENTIFIER	COPPER CONDUCTORS INSULATION PER SPECIFICATIONS	FEEDER IDENTIFIER	COPPER CONDUCTORS INSULATION PER SPECIFICATIONS
20	3WG20	(3#12 + 1#12G)1/2"C	4WG20	(4#12 + 1#12G)3/4"C
30	3WG30	(3#10 + 1#10G)3/4"C	4WG30	(4#10 + 1#10G)3/4"C
40	3WG40	(3#8 + 1#10G)3/4"C	4WG40	(4#8 + 1#10G)3/4"C
50	3WG50	(3#6 + 1#10G)3/4"C	4WG50	(4#6 + 1#10G)1"C
60	3WG60	(3#4 + 1#10G)1"C	4WG60	(4#4 + 1#10G)1-1/4"C
70	3WG70	(3#4 + 1#8G)1"C	4WG70	(4#4 + 1#8G)1-1/4"C
100	3WG100	(3#1 + 1#8G)1-1/4"C	4WG100	(4#1 + 1#8G)1-1/2"C
125	3WG125	(3#1 + 1#6G)1-1/4"C	4WG125	(4#1 + 1#6G)1-1/2"C
150	3WG150	(3#1/0 + 1#6G)1-1/4"C	4WG150	(4#1/0 + 1#6G)2"C
175	3WG175	(3#2/0 + 1#6G)2"C	4WG175	(4#2/0 + 1#6G)2"C
200	3WG200	(3#3/0 + 1#6G)2"C	4WG200	(4#3/0 + 1#6G)2"C
225	3WG225	(3#4/0 + 1#4G)2"C	4WG225	(4#4/0 + 1#4G)2-1/2"C
250	3WG250	(3#250KCMIL + 1#4G)2-1/2"C	4WG250	(4#250KCMIL + 1#4G)3"C
300	3WG300	(3#350KCMIL + 1#4G)2-1/2"C	4WG300	(4#350KCMIL + 1#4G)3-1/2"C
350	3WG350	(3#500KCMIL + 1#3G)3"C	4WG350	(4#500KCMIL + 1#3G)3-1/2"C
400	3WG400	(3#500KCMIL + 1#3G)3"C	4WG400	(4#500KCMIL + 1#3G)3-1/2"C
500	3WG500	2[(3#250KCMIL + 1#2G)2-1/2"C]	4WG500	2[(4#250KCMIL + 1#2G)3"C]
600	3WG600	2[(3#350KCMIL + 1#1G)2-1/2"C]	4WG600	2[(4#350KCMIL + 1#1G)3"C]
800	3WG800	2[(3#500KCMIL + 1#1/0G)3"C]	4WG800	2[(4#500KCMIL + 1#1/0G)3-1/2"C]
1000	3WG1000	4[(3#250KCMIL + 1#2/0G)2-1/2"C]	4WG1000	4[(4#250KCMIL + 1#2/0G)3"C]
1200	3WG1200	4[(3#350KCMIL + 1#3/0G)2-1/2"C]	4WG1200	4[(4#350KCMIL + 1#3/0G)3"C]
1600	3WG1600	5[(3#500KCMIL + 1#4/0G)3"C]	4WG1600	5[(4#500KCMIL + 1#4/0G)3-1/2"C]
2000	3WG2000	6[(3#500KCMIL + 1#250KCMILG)3"C]	4WG2000	6[(4#500KCMIL + 1#250KCMILG)3-1/2"C]
2500	3WG2500	7[(3#500KCMIL + 1#350KCMILG)3"C]	4WG2500	7[(4#500KCMIL + 1#350KCMILG)3-1/2"C]
3000	3WG3000	8[(3#500KCMIL + 1#400KCMILG)3"C]	4WG3000	8[(4#500KCMIL + 1#400KCMILG)3-1/2"C]

OWNER METERING REQUIREMENTS:

OWNER ELECTRICAL METERING IS REQUIRED FOR THE FOLLOWING PIECES OF EQUIPMENT:

- "MDS" BUILDING MAIN DISTRIBUTION
- PANEL "LPL"
- PANEL "LPP"
- PANEL "LPM"
- AUTOMATIC BOOK SORTING EQUIPMENT
- RTU-1

PROVIDE ELECTRONIC DIGITAL METER WITH LCD DISPLAY OF CUMULATIVE KWH AND NETWORK ABILITY TO REMOTELY MONITOR KWH, KVARH, AMPS, VOLTS, KW, KVA, KVAR AT THE BUILDING AUTOMATION SYSTEM VIA A BACnet IP COMMUNICATION CONNECTION. INCLUDE INSTALLATION OF CURRENT SENSORS AND WIRING FROM PANEL FEEDERS TO EXTERNALLY MOUNTED METERS. DIGITAL METER IS TO BE E-MON D-MON CLASS 3400 METER. REFER TO THE ELECTRICAL ONE-LINE DIAGRAM FOR FEEDER SIZES TO DETERMINE THE CORRESPONDING METER CATALOG NUMBER BASED ON THE REQUIRED AMP SIZE. DIGITAL METERS ARE TO BE PROVIDED WITH OPTIONS FOR BACnet IP COMMUNICATIONS. PROVIDE AN ENGRAVED NAMEPLATE FOR EACH METER WITH THE CORRESPONDING PANEL NAME. REFER TO SUB METER CONTROL DIAGRAM ON SHEET M-304 FOR ADDITIONAL INFORMATION.

THE ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR PROVIDING THE METERS AND CONNECTING THE METER TO THE CT'S AND THE CT'S TO THE THE METERED LOAD. THE TEMPERATURE CONTROLS CONTRACTOR IS RESPONSIBLE FOR CONNECTING THE OUTPUT OF THE METERS TO THE BUILDING AUTOMATION SYSTEM. THE BUILDING AUTOMATION SYSTEM SHALL PROVIDE AN INTERFACE WITH THE LEARNING CENTER AND ALL REQUIRED DATA OUTPUTS FOR LEED MONITORING.

THE ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR ENSURING COMPATIBILITY BETWEEN THE PROVIDED METERS AND THE BUILDING AUTOMATION SYSTEM. CONTRACTOR SHALL PROVIDE E-MON D-MON METERS, CLASS 3400 SERIES OR APPROVED EQUAL.

OWNERSHIP OF DOCUMENTS:
ALL DRAWINGS, SPECIFICATIONS AND OTHER WORK PRODUCT OF THE ENGINEER FOR THIS PROJECT ARE INSTRUMENTS OF SERVICE FOR THIS PROJECT ONLY AND SHALL REMAIN THE PROPERTY OF THE ENGINEER WHETHER THE PROJECT IS COMPLETED OR NOT. REUSE OF ANY OF THE INSTRUMENTS OF SERVICE OF THE ENGINEER BY THE OWNER OF EXTENSIONS OF THIS PROJECT WITHOUT WRITTEN PERMISSION OF THE ENGINEER SHALL BE AT THE OWNER'S RISK AND THE OWNER AGREES TO DEFEND, INDEMNIFY AND HOLD HARMLESS THE ENGINEER FROM ALL CLAIMS, DAMAGES, AND EXPENSES INCLUDING ATTORNEYS' FEES ARISING OUT OF UNAUTHORIZED REUSE OF THE ENGINEER'S INSTRUMENTS OF SERVICE BY THE OWNER OR BY OTHERS ACTING THROUGH THE OWNER.

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2942 Nelson Street · Denver, CO 80205 · 303.308.1144 · www.studiotrope.com

OWNER
CITY AND COUNTY OF DENVER
201 W. Colfax Ave.
DENVER, COLROADO 80202

CIVIL ENGINEER
SAN ENGINEERING
6099 Windermere St.
LITTLETON, COLORADO 80120
P. 303.953.9014
F. 303.953.9016
www.sanengineeringllc.com

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F. 303.440.8536
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5420 Ward Road, Suite 200
Arvada, Colorado 80002-1838
P. 303.422.7400
F. 303.422.7900
www.bcer.com

ELECTRICAL ENGINEER
BCER ENGINEERING
5420 Ward Road, Suite 200
Arvada, Colorado 80002-1838
P. 303.422.7400
F. 303.422.7900
www.bcer.com

AV-IT-SECURITY
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WEST DENVER BRANCH LIBRARY
1498 NORTH IRVING STREET
DENVER, COLORADO 80204

sDC PROJECT NO: 1020.00
COOD PROJECT NO: CE 02089

COLORADO REGISTERED PROFESSIONAL ENGINEER JAMES W. BOWEN 29364 11/1/12

ISSUE DATE
01-12-2012

PHASE
100% CD

ELECTRICAL ONE-LINE DIAGRAM

E-201

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XREFS=(xx-tb) Layouts=(E-201 ELECTRICAL ONE-LINE DIAGRAM)
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PANEL: LPL

X	100% NEUTRAL
X	GROUND
X	MLO
X	SURFACE

AMPACITY = 225 AMPS
AIC RATING = 10,000 AMPS
VOLTAGE = 120/208 VOLT, 3 PH

	TYP	VA	DESCRIPTION	P	CB	CKT	PH	CKT	CB	P	DESCRIPTION	VA	TYP	
[1]	L	1494	1ST CHILD. COL/TECH LTG	1	20	1	A	2	20	1	2ND OFFICES	1445	L	[1]
	L	165	1ST EM/NL/EXITS	1	20	3	B	4	20	1	2ND EM/NL/EXITS	270	L	
[1]	L	1594	1ST CHILD. ENTRY/CORR./RR	1	20	5	C	6	20	1	2ND COLLABORATIVE	930	L	[1]
	L	360	1ST EM/NL/EXITS	1	20	7	A	8	20	1	2ND EM/NL/EXITS	204	L	
[1]	L	1585	1ST CLP	1	20	9	B	10	20	1	2ND PENDANTS/WALLWASH	888	L	[1]
	L	20	1ST EM/NL/EXITS	1	20	11	C	12	20	1	2ND EM/NL/EXITS	20	L	
[1]	L	1855	1ST SORT/ELEC/MECH/STOR.	1	20	13	A	14	20	1	2ND ADULT NON-FICTION	1210	L	[1]
	L	110	1ST EM/NL/EXITS	1	20	15	B	16	20	1	2ND EM/NL/EXITS	165	L	
[1]	L	495	1ST LOBBY	1	20	17	C	18	20	1	2ND ADULT FICTION	1595	L	[1]
	L	352	1ST EM/NL/EXITS	1	20	19	A	20	20	1	2ND EM/NL/EXITS	165	L	
[1]	L	1495	1ST STACKS/WAITING	1	20	21	B	22	20	1	2ND OUTDOOR READING	45	L	[1]
	L	165	1ST EM/NL/EXITS	1	20	23	C	24	20	1	2ND EM/NL/EXITS	20	L	
[1]	L	550	1ST STACKS	1	20	25	A	26	20	1	2ND OPEN COMPUTING	998	L	[1]
	L	55	1ST EM/NL/EXITS	1	20	27	B	28	20	1	2ND EM/NL/EXITS	165	L	
[2]	L	252	1ST STACKS ALT. BID #9b	1	20	29	C	30	20	1	2ND OPEN COMPUTING	1100	L	[1]
[2]	L	112	1ST STORY TIME	1	20	31	A	32	20	1	2ND EM/NL/EXITS	220	L	
[2]	L	3000	PARKING LOT LTG	2	20	33	B	34	20	1	2ND STUDY/MEETING	855	L	[2]
			---			35	C	36	20	1	EXTERIOR BLDG LTG	504	L	[2]
	E	6	METER CONNECTION	3	20	37	A	38	20	1	SPARE			[2]
			---			39	B	40	20	1	SPARE			[2]
			---			41	C	42	20	1	BICYCLE UNIT	300	E	

LOAD TYPE		CONNECTED LOAD (VA)	DEMAND FACTOR	DEMAND LOAD (VA)	NEC	DERATED DEMAND LOAD (VA)
LIGHTING		26176	1.00	26176	1.25	32720
REC	1st 10 KVA	900	1.00	900	1.0	900
	REMAINING	0	1.00		0.5	
LARGEST MOTORS		0	1.00		1.25	
REMAINING MOTORS		0	1.00		1.0	
EQUIPMENT		306	1.00	306	1.0	306
HEATING		0	1.00		1.25	
PANEL		0	1.00		1.0	
TRANSFORMER		0	1.00		1.0	
KITCHEN		0	1.00		1.0	
TOTAL		**27382**		**27382**		**33926**

PHASE LOADING

A= 9675	VA	DERATED DEMAND LOAD	=	94 AMPS
B= 8794	VA	SPARE CAPACITY	= 58%	131 AMPS
C= 8913	VA	**TOTAL**	=	**225 AMPS**

[1] PROVIDE POWERLINK 2-POLE REMOTELY OPERATED CIRCUIT BREAKER #ECB142020G3EL.
[2] PROVIDE POWERLINK CONTROLLABLE CIRCUIT BREAKER.

PANEL: LPL

TYP	VA	DESCRIPTION	P	CB	CKT	PH	CKT	CB	P	DESCRIPTION	VA	TYP	
		SPARE	1	20	43	A	44	20	1	SPARE			
L	294	EXTERIOR BLDG LTG	1	20	45	B	46	20	1	BUILDING SIGN	1200	L	[2]
L	56	EXTERIOR NL/EM	1	20	47	C	48	20	1	PARKING LOT RECEPT	360	R	[2]
		SPARE	1	20	49	A	50	20	1	PARKING LOT RECEPT	540	R	[2]
		SPARE	1	20	51	B	52	20	1	SPARE			[2]
		SPARE	1	20	53	C	54	20	1	SPARE			[2]
		SPARE	1	20	55	A	56	20	1	SPARE			[2]
		SPARE	1	20	57	B	58	20	1	SPARE			[2]
		SPARE	1	20	59	C	60	20	1	SPARE			[2]
		SPARE	1	20	61	A	62	20	1	SPARE			[2]
		SPARE	1	20	63	B	64	20	1	SPARE			[2]
		SPARE	1	20	65	C	66	20	1	SPARE			[2]
		SPACE			67	A	68			SPACE			
		SPACE			69	B	70			SPACE			
		SPACE			71	C	72			SPACE			
		SPACE			73	A	74			SPACE			
		SPACE			75	B	76			SPACE			
		SPACE			77	C	78			SPACE			
		SPACE			79	A	80			SPACE			
		SPACE			81	B	82			SPACE			
		SPACE			83	C	84			SPACE			

PANEL: LPP

X	100% NEUTRAL
X	GROUND
X	MLO
X	RECESSED

AMPACITY = 225 AMPS
AIC RATING = 10,000 AMPS
VOLTAGE = 120/208 VOLT, 3 PH

	TYP	VA	DESCRIPTION	P	CB	CKT	PH	CKT	CB	P	DESCRIPTION	VA	TYP	
[1]	R	1080	REC 1ST FLR WAITING	1	20	1	A	2	20	1	REC CLP & REST RMS	1260	R	[1] [1]
	E	600	SECURITY GATES	1	20	3	B	4	20	1	MOTORIZED SCREEN CLP	500	E	[1] [1]
[1]	R	540	REC 1ST FLR LOBBY & VEST	1	20	5	C	6	20	1	REC PROJECTOR CLP	500	E	[1] [1]
[1]	R	1080	REC 1ST FLR STACKS	1	20	7	A	8	20	1	REC 1ST FLR CLP	1080	R	[1]
[1]	R	1080	REC 1ST FLR STACKS	1	20	9	B	10	20	1	REC 1ST FLR CLP	1080	R	[1]
[1]	R	720	REC 1ST FLR STACKS	1	20	11	C	12	20	1	REC 1ST FLR CLP	900	R	[1]
	E	500	AUTO DOORS VESTIBULE	1	20	13	A	14	20	1	REC 1ST FLR A/V STORAGE	360	R	[1]
[1]	R	180	REC 1ST FLR RECEPTION	1	20	15	B	16	20	1	REC 1ST FLR A/V STORAGE	360	R	[1] [1]
	E	500	AUTO DOORS VESTIBULE	1	20	17	C	18	20	1	REC 1ST FLR ARTS & CRAFTS	180	R	[1]
	E	600	SECURITY GATES	1	20	19	A	20	20	1	REC 1ST FLR A/V RACK	1000	E	[1] [1]
[1]	R	1260	REC SORTING	1	20	21	B	22	20	1	REC 1ST FLR ARTS & CRAFTS	360	R	[1] [1]
[1]	R	1440	REC SORTING	1	20	23	C	24	20	1	REFRIG 1ST FLR ARTS & CRAFTS	1200	E	[1] [1]
[1]	R	1080	REC SORTING	1	20	25	A	26	20	1	REC 1ST FLR ARTS & CRAFTS	360	R	[1] [1]
[1]	R	360	REC BOOK SORTER	1	20	27	B	28	20	1	REC 1ST FLR CHILD TECH	720	R	[1] [1]
[1]	R	180	REC MAILBOXES	1	20	29	C	30	20	1	REC 1ST FLR CHILDRENS	1260	R	[1] [1]
	E	1200	REC VENDING	1	20	31	A	32	20	1	REC 1ST FLR CHILD TECH	540	R	[1] [1]
	E	1200	REC VENDING	1	20	33	B	34	20	1	REC 1ST FLR CHILD TECH	720	R	[1] [1]
	E	500	REC EWC	1	20	35	C	36	20	1	REC 1ST FLR CHILDRENS	900	R	[1] [1]
	E	6	METER CONNECTION	3	20	37	A	38	20	1	REC 1ST FLR CHILDRENS	1260	R	[1] [1]
			---			39	B	40	20	1	FACP	500	E	[1]
			---			41	C	42	20	1	OVERHEAD DOOR CLP	1176	M	[1] [1]

LOAD TYPE		CONNECTED LOAD (VA)	DEMAND FACTOR	DEMAND LOAD (VA)	NEC	DERATED DEMAND LOAD (VA)
LIGHTING		0	1.00		1.25	0
REC	1st 10 KVA	10000	1.00	10000	1.0	10000
	REMAINING	57320	1.00	57320	0.5	28660
LARGEST MOTORS		1176	1.00	1176	1.25	1470
REMAINING MOTORS		1176	1.00	1176	1.0	1176
EQUIPMENT		29586	1.00	29586	1.0	29586
HEATING		0	1.00		1.25	0
PANEL		0	1.00		1.0	0
TRANSFORMER		0	1.00		1.0	0
KITCHEN		0	1.00		1.0	0
TOTAL		**99258**				**70892**

PHASE LOADING

A= 37678	VA	DERATED DEMAND LOAD	=	197 AMPS
B= 32822	VA	SPARE CAPACITY	= 13%	28 AMPS
C= 28758	VA	**TOTAL**	=	**225 AMPS**

[1] PROVIDE POWERLINK CONTROLLABLE CIRCUIT BREAKER.

PANEL: LPP

TYP	VA	DESCRIPTION	P	CB	CKT	PH	CKT	CB	P	DESCRIPTION	VA	TYP	
R	1260	REC 1ST FLR CHILD ENT & RR	1	20	43	A	44	20	1	REC 2ND FLR DISPOSAL	1176	M	[1] [1]
R	1260	REC 1ST FLR CHILD ENTRY	1	20	45	B	46	20	1	REC 2ND FLR STAFF LOUNGE	180	R	[1] [1]
R	720	REC RECEPTION	1	20	47	C	48	20	1	REC 2ND FLR DISHWASHER	1200	E	[1] [1]
E	240	ELEV MACH RM LTG & REC	1	20	49	A	50	20	1	REC 2ND FLR REFRIG	1200	E	[1]
E	500	ELEV CAB LTG & REC	1	20	51	B	52	20	1	REC 2ND FLR MICRO	1200	E	[1] [1]
E	240	ELEV PIT LTG & REC	1	20	53	C	54	20	1	REC 2ND FLR STAFF LOUNGE	180	R	[1] [1]
R	1260	REC STORAGE	1	20	55	A	56	20	1	REC 2ND FLR CONFERENCE	1080	R	[1] [1]
R	1080	REC MECH/ELECT	1	20	57	B	58	20	1	REC 2ND FLR ADMIN AREA	900	R	[1] [1]
E	200	IRRIGATION CONTROL PNL	1	20	59	C	60	20	1	REC 2ND FLR STAFF LOUNGE	1260	R	[1] [1]
E	1200	SMART BINS	1	20	61	A	62	20	1	REC 2ND FLR OFFICE	1080	R	[1] [1]
E	1200	SMART BINS	1	20	63	B	64	20	1	REC 2ND FLR WORKROOM	1080	R	[1] [1]
E	1200	SMART BINS	1	20	65	C	66	20	1	REC 2ND FLR WORKROOM	1080	R	[1] [1]
E	1200	SMART BINS	1	20	67	A	68	20	1	REC 2ND FLR REST RM	360	R	[1] [1]
E	1200	SMART BINS	1	20	69	B	70	20	1	REC 2ND FLR STUDIO	900	R	[1] [1]
E	1000	1ST FLR MOTORIZED SHADES	1	20	71	C	72	20	1	REC 2ND FLR SEATING	900	R	[1] [1]
R	1080	REC 2ND FLR COLLABORATIVE	1	20	73	A	74	20	1	REC 2ND FLR NONFICTION	1260	R	[1] [1]
E	1000	2ND FLR MOTORIZED SHADES	1	20	75	B	76	20	1	REC 2ND FLR ADULT SEATING	900	R	[1] [1]
E	500	2ND FLR MOTORIZED SHADES	1	20	77	C	78	20	1	REC 2ND FLR FICTION	900	R	[1] [1]
		SPARE	1	20	79	A	80	20	1	REC 2ND FLR FICTION	1260	R	[1] [1]
		SPARE	1	20	81	B	82	20	1	REC 2ND FLR FICTION	1080	R	[1] [1]
		SPARE	1	20	83	C	84	20	1	SPARE			[1] [1]

PANEL: LPP

TYP	VA	DESCRIPTION	P	CB	CKT	PH	CKT	CB	P	DESCRIPTION	VA	TYP	
R	1080	REC 2ND FLR AUDIO BOOKS	1	20	85	A	86	20	1	REC 2ND FLR COMPUTER	720	R	[1]
E	1500	REC 2ND FLR COPIER	1	20	87	B	88	20	1	REC 2ND FLR COMPUTER	720	R	[1]
E	1000	REC 2ND FLR PRINTER	1	20	89	C	90	20	1	REC 2ND FLR STUDY	1080	R	[1]
R	720	REC 2ND FLR COMPUTER	1	20	91	A	92	20	1	REC 2ND FLR COMPUTER	720	R	[1]
R	720	REC 2ND FLR COMPUTER	1	20	93	B	94	20	1	REC 2ND FLR MTG RM	720	R	[1]
R	360	REC 2ND FLR COMPUTER	1	20	95	C	96	20	1	REC 2ND FLR MTG RM	720	R	[1]
R	1080	REC 2ND FLR COMPUTER	1	20	97	A	98	20	1	REC 2ND FLR COLLABORATIVE	720	R	[1]
R	720	REC 2ND FLR COMPUTER	1	20	99	B	100	20	1	REC 2ND FLR COLLABORATIVE	1080	R	[1]
R	720	REC 2ND FLR COMPUTER	1	20	101	C	102	20	1	REC 2ND FLR COLLABORATIVE	900	R	[1]
R	1080	REC 2ND FLR COMPUTER	1	20	103	A	104	20	1	REC IT RM CONVENCE	900	R	[1]
R	720	REC 2ND FLR COMPUTER	1	20	105	B	106	20	1	REC IT RM SECURITY PNL	500	E	
R	720	REC 2ND FLR COMPUTER	1	20	107	C	108	20	1	REC IT RM SECURITY PNL	500	E	
R	720	REC 2ND FLR COMPUTER	1	20	109	A	110	20	1	REC IT RM RACK	1000	E	
R	720	REC 2ND FLR COMPUTER	1	20	111	B	112	20	1	REC IT RM RACK	1000	E	
R	360	REC 2ND FLR COMPUTER	1	20	113	C	114	20	1	REC IT RM RACK	1000	E	
R	1080	REC 2ND FLR STUDY	1	20	115	A	116	20	1	REC IT RM RACK	1000	E	
R	720	REC 2ND FLR COMPUTER	1	20	117	B	118	20	1	REC 2ND FLR COMPUTER	720	R	[1]
R	720	REC 2ND FLR COMPUTER	1	20	119	C	120	20	1	REC 2ND FLR COMPUTER	1080	R	[1]
R	1080	REC 2ND FLR COMPUTER	1	20	121	A	122	20	1	REC 2ND FLR COMPUTER	720	R	[1]
E	500	REC PROJECTOR ENTRY	1	20	123	B	124	20	1	REC 2ND FLR COMPUTER	1080	R	[1]
R	720	REC ROOF	1	20	125	C	126	20	1	SPARE			

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F. 303.953.9016
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MUNDUS BISHOP
333 West Colfax Ave. #350
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Boulder, Colorado 80301
P. 303.865.5500
F. 303.865.5504
www.k2audio.com

SUSTAINABILITY
AMBIENT ENERGY
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Denver, Colorado 80204
P. 303.278.1532
F. 303.278.8533
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DENVER, COLORADO 80204

COLORADO REGISTERED PROFESSIONAL ENGINEER — 23044 — 11/3/12

sDC PROJECT NO: 1020.00
COOD PROJECT NO: CE 02089

ISSUE DATE 01-12-2012
PHASE 100% CD

ELECTRICAL PANEL SCHEDULES

E-301

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XREFS=(xx-tb) Layouts=(E-301 ELECTRICAL PANEL SCHEDULES)
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PANEL: LPM

AMPACITY = 400 AMPS
AIC RATING = 10,000 AMPS
VOLTAGE = 120/208 VOLT, 3 PH

X	100% NEUTRAL
X	GROUND
X	MLO
X	SURFACE

TYP	VA	DESCRIPTION	P	CB	CKT	PH	CKT	CB	P	DESCRIPTION	VA	TYP	
M	1176	FCU-1-1	1	20	1	A	2	30	2	EDWH-1c	4900	H	
M	1176	FCU-1-2	1	20	3	B	4			---			
M	1176	FCU-1-3	1	20	5	C	6	40	3	HWP-1	6016	M	
M	1176	FCU-1-4	1	20	7	A	8			---			
M	1176	FCU-1-5	1	20	9	B	10			---			
M	1176	FCU-1-6	1	20	11	C	12	40	3	HWP-2	6016	M	
M	1176	FCU-1-7	1	20	13	A	14			---			
M	1176	FCU-1-8	1	20	15	B	16			---			
M	1176	FCU-1-9	1	20	17	C	18	20	2	B-2	2496	E	[1]
M	1176	FCU-1-10	1	20	19	A	20			---			
M	113	EF-3	1	20	21	B	22			SPACE FOR SHUNT TRIP			
M	696	UH-1	1	20	23	C	24	15	3	HWCP-2	1260	M	
M	30	CUH-3	1	20	25	A	26			---			
M	42	CUH-2	1	20	27	B	28			---			
M	696	EF-4	1	20	29	C	30	20	2	B-1	2496	E	[1]
H	4900	EDWH-1a	2	30	31	A	32			---			
		---			33	B	34			SPACE FOR SHUNT TRIP			
H	4900	EDWH-1b	2	30	35	C	36	15	3	HWCP-1	1260	M	
		---			37	A	38			---			
H	7200	EDWH-2	2	50	39	B	40			---			
		---			41	C	42	20	1	CHU-1	42	M	

LOAD TYPE	CONNECTED LOAD (VA)	DEMAND FACTOR	DEMAND LOAD (VA)	NEC	DERATED DEMAND LOAD (VA)
LIGHTING	0	1.00		1.25	0
REC 1st 10 KVA	0	1.00		1.0	0
REC REMAINING	0	1.00		0.5	0
LARGEST MOTORS	12213	1.00	12213	1.25	15266
REMAINING MOTORS	68642	1.00	68642	1.0	68642
EQUIPMENT	8261	1.00	8261	1.0	8261
HEATING	21950	1.00	21950	1.0	21950
PANEL	0	1.00		1.0	0
TRANSFORMER	0	1.00		1.0	0
KITCHEN	0	1.00		1.0	0
TOTAL	**111066**				**114119**

PHASE LOADING

A= 37900 VA
B= 36912 VA
C= 36255 VA

DERATED DEMAND LOAD = 317 AMPS
SPARE CAPACITY = 21% 83 AMPS
TOTAL = **400 AMPS**

[1] PROVIDE SHUNT TRIP TYPE CIRCUIT BREAKER.
[2] PROVIDE GFCI TYPE CIRCUIT BREAKER WITH 30mA TRIP.

PANEL: LPM

TYP	VA	DESCRIPTION	P	CB	CKT	PH	CKT	CB	P	DESCRIPTION	VA	TYP
E	500	MECH CNTRLS 1ST FLR	1	20	43	A	44	20	1	FCU-2-1	1176	M
E	1800	GF-1	1	20	45	B	46	20	1	FCU-2-2	1176	M
M	696	UH-2	1	20	47	C	48	20	1	FCU-2-3	1176	M
M	1260	HWCP-3	3	15	49	A	50	20	1	FCU-2-4	1176	M
		---			51	B	52	20	1	FCU-2-5	1176	M
		---			53	C	54	20	1	FCU-2-6	1176	M
M	696	UNDERSLAB VENT FAN	1	20	55	A	56	20	1	FCU-2-7	1176	M
M	696	UNDERSLAB VENT FAN	1	20	57	B	58	20	1	FCU-2-8	1176	M
M	696	UNDERSLAB VENT FAN	1	20	59	C	60	20	1	FCU-2-9	1176	M
E	200	RTU-1 REC & LTG	1	20	61	A	62	20	1	FCU-2-10	1176	M
M	12213	RTU-2a	3	50	63	B	64	20	1	FCU-2-11	1176	M
		---			65	C	66	20	1	FCU-2-12	1176	M
		---			67	A	68	20	1	FCU-2-13	1176	M
M	3278	RTU-2b	3	20	69	B	70	20	1	FCU-2-14	1176	M
		---			71	C	72	20	1	FCU-2-15	1176	M
		---			73	A	74	20	1	FCU-2-16	1176	M
M	2702	ACCU-1	2	15	75	B	76	20	1	FCU-2-17	1176	M
		---			77	C	78	20	1	FCU-2-18	1176	M
M	2702	ACCU-2	2	15	79	A	80	20	1	TF-5	696	M
		---			81	B	82	20	1	MECH CNTRLS 2ND FLR	500	E
		SPARE	1	20	83	C	84	20	1	DWH-1	63	E

PANEL: LPM

TYP	VA	DESCRIPTION	P	CB	CKT	PH	CKT	CB	P	DESCRIPTION	VA	TYP	
M	696	EF-1	1	20	85	A	86	15	3	SMP-1	2377	M	
M	696	EF-2	1	20	87	B	88			---			
M	1656	SP-1	1	30	89	C	90			---			
E	200	LEAK DETECTION CNTRL PNL	1	20	91	A	92	20	1	SPARE			
H	50	ROOF HEAT TRACE	1	20	93	B	94	20	1	SPARE			[2]
		SPACE FOR GFCI			95	C	96	20	1	SPARE			
M	696	UNDERSLAB VENT FAN	1	20	97	A	98	20	1	SPARE			
		SPARE	1	20	99	B	100	20	1	SPARE			
		SPARE	1	20	101	C	102	20	1	SPARE			
		SPARE	1	20	103	A	104	20	1	SPARE			
		SPARE	1	20	105	B	106	20	1	SPARE			
		SPARE	1	20	107	C	108	20	1	SPARE			
		SPARE	1	20	109	A	110	20	1	SPARE			
		SPARE	1	20	111	B	112	20	1	SPARE			
		SPACE			113	C	114			SPACE			
		SPACE			115	A	116			SPACE			
		SPACE			117	B	118			SPACE			
		SPACE			119	C	120			SPACE			
E	6	METER CONNECTION	3	20	121	A	122			SPACE			
		---			123	B	124			SPACE			
		---			125	C	126			SPACE			

"MDS" LOAD SUMMARY

120/208V, 3P, 4W — NEC – DERATED DEMAND LOAD IN VA

	Lighting	Recepts	Largest Motor	Remaining Motors	Equipment	Heating	Kitchen	Total
PANEL "LPL"	26,176	900	0	0	306	0	0	
PANEL "LPP"	0	67,320	1,176	1,176	29,586	0	0	
PANEL "LPM"	0	0	12,213	68,642	8,261	21,950	0	
BOOK SORTER					21,615			
RTU-1					51,157			
ELEVATOR					26,947			
TOTAL CONNECTED VA	26,176	68,220	12,213	70,994	137,872	21,950	0	
DEMAND FACTORS PER NEC	1.25	NEC 220.44	1.25	1.00	1.00	1.00	0.65	
TOTAL DEMAND LOAD (VA)	32,720	39,110	15,266	70,994	137,872	21,950	0	317,912

TOTAL DEMAND LOAD = 882 A
SPARE CAPACITY = 26% 318 A
TOTAL = 1,200 A

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ELECTRICAL PANEL SCHEDULES

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SYMBOLS

DATA/TELEPHONE DEVICES

- DATA (WALL)
- DATA/TELEPHONE COMBINATION (WALL)
- WALL PHONE - ANALOG/TDM
- WALL PHONE - VOIP
- DATA (FLOOR)
- DATA (CEILING)
- WIRELESS ACCESS POINT (CEILING)
- TELEVISION OUTLET (WALL)

POWER DEVICES

- DUPLEX AC OUTLET
- QUAD AC OUTLET
- J-BOX (WALL)
- J-BOX (FLOOR)
- J-BOX (CEILING)

SECURITY DEVICES

- CCTV CAMERA
- DOME CAMERA
- ACP — ACCESS CONTROL PANEL
- CB — CRASH BAR
- CR — CARD READER
- DA — DOOR ALARM
- DB — DOORBELL
- DR — DOOR RELEASE
- DPS — DOOR POSITION SWITCH
- EL — ELECTRIC LOCK
- ES — ELECTRIC STRIKE
- IAP — INTRUSION ALARM PANEL
- GB — GLASS BREAK
- KP — KEYPAD
- MD — MOTION DETECTOR
- MON — MONITOR
- PB — PANIC BUTTON
- PS — POWER SUPPLY
- REX — REQUEST TO EXIT
- SPA — SERVICE POINT ANNUNCIATOR
- SR — SIREN

AUDIO VISUAL DEVICES

- C-X — WALL MOUNTED CAMERA
- CB-X — COLLECTION BOX
- FB-X — FLOOR BOX
- FP-X — FLAT PANEL CONNECTION BOX
- KP-X — KEY PAD
- PU-X — TABLE POP-UP
- TP-X — TOUCH PANEL
- TV-X — TELEVISION
- VC-X — VOLUME CONTROL
- VS-X — VOLUME CONTROL/SOURCE SELECTION
- WA-X — WIRELESS ANTENNA
- WP-X — WALL PLATE
- CEILING MOUNTED J-BOX
- FLOOR MOUNTED J-BOX
- POKE THROUGH
- MICROPHONE
- CEILING MOUNTED SPEAKER
- WALL MOUNTED SPEAKER
- UNDER-FLOOR SOUND MASKING SPEAKER
- CEILING MOUNTED CAMERA
- PROJECTOR
- PROJECTOR W/LIFT

MISCELLANEOUS

- X / X-XX — WALL ELEVATION DETAIL CALL-OUT

ABBREVIATIONS

AC	ABOVE COUNTER
AFF	ABOVE FINISHED FLOOR
ARF	ABOVE RAISED FLOOR
AVC	AUDIOVISUAL CONTRACTOR
BLDG	BUILDING
CCTV	CLOSED CIRCUIT TELEVISION
CLG	CEILING
COMM	COMMUNICATION
CONT	CONTINUATION
DN	DOWN
DWG	DRAWING
EA	EACH
EC	ELECTRICAL CONTRACTOR
EF	ENTRANCE FACILITY
EM	EMERGENCY
EQUIP	EQUIPMENT
ER	EQUIPMENT ROOM
E	EXISTING
FBO	FURNISHED BY OTHERS
FT	FEET OR FOOT
HC	HORIZONTAL CROSS-CONNECT
HH	HAND HOLE
IC	INTERMEDIATE CROSS-CONNECT
IDF	INTERMEDIATE DISTRIBUTION FRAME
LOMMF	LASER OPTIMIZED MULTIMODE FIBER
MAX	MAXIMUM
MC	MAIN CROSS-CONNECT
MDF	MAIN DISTRIBUTION FRAME
MH	MAINTENANCE HOLE
MIN	MINIMUM
MM	MULTIMODE FIBER
MTD	MOUNTED
MTG	MOUNTING
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
OFE	OWNER FURNISHED EQUIPMENT
PB	PULL BOX
PP	POWER POLE
PTZ	PAN TILT ZOOM (CAMERA TYPE)
REQ	REQUIRED
SC	SECURITY CONTRACTOR
SCC	STRUCTURED CABLING CONTRACTOR
SM	SINGLEMODE FIBER
SPEC	SPECIFICATION
SPKR	SPEAKER
TBD	TO BE DETERMINED
TC	TELECOMMUNICATIONS CONTRACTOR
TO	TELECOMMUNICATIONS OUTLET
TR	TELECOMMUNICATIONS ROOM
TV	TELEVISION
TYP	TYPICAL
UON	UNLESS OTHERWISE NOTED
UTP	UNSHIELDED TWISTED PAIR
XC	CROSS CONNECT WIRE

STRUCTURED CABLING NOTES

1. NUMBER NEXT TO DATA OR DATA/VOICE INDICATES QUANTITY OF CABLES TO INSTALL. FOR DATA SYMBOLS INSTALL QUANTITY OF CABLES CALLED OUT. FOR DATA/VOICE SYMBOLS FIRST NUMBER INDICATES QUANTITY OF DATA, SECOND NUMBER INDICATES QUANTITY OF VOICE.
2. SCC TO FURNISH ALL MATERIALS AND INSTALLATION LABOR TO COMPLETE A FULLY FUNCTIONAL STRUCTURED CABLING SYSTEM INCLUDING, BUT NOT LIMITED TO: HORIZONTAL AND BACKBONE COPPER CABLE, JACKS, ADAPTERS, FACEPLATES, COPPER PATCH PANELS, COPPER TERMINATION BLOCKS, FIBER OPTIC CABLE, FIBER INNERDUCT, FIBER TERMINATION HARDWARE, FIBER CONNECTORS, VERTICAL AND HORIZONTAL CABLE MANAGEMENT, EQUIPMENT RACKS, CABLE TRAYS AND MOUNTING HARDWARE, CABLE SUPPORT HARDWARE, COPPER AND FIBER PATCH CORDS, LABELS, GROUNDING AND BONDING, TESTING AND CERTIFICATION.
3. UNLESS OTHERWISE NOTED, PROVIDE 6"-12" CABLE SLACK AT THE TELECOMMUNICATIONS OUTLET AND 10' CABLE SLACK AT THE TR. NEATLY MANAGE CABLE SLACK AT THE TR TO PERMIT RELOCATION OF EQUIPMENT RACKS.
4. EC TO FURNISH AND INSTALL ALL CONDUIT, CONDUIT SLEEVES, CORES, J-BOXES, PULL BOXES, AND OUTLET BOXES IN WALLS, FLOORS AND CEILINGS FOR SCC INSTALLED CABLING. PROVIDE BUSHINGS ON ALL CONDUIT AND CONDUIT SLEEVE ENDS. PROVIDE PULL STRINGS IN ALL CONDUITS.
5. TELECOMMUNICATION CONDUIT ROUTES AND LOCATIONS SHOWN ARE APPROXIMATE. INSTALL CONDUITS WITH A MAXIMUM OF TWO 90-DEGREE BENDS BETWEEN PULL POINTS. LOCATE PULL BOXES IN ACCESSIBLE AREAS.
6. UNLESS OTHERWISE NOTED THE SCC SHALL INSTALL APPROVED FIRE STOPPING MATERIALS IN ALL CONDUITS AND CONDUIT SLEEVES USED FOR COMMUNICATIONS AND/OR OTHER LOW-VOLTAGE CABLE INSTALLED BY THE SCC.
7. EC TO PROVIDE A TELECOMMUNICATIONS GROUNDING SYSTEM IN ALL TELECOMMUNICATIONS ROOMS. SYSTEM TO CONSIST OF A TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB) LOCATED IN THE ENTRANCE FACILITY AND A TELECOMMUNICATIONS GROUNDING BUSBAR (TGB) IN ALL TRS. A TMGB/TGB SHALL BE CONNECTED TO THE BUILDING GROUNDING ELETRODE AT THE CLOSEST PRACTICABLE POINT. REFER TO ANSI J-STD-607-A FOR FURTHER INFORMATION.

SECURITY NOTES

1. ALL EMPTY CONDUITS SHALL BE CLEANED, CAPPED, LABELED AND FURNISHED WITH A PULL STRING.
2. EC TO FURNISH AND INSTALL ALL CONDUITS AND BACK BOXES FOR ALL SYSTEMS AND DEVICES AS SHOWN ON THE DRAWINGS.
3. THERE SHALL BE ONE PULL BOX FOR EVERY 100 FEET OF CONDUIT AND A PULL BOX IF MORE THAN 180 DEGREES OF BEND ARE REQUIRED IN ANY RUN.
4. EC TO CONSOLIDATE CONDUITS FOR LIKE DEVICE VIA COLLECTION BOXES WHERE POSSIBLE.
5. ELECTRICAL FEEDS SHOULD NOT RUN PARALLEL WITH SECURITY SYSTEM CONDUIT. IF ELECTRICAL FEEDS CROSS SECURITY CONDUITS, THEY MUST CROSS AT 90-DEGREES.
6. AVOID ROUTING SECURITY CABLES NEAR SOURCES OF EMI. KEEP A MINIMUM CLEARANCE OF 4 FEET FROM POWER TRANSFORMERS AND MOTORS AND 6 INCHES FROM ALL CONDUIT AND CABLE USED FOR POWER DISTRIBUTION.
7. SC TO COORDINATE WITH GC TO ENSURE ALL SECURITY COMPONENTS ARE GROUNDED AND SURGE PROTECTED.
8. SECURITY CABLE SHALL NOT REST DIRECTLY ON ANY BUILDING STRUCTURE, PIPING, DUCT, ETC. AND SHALL BE SUPPORTED BY J-HOOKS OR APPROVED METHOD. SUPPORT METHOD SHALL HAVE A 5 FOOT SPACING MAXIMUM.
9. SC IS RESPONSIBLE FOR FIRE STOPPING THE CONDUITS, SLEEVES AND CORES THAT ARE DESIGNATED FOR USE BY THE SC. FOLLOW LOCAL CODES UNLESS OTHERWISE NOTED.
10. EC TO PROVIDE HARDWIRED 120VAC FOR ACCESS CONTROL PANELS PER APPLICABLE LOCAL CODES.
11. ALL CARD READERS TO BE MOUNTED AT 48" TO TOP OF READER UNLESS OTHERWISE NOTED.
12. SC TO PROVIDE ENVIRONMENTAL HOUSINGS FOR ALL EXTERIOR CAMERAS AND ANY CAMERAS REGULARLY EXPOSED TO THE ELEMENTS.
13. ALL CAMERAS SHALL TRANSMIT VIDEO OVER CAT-6.
14. POWER SUPPLIES FOR EXTERNAL PTZ CAMERAS SHALL BE LOCATED IN THE NEAREST TELECOM ROOM. SC TO COORDINATE WITH EC TO PROVIDE 120VAC POWER WHERE REQUIRED.
15. ALL ACCESS CONTROLLED EXTERIOR DOORS ARE TO FAIL SECURE.
16. SC TO FURNISH AND INSTALL A DPS FOR ALL EXTERIOR DOORS. THIS INCLUDES ALL MAN DOORS, BAY DOORS, AND ROOF HATCHES.
17. SC IS RESPONSIBLE FOR COORDINATING FINAL CAMERA VIEWS WITH OWNER.
18. ALL EXTERIOR CAMERAS SHALL BE EQUIPPED WITH A DAY/NIGHT IMAGER.
19. NOT ALL EQUIPMENT MAY BE SHOWN THAT MAY BE REQUIRED FOR OPERATION. PROVIDE ALL EQUIPMENT NECESSARY FOR A COMPLETE AND FUNCTIONAL SYSTEM.

AUDIOVISUAL NOTES

1. AUDIO VISUAL CONTRACTOR TO FURNISH AND INSTALL A COMPLETE AV SYSTEM FOR ALL DESIGNATED AREAS.
2. DATA AND POWER OUTLETS ARE SHOWN TO INDICATE REQUIREMENTS AND ARE FOR REFERENCE ONLY. REFER TO COMMUNICATIONS AND ELECTRICAL DRAWINGS FOR FURTHER INFORMATION.
3. ALL EMPTY CONDUITS SHALL BE CLEANED, CAPPED, LABELED AND FURNISHED WITH A PULL STRING.
4. EC TO FURNISH AND INSTALL ALL CONDUITS AND BACK BOXES FOR ALL SYSTEMS AND DEVICES AS SHOWN ON THE DRAWINGS.
5. THERE SHALL BE ONE PULL BOX FOR EVERY 100 FEET OF CONDUIT AND A PULL BOX IF MORE THAN 180 DEGREES OF BEND ARE REQUIRED IN ANY RUN.
6. ELECTRICAL FEEDS SHOULD NOT RUN PARALLEL WITH AUDIOVISUAL SYSTEM CONDUIT. IF ELECTRICAL FEEDS CROSS AUDIOVISUAL CONDUITS, THEY MUST CROSS AT 90DEGREES.
7. AVOID ROUTING AV CABLES NEAR SOURCES OF EMI. KEEP A MINIMUM CLEARANCE OF 4 FEET FROM POWER TRANSFORMERS AND MOTORS AND 6 INCHES FROM ALL CONDUIT AND CABLE USED FOR POWER DISTRIBUTION.
8. ALL POWER CONDUIT AND POWER OUTLET BOXES ARE TO BE REVIEWED BY ELECTRICAL ENGINEER.
9. ANY CABLE SHALL NOT REST DIRECTLY ON ANY BUILDING STRUCTURE PIPING, DUCT, ETC. CABLE SHALL BE SUPPORTED BY J-HOOKS OR APPROVED METHOD. SUPPORT METHOD SHALL HAVE A 5 FOOT SPACING MAXIMUM.
10. AVC IS RESPONSIBLE FOR FIRE STOPPING THE CONDUITS, SLEEVES AND CORES THAT EITHER THE AVC OR THE EC INSTALLS THAT ARE DESIGNATED FOR USE BY THE AVC, PER APPLICABLE CODES UNLESS NOTED OTHERWISE.
11. AVC TO FURNISH AND INSTALL CABLE MANAGEMENTS AS REQUIRED.
12. IF INDICATED ON THE DRAWINGS, A TECHNICAL GROUND SYSTEM MUST BE UTILIZED AS SHOWN.

RESPONSIBILITY MATRIX

SYSTEMS/EQUIPMENT	EC	SCC	AVC	SC	OFE	COMMENTS
CONDUITS AND SLEEVES (SEE COMMENTS)	X					
FIRESTOP PENETRATIONS	X					
FIRESTOP CONDUITS/SLEEVES	X	X				* (SEE NOTE BELOW)
OUTLET AND FLOOR BOXES	X					
WIRE MESH BASKET TRAY		X				
NETWORK EQUIPMENT					X	
PHONE SWITCH					X	
PHONE HAND SETS					X	
AV EQUIPMENT			X			
AV CABLE		X	X			SCC INSTALLS DATA CABLE
VOICE/DATA CABLE		X				
WIRELESS CALL DEVICES				X		
DOOR BELL	X					
PAGING SPEAKERS		X				
PAGING CABLE		X				
SECURITY DEVICES				X		
SECURITY CABLE		X		X		SCC INSTALLS DATA CABLE
SECURITY HEAD-END				X		

* SCC RESPONSIBLE FOR COMMUNICATIONS CONDUITS/SLEEVES

Sheet Number	Sheet Name
T000	Technology Sheet Index and Legend
TA101	Audiovisual - First Floor Plan
TA102	Audiovisual - Second Floor Plan
TA121	Audiovisual - First Floor RCP
TA401	Audiovisual One-lines
TC101	Telecom - First Floor Plan
TC102	Telecom - Second Floor Plan
TC121	Telecom - First Floor RCP
TC122	Telecom - Second Floor RCP
TC400	Telecom - Enlarged IT Room, Rack Elevations & Details
TS101	Security - First Floor Plan
TS102	Security - Second Floor Plan
TS121	Security - First Floor RCP
TS122	Security - Second Floor RCP

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Technology Sheet Index and Legend

T000

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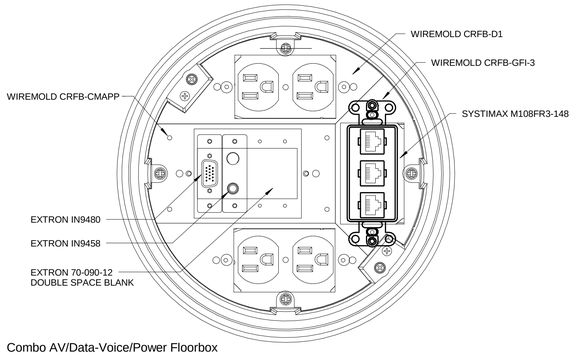
1 LEVEL 01
1/8" = 1'-0"

GENERAL SHEET NOTES:

1. REFER TO THE ARCHITECHTURAL DRAWINGS FOR CLAIRIFICATION OF PROVIDER & INSTALLER OF EQUIPMENT SCOPE.

EQUIPMENT LEGEND:

- CB-1 — 3-GANG BOX AT 18" ARF WITH (2) 1" AND (1) 3/4" CONDUIT STUBBED ABOVE CLG AND TURNED INTO ROOM AND (2) 1" CONDUITS STUBBED BELOW RAISED FLOOR AND TURNED INTO CLP SPACE.
- FB-1 — FLOOR BOX WITH POWER, DATA, AND CONNECTIVITY FOR AV.
- FB-2 — FLOOR BOX WITH POWER, DATA, AND CONNECTIVITY FOR AV.
- FB-3 — FLOOR BOX WITH POWER, DATA, AND CONNECTIVITY FOR AV.
- KP-1 — SINGLE GANG BOX AT 54" ARF WITH (1) 1" CONDUIT STUBBED BELOW RAISED FLOOR AND TURNED INTO ROOM.
- WP-1 — SINGLE GANG AT 72" ARF WITH (1) 1" CONDUIT STUBBED BELOW RAISED FLOOR AND TURNED INTO ROOM.
- FP-1 — 2-GANG BOX LOCATED AS SHOWN IN ELEVATION 4 ON SHEET TA6.01, WITH (1) 1-1/4" CONDUIT STUBBED BELOW RAISED FLOOR AND TURNED INTO ROOM.



2 Combo AV/Data-Voice/Power Floorbox (FB-1) - CLP 130
6" = 1'-0"

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Audiovisual - First Floor Plan

TA101

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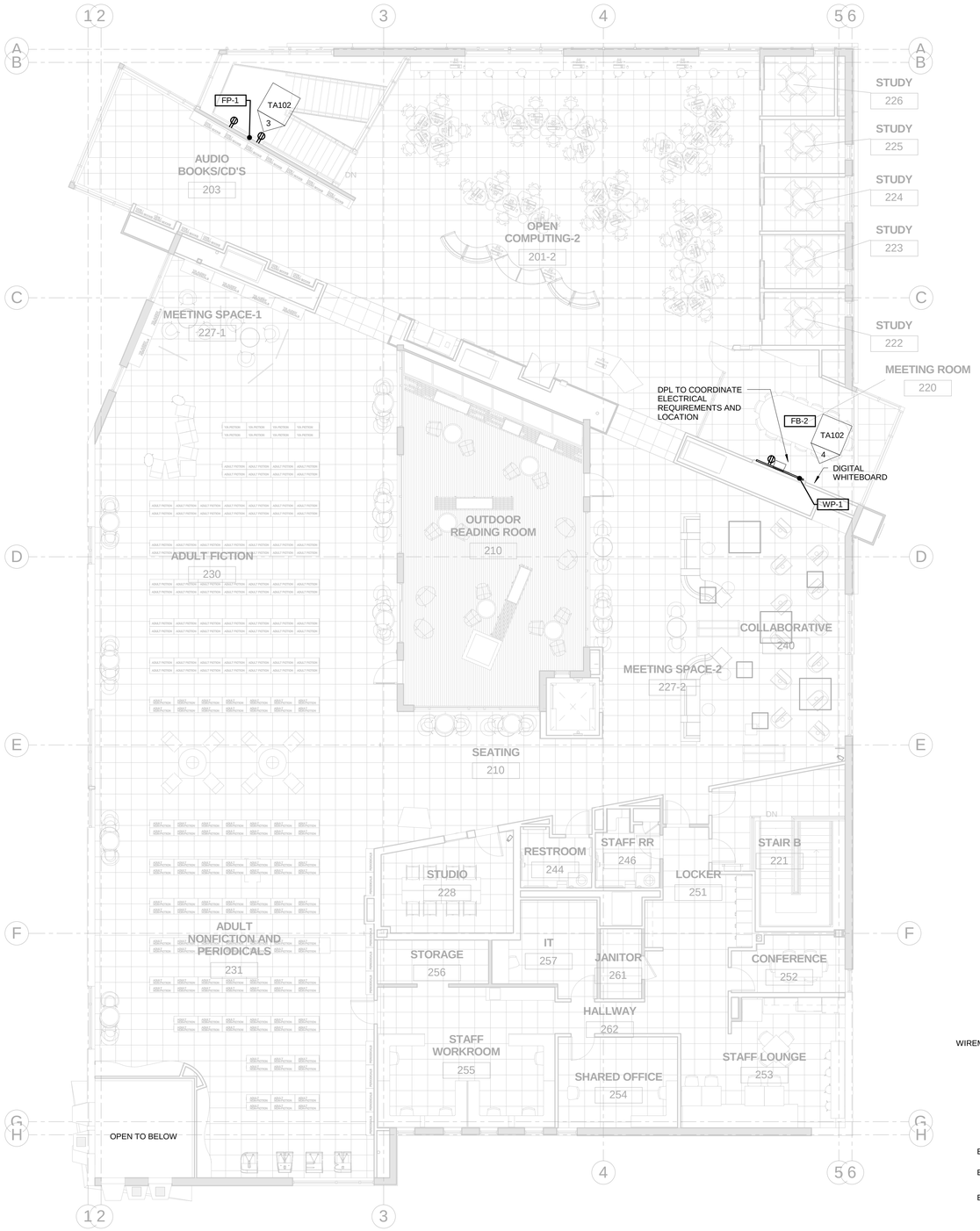

1 LEVEL 02
1/8" = 1'-0"

GENERAL SHEET NOTES:

1. REFER TO THE ARCHITECHTURAL DRAWINGS FOR CLAIRIFICATION OF PROVIDER & INSTALLER OF EQUIPMENT SCOPE.

EQUIPMENT LEGEND:

CB-1	3-GANG BOX AT 18" ARF WITH (2) 1" AND (1) 3/4" CONDUIT STUBBED ABOVE CLG AND TURNED INTO ROOM AND (2) 1" CONDUITS STUBBED BELOW RAISED FLOOR AND TURNED INTO CLP SPACE.
FB-1	FLOOR BOX WITH POWER, DATA, AND CONNECTIVITY FOR AV.
FB-2	FLOOR BOX WITH POWER, DATA, AND CONNECTIVITY FOR AV.
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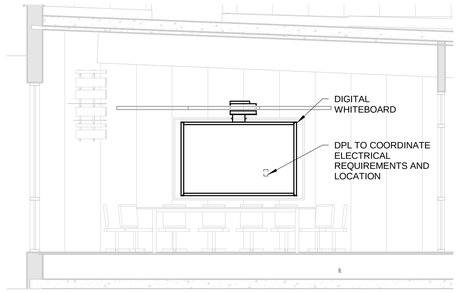
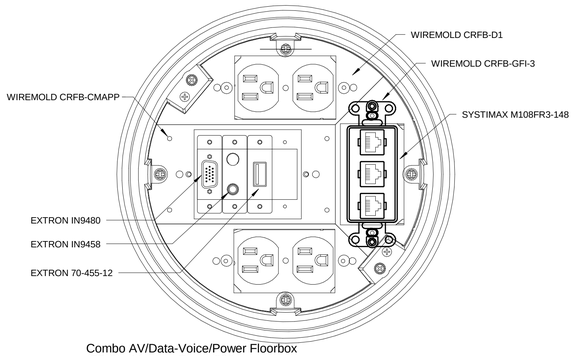
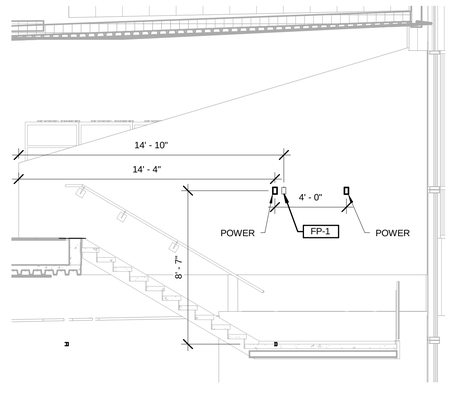
WP-1	SINGLE GANG AT 72" ARF WITH (1) 1" CONDUIT STUBBED BELOW RAISED FLOOR AND TURNED INTO ROOM.
FP-1	2-GANG BOX LOCATED AS SHOWN IN ELEVATION 4 ON SHEET TA6.01, WITH (1) 1-1/4" CONDUIT STUBBED BELOW RAISED FLOOR AND TURNED INTO ROOM.



4 Elevation - Second Floor Conference Room
1/4" = 1'-0"



Combo AV/Data-Voice/Power Floorbox (FB-2) - Meeting Room 220
2 6" = 1'-0"



3 Elevation - Second floor AV wall at Stairs
1/4" = 1'-0"

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Audiovisual - Second Floor Plan

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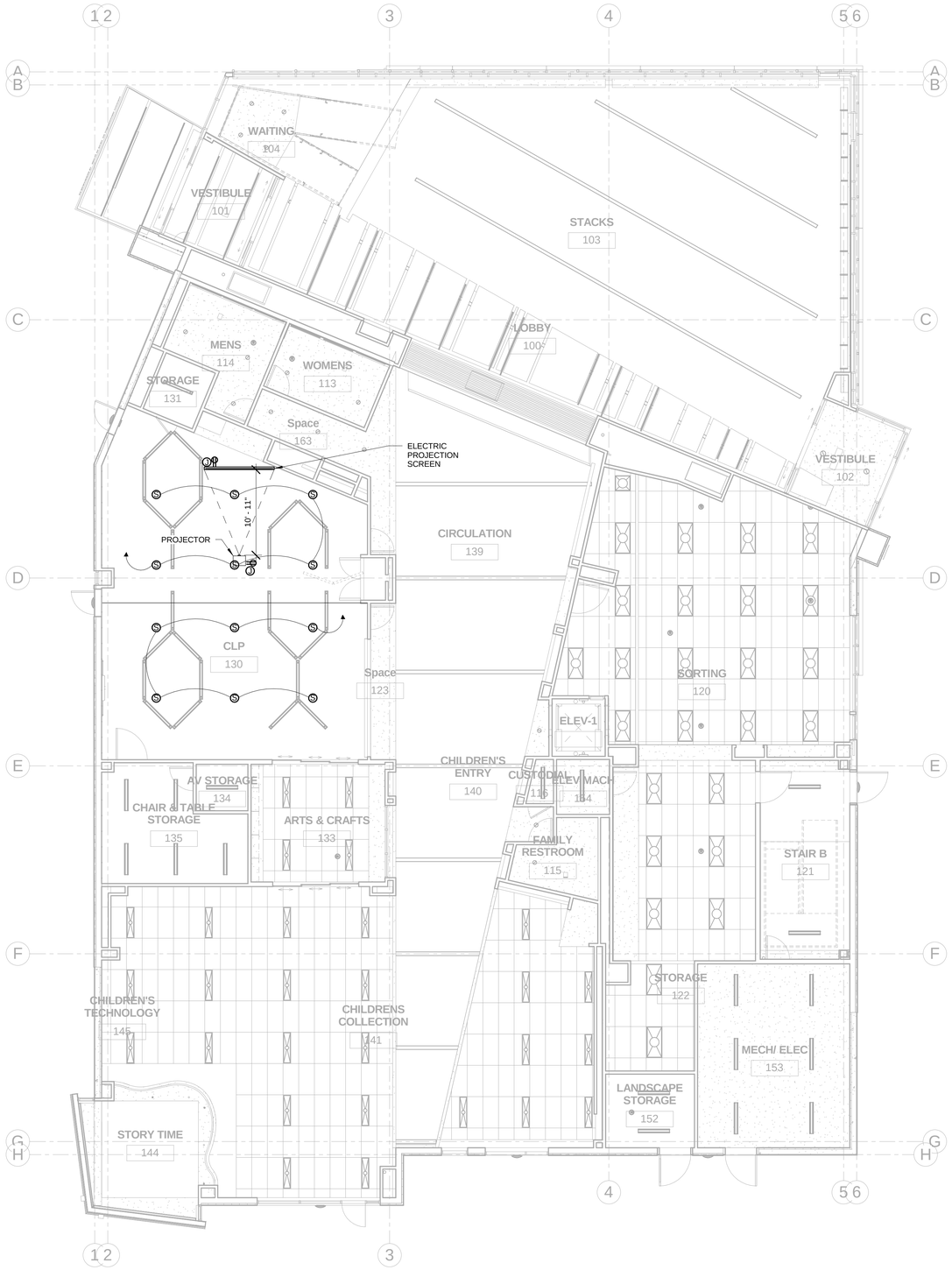

1 LEVEL 01
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Audiovisual - First Floor RCP

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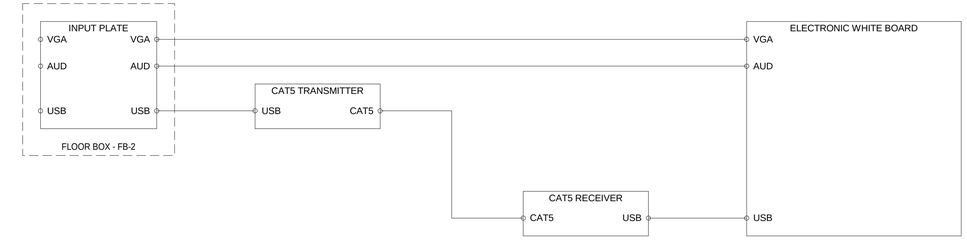
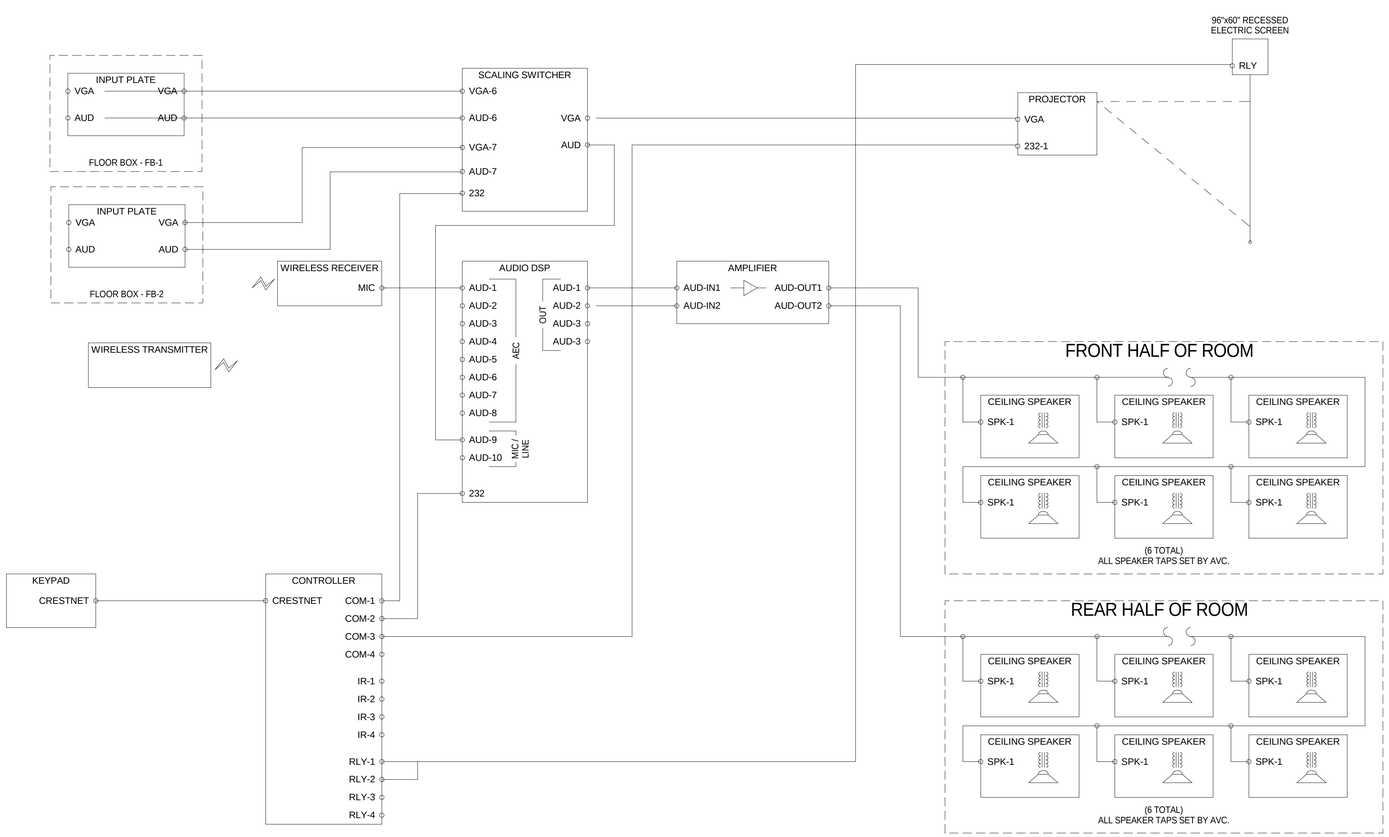


2 Meeting Room 220
NTS



1 AV One-Line Community Learning Plaza
NTS

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Audiovisual One-lines

TA401

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1 LEVEL 01
1/8" = 1'-0"

GENERAL SHEET NOTES:

1. EC TO FURNISH AND INSTALL ALL CONDUITS, CORES, CONDUIT SLEEVES, OUTLET BOXES, FLOOR BOXES, POKE-THRUS, PULL BOXES AND OTHER RACEWAY COMPONENTS REQUIRED FOR SCC TO INSTALL COMMUNICATIONS CABLE. INSTALL PULL STRINGS IN ALL CONDUITS INTENDED FOR COMMUNICATIONS AND AUDIOVISUAL CABLING.

2. RECEPTACLES SHALL BE LOCATED WITHIN 9" OF WALL MOUNTED TELECOMMUNICATIONS, AUDIOVISUAL AND TELEVISION OUTLETS. CONTRACTOR SHALL RELOCATE ASSOCIATED DEVICE (S) WHICH ARE NOT INSTALLED WITHIN 9" OF EACH OTHER AT THE REQUEST OF THE ARCHITECT AND/OR ENGINEER AT NO ADDITIONAL COST TO THE OWNER.

3. FOR OUTLET BOXES LOCATED IN WALLS, EC TO PROVIDE DOUBLE GANG BOX WITH SINGLE GANG MUDRING AND MINIMUM 1" CONDUIT STUBBED INTO ACCESSIBLE SPACE. WHERE OUTLETS ARE LOCATED IN WALLS WITH ACCESS FLOOR, STUB CONDUITS DOWN INTO FLOOR. WHERE OUTLETS ARE LOCATED IN WALL AND THERE IS NO RAISED FLOOR, STUB CONDUITS UP INTO ACCESSIBLE CEILING.

4. ALL HORIZONTAL COMMUNICATIONS CABLE FOR OUTLETS LOCATED ON THE FIRST AND SECOND FLOOR ROUTES TO SECOND FLOOR IT ROOM 257.

5. SCC TO INSTALL PLENUM RATED CABLE FOR ALL COMMUNICATIONS OUTLETS.

6. SCC TO PROVIDE MINIMUM 15' SERVICE COIL AT ALL FLOOR BOX LOCATIONS INSTALLED IN ACCESS FLOOR.

7. COORDINATE CONDUIT REQUIREMENTS WITH AV DESIGNER FOR FLOOR BOXES CONTAINING AUDIOVISUAL CONNECTIONS.

8. LOCATION OF FLOOR BOXES IS FURNITURE DEPENDANT; CONTRACTOR SHALL RELOCATE ANY FLOOR BOX REQUESTED BY OWNER/ARCHITECT DURING CONSTRUCTION WITHIN 10' OF INSTALLED LOCATION AT NO ADDITIONAL COST TO THE OWNER.

⎔ SHEET KEY NOTES:

T1 COMBINATION DATA/POWER FLOOR BOX IN ACCESS FLOOR BY EC, TYPICAL. SCC TO PROVIDE QUANTITY OF CABLE SHOWN.

T3 SCC TO PROVIDE CAT 6 DATA FOR EACH RFID GATE PEDESTAL. COORDINATE CONNECTIONS WITH RFID GATE VENDOR.

T4 DIGITAL SIGNAGE LOCATION. EC TO PROVIDE OUTLET BOX WITH MINIMUM 1" CONDUIT TO ACCESSIBLE FLOOR OR CEILING. SCC TO PROVIDE QUANTITY OF DATA SHOWN. COORDINATE LOCATION WITH AV.

T5 SECURITY MONITOR LOCATION. SCC TO PROVIDE QUANTITY OF DATA SHOWN.

T6 DATA OUTLETS SHOWN FOR COUNT PURPOSES. OUTLET PLATES WILL BE LOCATED IN THE FURNITURE UTILITY COLUMNS AND WILL BE FED FROM BELOW. CONFIRM WITH FURNITURE MANUFACTURER AS TO TYPE OF PLATE NEEDED TO HOLD SYSTIMAX JACKS.

T7 DATA OUTLET FOR BUILDING CONTROLS. SCC TO COORDINATE LOCATION AND TERMINATION WITH MECHANICAL/ELECTRICAL CONTRACTOR.

T8 COORDINATE LOCATION WITH FURNITURE.

T9 COMBINATION DATA/AUDIOVISUAL/POWER FLOOR BOX IN ACCESS FLOOR BY EC. SCC TO PROVIDE QUANTITY OF CABLE SHOWN. AUDIOVISUAL COMPONENTS AND CABLE BY AV CONTRACTOR.

T10 PHONE LINE FOR GAS METER. INSTALL WEATHERPROOF COVER OVER FACEPLATE. ROUTE CAT 6 CABLE TO TR AND TERMINATE ON 66-BLOCK.

T11 PHONE LINE FOR ELEVATOR EMERGENCY PHONE. SCC TO PROVIDE (1) CAT 6 CABLE TO ELEVATOR CONTROL ROOM. COORDINATE LOCATION AND TERMINATION WITH ELEVATOR CONTRACTOR. TERMINATE CABLE IN TR ON 66-BLOCK.

T12 DATA OUTLET FOR DIGITAL WHITEBOARD.

T13 PHONE LINES FOR FIRE ALARM PANEL. COORDINATE LOCATION AND TERMINATION WITH FIRE ALARM CONTRACTOR. TERMINATE CABLE IN TR ON 66-BLOCK.

T14 12" X 4" WIRE MESH CABLE TRAY INSTALLED IN RAISED FLOOR BY SCC. INSTALL WITH BOTTOM OF TRAY BETWEEN 6" - 8" ABOVE STRUCTURAL FLOOR. COORDINATE TRAY TO CROSS BELOW 14" FABRIC HVAC DUCT.

T16 (2) 4" CONDUITS BY EC FOR ROUTING OF 1ST FLOOR DATA CABLE TO 2ND FLOOR RAISED FLOOR. STUB CONDUITS DOWN 4" INTO 1ST FLOOR RAISED FLOOR. STUB CONDUITS UP 4" ABOVE STRUCTURAL FLOOR ON 2ND FLOOR. INSTALL BUSHINGS ON ALL CONDUITS.

T17 EZ-PATH SERIES 44 FIRE RATED PATHWAYS BY EC. REFER TO 271500 FOR PRODUCT SPECIFICATIONS. INSTALL QUANTITY SHOWN. ALIGN HEIGHT TO MATCH BOTTOM OF WIRE MESH CABLE TRAY.

T30 (5) 4" SERVICE ENTRANCE CONDUITS BY EC. ROUTE CONDUITS DOWN THROUGH LEVEL ONE UNDER SLAB. ROUTE (4) CONDUITS TO THE NORTH TO COLFAX STREET AND TERMINATE IN MINIMUM 24" X 24" HAND HOLE. COORDINATE LOCATION WITH LANDSCAPE AND CIVIL PLANS. ROUTE (1) CONDUIT WEST TOWARDS IRVING STREET. CAP AND MARK AT PROPERTLY LINE FOR FUTURE USE.

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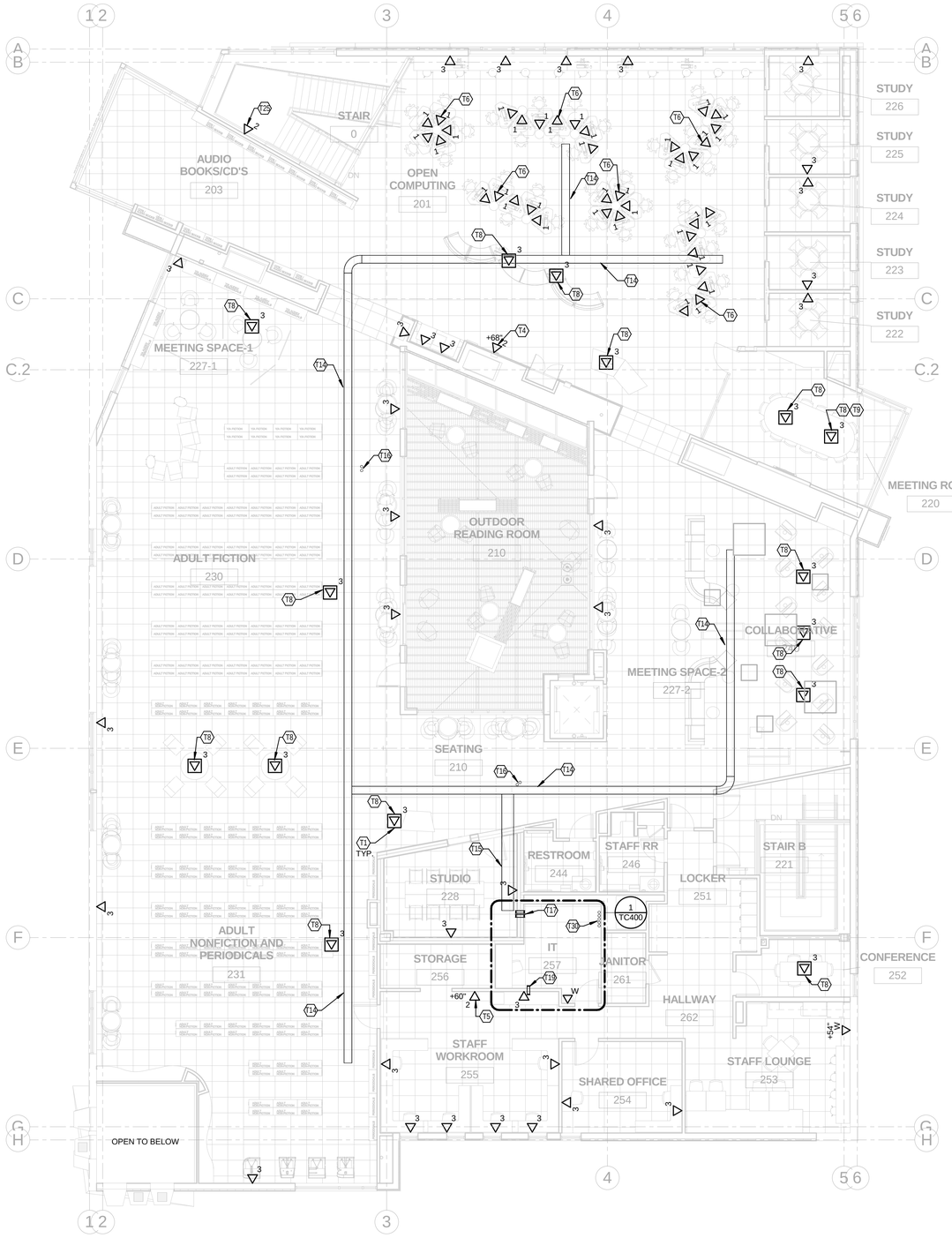

1 LEVEL 02
1/8" = 1'-0"

GENERAL SHEET NOTES:

1. EC TO FURNISH AND INSTALL ALL CONDUITS, CORES, CONDUIT SLEEVES, OUTLET BOXES, FLOOR BOXES, POKE-THRUS, PULL BOXES AND OTHER RACEWAY COMPONENTS REQUIRED FOR SCC TO INSTALL COMMUNICATIONS CABLE. INSTALL PULL STRINGS IN ALL CONDUITS INTENDED FOR COMMUNICATIONS AND AUDIOVISUAL CABLING.

2. RECEPTACLES SHALL BE LOCATED WITHIN 9" OF WALL MOUNTED TELECOMMUNICATIONS, AUDIOVISUAL AND TELEVISION OUTLETS. CONTRACTOR SHALL RELOCATE ASSOCIATED DEVICE (S) WHICH ARE NOT INSTALLED WITHIN 9" OF EACH OTHER AT THE REQUEST OF THE ARCHITECT AND/OR ENGINEER AT NO ADDITIONAL COST TO THE OWNER.

3. FOR OUTLET BOXES LOCATED IN WALLS, EC TO PROVIDE DOUBLE GANG BOX WITH SINGLE GANG MUDRING AND MINIMUM 1" CONDUIT STUBBED INTO ACCESSIBLE SPACE. WHERE OUTLETS ARE LOCATED IN WALLS WITH ACCESS FLOOR, STUB CONDUITS DOWN INTO FLOOR. WHERE OUTLETS ARE LOCATED IN WALL AND THERE IS NO RAISED FLOOR, STUB CONDUITS UP INTO ACCESSIBLE CEILING.

4. ALL HORIZONTAL COMMUNICATIONS CABLE FOR OUTLETS LOCATED ON THE FIRST AND SECOND FLOOR ROUTES TO SECOND FLOOR IT ROOM 257.

5. SCC TO INSTALL PLENUM RATED CABLE FOR ALL COMMUNICATIONS OUTLETS.

6. SCC TO PROVIDE MINIMUM 15' SERVICE COIL AT ALL FLOOR BOX LOCATIONS INSTALLED IN ACCESS FLOOR.

7. COORDINATE CONDUIT REQUIREMENTS WITH AV DESIGNER FOR FLOOR BOXES CONTAINING AUDIOVISUAL CONNECTIONS.

8. LOCATION OF FLOOR BOXES IS FURNITURE DEPENDANT; CONTRACTOR SHALL RELOCATE ANY FLOOR BOX REQUESTED BY OWNER/ARCHITECT DURING CONSTRUCTION WITHIN 10' OF INSTALLED LOCATION AT NO ADDITIONAL COST TO THE OWNER.

⎔ SHEET KEY NOTES:

T1 COMBINATION DATA/POWER FLOOR BOX IN ACCESS FLOOR BY EC, TYPICAL. SCC TO PROVIDE QUANTITY OF CABLE SHOWN.

T4 DIGITAL SIGNAGE LOCATION. EC TO PROVIDE OUTLET BOX WITH MINIMUM 1" CONDUIT TO ACCESSIBLE FLOOR OR CEILING. SCC TO PROVIDE QUANTITY OF DATA SHOWN. COORDINATE LOCATION WITH AV.

T5 SECURITY MONITOR LOCATION. SCC TO PROVIDE QUANTITY OF DATA SHOWN.

T6 DATA OUTLETS SHOWN FOR COUNT PURPOSES. OUTLET PLATES WILL BE LOCATED IN THE FURNITURE UTILITY COLUMNS AND WILL BE FED FROM BELOW. CONFIRM WITH FURNITURE MANUFACTURER AS TO TYPE OF PLATE NEEDED TO HOLD SYSTIMAX JACKS.

T8 COORDINATE LOCATION WITH FURNITURE.

T9 COMBINATION DATA/AUDIOVISUAL/POWER FLOOR BOX IN ACCESS FLOOR BY EC. SCC TO PROVIDE QUANTITY OF CABLE SHOWN. AUDIOVISUAL COMPONENTS AND CABLE BY AV CONTRACTOR.

T14 12" X 4" WIRE MESH CABLE TRAY INSTALLED IN RAISED FLOOR BY SCC. INSTALL WITH BOTTOM OF TRAY BETWEEN 6" - 8" ABOVE STRUCTURAL FLOOR. COORDINATE TRAY TO CROSS BELOW 14" FABRIC HVAC DUCT.

T15 18" X 4" WIRE MESH CABLE TRAY INSTALLED IN RAISED FLOOR BY SCC. INSTALL WITH BOTTOM OF TRAY BETWEEN 6" - 8" ABOVE STRUCTURAL FLOOR. COORDINATE HEIGHT WITH IT ROOM ENTRY CONDUITS.

T16 (2) 4" CONDUITS BY EC FOR ROUTING OF 1ST FLOOR DATA CABLE TO 2ND FLOOR RAISED FLOOR. STUB CONDUITS DOWN 4" INTO 1ST FLOOR RAISED FLOOR. STUB CONDUITS UP 4" ABOVE STRUCTURAL FLOOR ON 2ND FLOOR. INSTALL BUSHINGS ON ALL CONDUITS.

T17 EZ-PATH SERIES 44 FIRE RATED PATHWAYS BY EC. REFER TO 271500 FOR PRODUCT SPECIFICATIONS. INSTALL QUANTITY SHOWN. ALIGN HEIGHT TO MATCH BOTTOM OF WIRE MESH CABLE TRAY.

T19 EZ-PATH SERIES 44 FIRE RATED PATHWAYS BY EC. REFER TO 271500 FOR PRODUCT SPECIFICATIONS. INSTALL QUANTITY SHOWN. INSTALL ABOVE CEILING.

T21 PROVIDE OUTDOOR RATED PAGING SPEAKER.

T25 FUTURE VIDEO WALL LOCATION. EC TO PROVIDE 4S DEEP OUTLET BOX WITH MINIMUM 1" CONDUIT STUBBED INTO ACCESSIBLE FLOOR FOR FUTURE VIDEO WALL. SCC TO PROVIDE QUANTITY OF DATA SHOWN FOR FLAT PANEL DISPLAYS. TERMINATE CABLE AND LEAVE JACKS STORED INSIDE BACKBOX. DO NOT PROVIDE FACEPLATE AS OUTLET BOX WILL BE COVERED BY GYP BOARD UNTIL NEEDED.

T30 (5) 4" SERVICE ENTRANCE CONDUITS BY EC. ROUTE CONDUITS DOWN THROUGH LEVEL ONE UNDER SLAB. ROUTE (4) CONDUITS TO THE NORTH TO COLFAX STREET AND TERMINATE IN MINIMUM 24" X 24" HAND HOLE. COORDINATE LOCATION WITH LANDSCAPE AND CIVIL PLANS. ROUTE (1) CONDUIT WEST TOWARDS IRVING STREET. CAP AND MARK AT PROPERTLY LINE FOR FUTURE USE.

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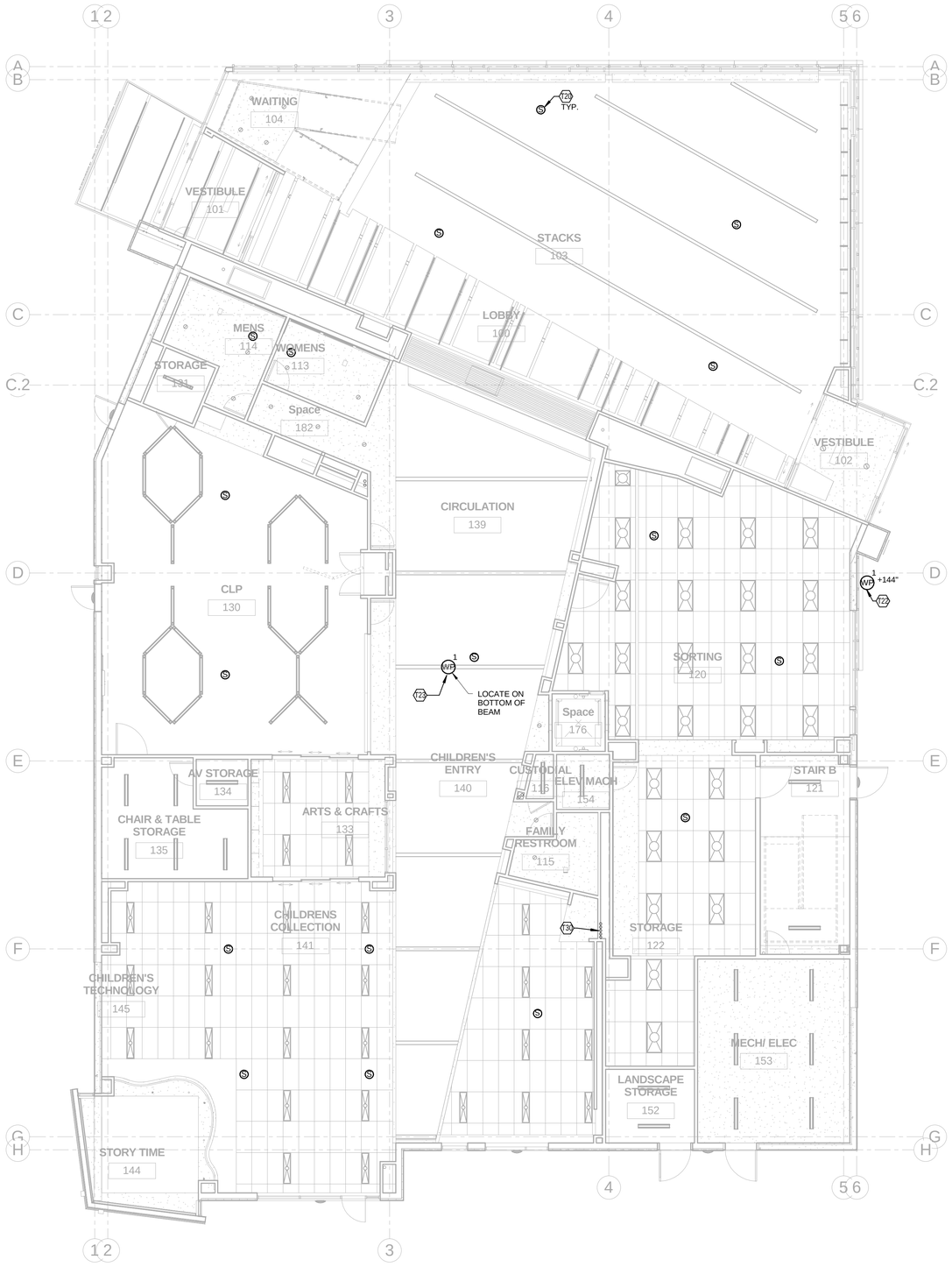

1 LEVEL 01
1/8" = 1'-0"

GENERAL SHEET NOTES:

1. FOR CEILING MOUNTED COMMUNICATIONS OUTLETS INCLUDING WAPS LOCATED IN ACCESSIBLE CEILING. STUB CONDUIT DOWN INTO ACCESSIBLE FLOOR OR INTO ACCESSIBLE CEILING.

2. FOR CEILING MOUNTED COMMUNICATIONS OUTLETS INCLUDING WAPS LOCATED IN NON-ACCESSIBLE CEILING OR CEILINGS OPEN TO STRUCTURE, PROVIDE 4S BOX WITH MINIMUM 3/4" CONDUIT FROM OUTLET DOWN INTO ACCESSIBLE FLOOR OR INTO ACCESSIBLE CEILING.

3. SCC TO PROVIDE ONE (1) CAT 6 CABLE AT EACH WAP LOCATION. FOR WAPS LOCATED IN AREAS WITH CEILINGS OPEN TO STRUCTURE, EC TO PROVIDE MINIMUM 3/4" CONDUIT FROM WAP LOCATION DOWN INTO ACCESSIBLE FLOOR SPACE FOR SCC INSTALLED DATA CABLE.

4. EC TO PROVIDE 120V POWER FOR OUTDOOR WAP.

5. PAGING SPEAKERS AND CABLING BY SCC. REFER TO SPECIFICATION SECTION FOR APPROVED MANUFACTURERS. PAGING SYSTEM WILL BE A MULTIZONED SYSTEM. COORDINATE WITH DPL ON ZONE COVERAGE.

⎔ SHEET KEY NOTES:

T20 PAGING SPEAKER BY SCC, TYPICAL. REFER TO SPECIFICATIONS FOR APPROVED SPEAKER MANUFACTURER AND TYPES.

T22 OUTDOOR WIRELESS ACCESS POINT. EC TO PROVED SINGLE GANG BOX WITH 3/4" CONDUIT STUBBED INTO ACCESSIBLE FLOOR FOR SCC INSTALLED CABLING. PROVIDE 12-18 CABLE SLACK AT WAP LOCATION TO ALLOW FIELD INSTALLED RJ-45 PLUG. EC TO CONFIRM WITH DPL-IT IF 120V POWER IS NEEDED FOR WIRELESS EQUIPMENT.

T23 SCC TO PROVIDE ONE (1) CAT 6 DATA AT EACH WAP LOCATION. CONFIRM WAP LOCATION WITH DPL-IT PRIOR TO ROUGH-IN. EC TO PROVIDE MIN. 3/4" CONDUIT FROM WAP LOCATION DOWN INTO ACCESSIBLE FLOOR.

T30 (5) 4" SERVICE ENTRANCE CONDUITS BY EC. ROUTE CONDUITS DOWN THROUGH LEVEL ONE UNDER SLAB. ROUTE (4) CONDUITS TO THE NORTH TO COLFAX STREET AND TERMINATE IN MINIMUM 24" X 24" HAND HOLE. COORDINATE LOCATION WITH LANDSCAPE AND CIVIL PLANS. ROUTE (1) CONDUIT WEST TOWARDS IRVING STREET. CAP AND MARK AT PROPERTLY LINE FOR FUTURE USE.

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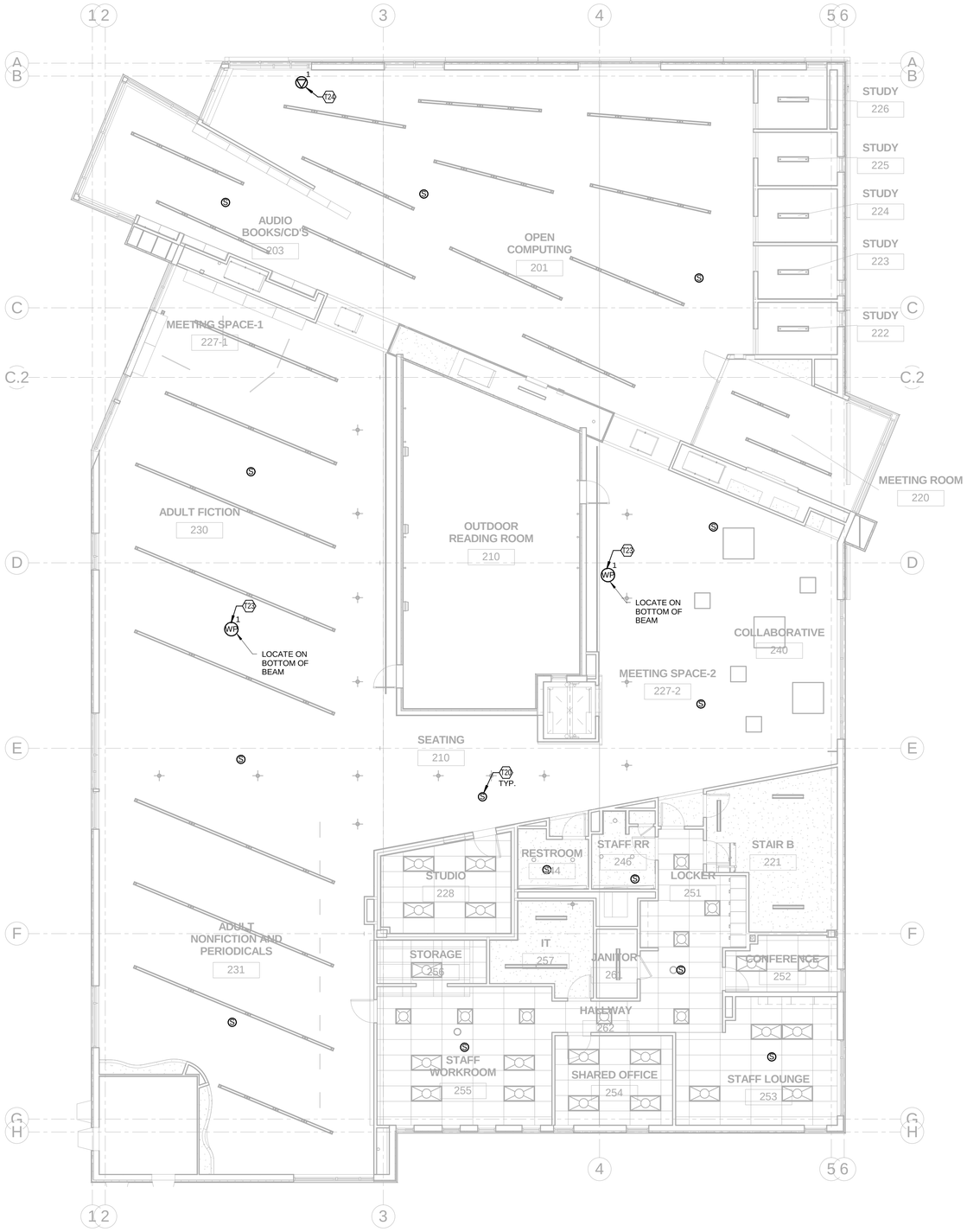

1 LEVEL 02
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1. FOR CEILING MOUNTED COMMUNICATIONS OUTLETS INCLUDING WAPS LOCATED IN ACCESSIBLE CEILING, STUB CONDUIT DOWN INTO ACCESSIBLE FLOOR OR INTO ACCESSIBLE CEILING.

2. FOR CEILING MOUNTED COMMUNICATIONS OUTLETS INCLUDING WAPS LOCATED IN NON-ACCESSIBLE CEILING OR CEILINGS OPEN TO STRUCTURE, PROVIDE 4S BOX WITH MINIMUM 3/4" CONDUIT FROM OUTLET DOWN INTO ACCESSIBLE FLOOR OR INTO ACCESSIBLE CEILING.

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4. EC TO PROVIDE 120V POWER FOR OUTDOOR WAP.

5. PAGING SPEAKERS AND CABLING BY SCC. REFER TO SPECIFICATION SECTION FOR APPROVED MANUFACTURERS. PAGING SYSTEM WILL BE A MULTIZONED SYSTEM. COORDINATE WITH DPL ON ZONE COVERAGE.

⎔ SHEET KEY NOTES:

T20 PAGING SPEAKER BY SCC, TYPICAL. REFER TO SPECIFICATIONS FOR APPROVED SPEAKER MANUFACTURER AND TYPES.

T23 SCC TO PROVIDE ONE (1) CAT 6 DATA AT EACH WAP LOCATION. CONFIRM WAP LOCATION WITH DPL-IT PRIOR TO ROUGH-IN. EC TO PROVIDE MIN. 3/4" CONDUIT FROM WAP LOCATION DOWN INTO ACCESSIBLE FLOOR.

T24 CEILING DATA FOR PROJECTOR. COORDINATE LOCATION WITH ELECTRICAL OUTLET AND PROJECTOR MOUNT.

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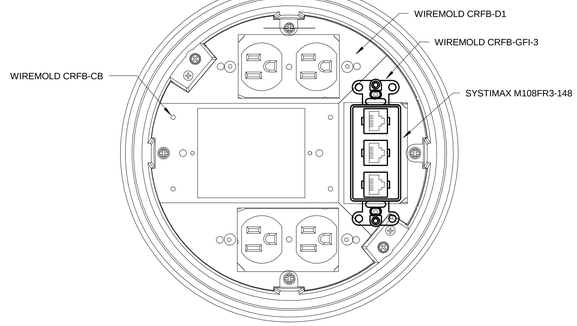
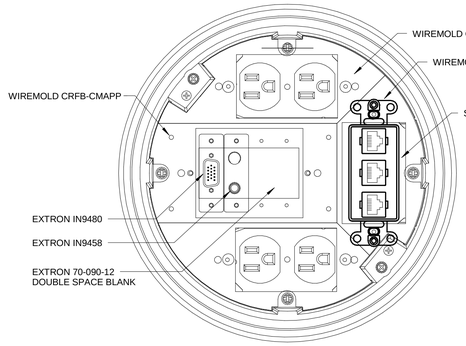
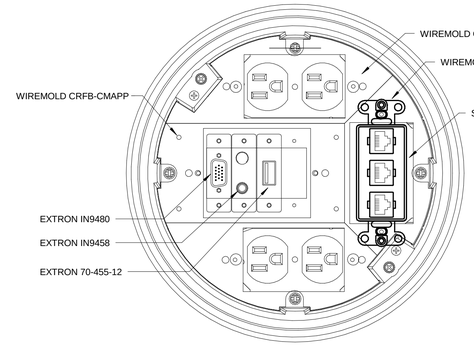


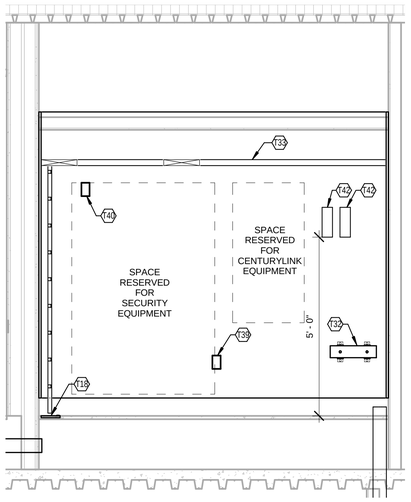
6 Combo Data-Voice/Power Floorbox
6" = 1'-0"



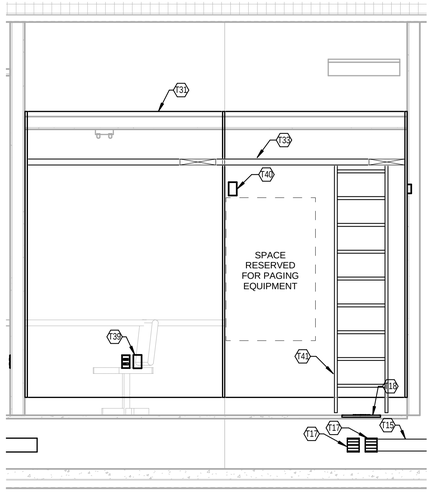
7 Combo AV/Data-Voice/Power Floorbox
(FB-1) - CLP 130
6" = 1'-0"



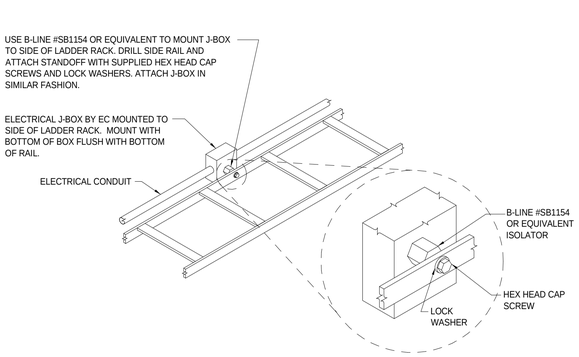
8 Combo AV/Data-Voice/Power Floorbox
(FB-2) - Meeting Room 220
6" = 1'-0"



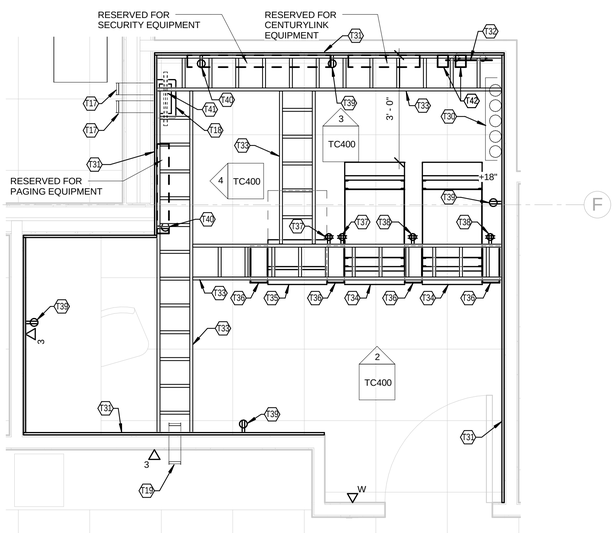
3 North Wall Elevation - IT Room 257
1/2" = 1'-0"



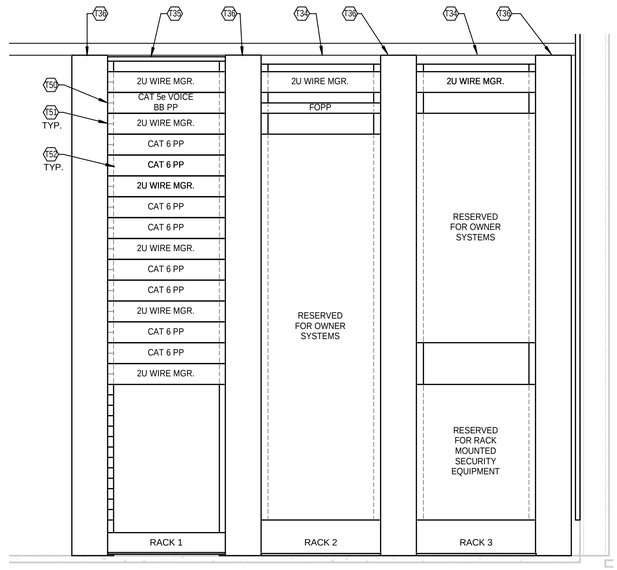
4 West Wall Elevation - IT Room 257
1/2" = 1'-0"



5 Ladder Rack J-box (Isolator) Mounting Detail
NTS



1 Enlarged Plan - IT Room 257
1/2" = 1'-0"



2 Telecom Rack Elevation - IT Room 257
1" = 1'-0"

GENERAL SHEET NOTES:

1. GC TO FURNISH AND INSTALL PLYWOOD IN TELECOMMUNICATIONS ROOM. INSTALL 4' X 8' X 3/4" AC GRADE PLYWOOD WITH A-SIDE FACING OUT. PAINT PLYWOOD WITH MINIMUM OF TWO COATS OF FIRE RETARDENT PAINT ON ALL EXPOSED SIDES, WHITE. MOUNT PLYWOOD VERTICALLY WITH BOTTOM AT 6" AFF AND TOP AT 102" AFF. TRIM TOP IF REQUIRED.

2. EC TO FURNISH AND INSTALL ALL CONDUITS, CORES, CONDUIT SLEEVES, OUTLET BOXES, FLOOR BOXES, POKE-THRUS, PULL BOXES AND OTHER RACEWAY COMPONENTS REQUIRED FOR SCC TO INSTALL COMMUNICATIONS CABLE. INSTALL PULL STRINGS IN ALL CONDUITS. INSTALL BUSHINGS ON ALL CONDUIT AND SLEEVE ENDS.

3. EC TO FURNISH AND INSTALL A TELECOMMUNICATIONS GROUNDING SYSTEM CONSISTING OF A TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB) IN THE BUILDING ENTRANCE. INSTALL SYSTEM IN ACCORDANCE WITH ANSI-J-STD-607-A, "TELECOMMUNICATIONS GROUNDING AND BONDING FOR CUSTOMER PREMISES".

4. SCC TO FURNISH AND INSTALL EQUIPMENT RACKS AND LADDER RACKS AS SHOWN. BOND RACKS AND LADDER RACK PER ANSI/TIA-607-B USING APPROVED METHODS AND MATERIALS. INSTALL LADDER RACKS AT 84" UNLESS OTHERWISE NOTED.

5. SCC TO FURNISH AND INSTALL CABLE MANAGEMENT HARDWARE AS SHOWN.
6. SCC TO FURNISH AND INSTALL ALL RACK AND WALL MOUNTED TERMINATION HARDWARE AS SHOWN.

7. SCC TO COORDINATE WITH OTHER TRADES FOR ALL WALL MOUNTED EQUIPMENT SUCH AS SECURITY, FIRE ALARM AND LIGHTING CONTROLS.

8. RACK ELEVATIONS ARE SHOWN FOR DESIGN INTENT AND ARE NOT INTENDED TO SHOW EXACT QUANTITIES OF PATCH PANELS AND HORIZONTAL WIRE MANAGERS. SCC SHALL DETERMINE NUMBER OF PATCH PANELS AND HORIZONTAL WIRE MANAGERS NEEDED IN ALL TELECOMMUNICATIONS ROOMS FOR TERMINATION OF HORIZONTAL CABLE.

⬡ SHEET KEY NOTES:

T15 18" X 4" WIRE MESH CABLE TRAY INSTALLED IN RAISED FLOOR BY SCC. INSTALL WITH BOTTOM OF TRAY BETWEEN 6" - 8" ABOVE STRUCTURAL FLOOR. COORDINATE HEIGHT WITH IT ROOM ENTRY CONDUITS.

T17 EZ-PATH SERIES 44 FIRE RATED PATHWAYS BY EC. REFER TO 271500 FOR PRODUCT SPECIFICATIONS. INSTALL QUANTITY SHOWN. ALIGN HEIGHT TO MATCH BOTTOM OF WIRE MESH CABLE TRAY.

T18 RAISED FLOOR BRUSHED GROMMET BY SCC. ROUTE HORIZONTAL CABLE ENTERING ROOM TO MAINTAIN PROPER RADIUS WHERE CABLES EXIT CONDUIT SLEEVES AND ROUTE UP THROUGH BRUSHED GROMMET. SCC TO NEATLY ROUTE CABLE UP WALL ONTO LADDER RACK AND CONTINUE TO EQUIPMENT RACKS.

T19 EZ-PATH SERIES 44 FIRE RATED PATHWAYS BY EC. REFER TO 271500 FOR PRODUCT SPECIFICATIONS. INSTALL QUANTITY SHOWN. INSTALL ABOVE CEILING.

T30 (5) 4" SERVICE ENTRANCE CONDUITS BY EC. ROUTE CONDUITS DOWN THROUGH LEVEL ONE UNDER SLAB. ROUTE (4) CONDUITS TO THE NORTH TO COLFAX STREET AND TERMINATE IN MINIMUM 24" X 24" HAND HOLE. COORDINATE LOCATION WITH LANDSCAPE AND CIVIL PLANS. ROUTE (1) CONDUIT WEST TOWARDS IRVING STREET. CAP AND MARK AT PROPERTY LINE FOR FUTURE USE.

T31 3/4" X 4' X 8' AC GRADE PLYWOOD MOUNTED WITH TOP OF PLYWOOD AT 102" AND BOTTOM AT 6". PAINT PLYWOOD WITH TWO COATS OF FIRE RETARDENT WHITE PAINT.

T32 TELECOMMUNICATIONS GROUNDING BUSBAR BY EC. INSTALL BUSBAR PER ANSI/TIA-607-B.

T33 12" LADDER RACK AT 84" AFF BY SCC.

T34 4-POST EQUIPMENT RACK, CPI# 50120-703 BY SCC.

T35 2-POST EQUIPMENT RACK, CPI# 55053-703 BY SCC.

T36 DOUBLE-SIDED VERTICAL WIRE MANAGER, CPI# 35521-703 BY SCC, TYPICAL.

T37 120V 20A DOUBLE DUPLEX OUTLET MOUNTED TO SIDE OF LADDER RACK BY EC. TYPICAL.

T38 120V 30A OUTLET MOUNTED TO SIDE OF LADDER RACK BY EC. CONFIRM WITH CCOD-TS TYPE OF OUTLET DEVICE.

T39 120V 15A CONVENIENCE OUTLET.

T40 120V 20A OUTLET BY EC FOR SECURITY EQUIPMENT AND PAGING EQUIPMENT. COORDINATE DEVICE TYPE AND HEIGHT WITH CONTRACTOR.

T41 18" LADDER RACK MOUNTED TO WALL WITH STAND-OFF BRACKETS.

T42 WALL MOUNTED 66-BLOCKS.

T50 48-PORT C5E PATCH PANEL FOR TERMINATION OF 50-PAIR TIE CABLE FROM VOICE WALL FIELD.

T51 2U HORIZONTAL WIRE MANAGER. INSTALL CPI# 35441-702, TYPICAL.

T52 48-PORT C6 PATCH PANEL FOR TERMINATION OF HORIZONTAL CABLE, TYPICAL.

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TC400

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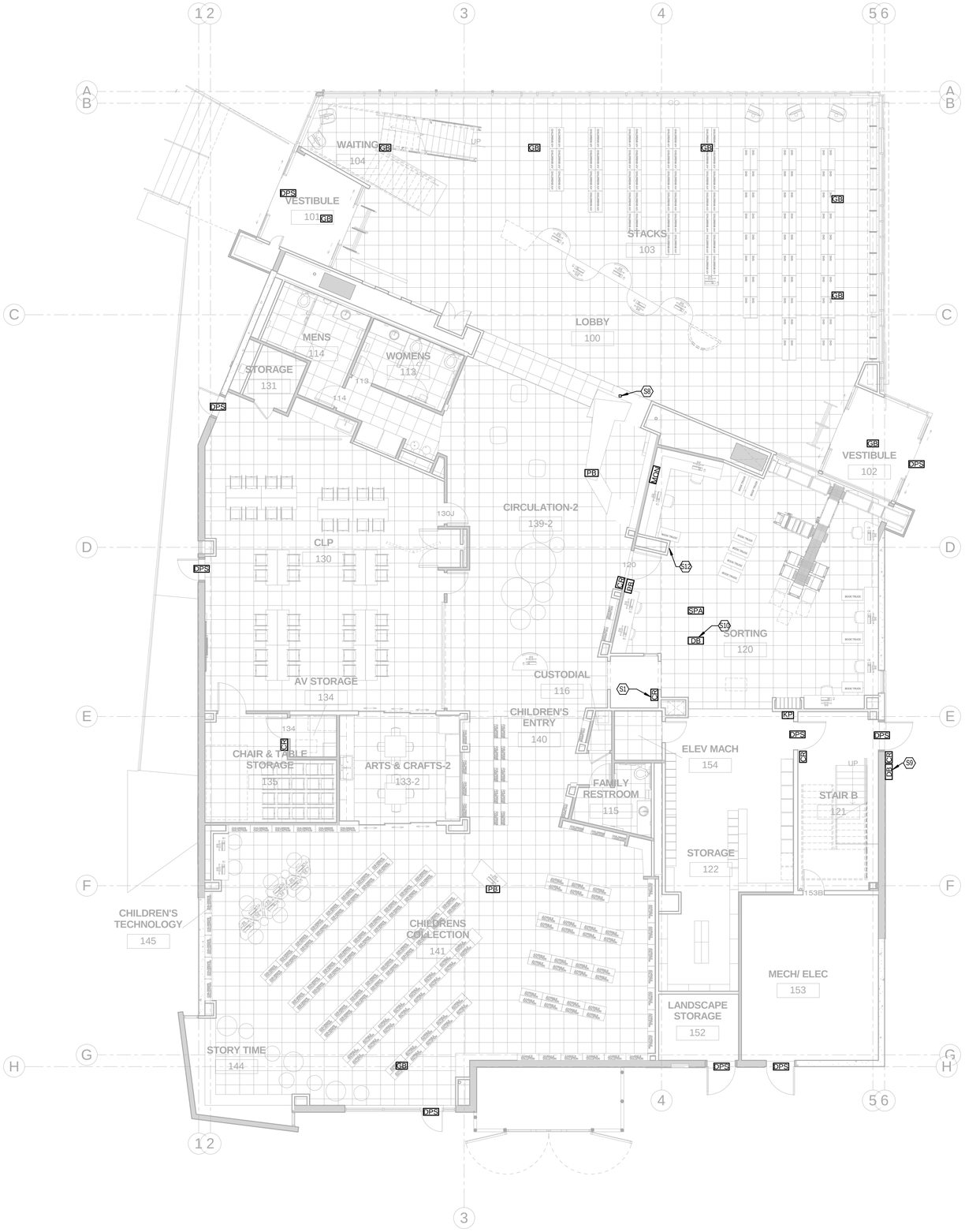


1 LEVEL 01
1/8" = 1'-0"

GENERAL SHEET NOTES:

1. EC TO FURNISH AND INSTALL ALL CONDUITS, CORES, CONDUIT SLEEVES, STANDARD BACK BOXES, BOXES AND OTHER RACEWAY COMPONENTS REQUIRED FOR SC TO INSTALL SECURITY CABLE. INSTALL PULL STRINGS IN ALL CONDUITS INTENDED FOR SECURITY.

2. ALL SECURITY CABLE OUTSIDE OF ACCESSIBLE CEILING OR ACCESSIBLE FLOOR SPACES SHALL BE IN CONDUIT.

3. ALL CABLE FOR SECURITY DEVICES LOCATED ON THE FIRST AND SECOND FLOOR ROUTES TO SECOND FLOOR IT ROOM 257 UNLESS OTHERWISE NOTED.

4. SC TO PROVIDE OUTPUTS FROM BAS TO IDS FROM INTRUSION DETECTION DEVICES. PROVIDE ONE OUTPUT FOR EACH ZONE AS FOLLOWS: ZONE 1 = PERIMETER DOORS, ZONE 2 = GLASS BREAK DETECTORS, ZONE 3 = MOTION DETECTORS, ZONE 4 = FORCED ACCESS CONTROL DOOR, ZONE 5 = PANIC BUTTONS.

5. COORDINATE ALL PANIC BUTTONS AND SERVICE POINT BUTTONS WITH CASEWORK SHOP DRAWINGS AND FURNITURE SUBMITTAL.

6. GLASS BREAK DETECTORS SHOWN ARE FOR DIAGRAMMATIC PURPOSES ONLY. SC IS TO PROVIDE QUANTITY AND PLACEMENT OF DEVICES BASED ON MAKE AND MODEL TO ADEQUATELY COVER THE AREAS SHOWN.

7. ACCESS CONTROL PANELS AND POWER SUPPLIES TO BE HARDWIRED BY EC TO 120 VAC SOURCE.

⎔ SHEET KEY NOTES:

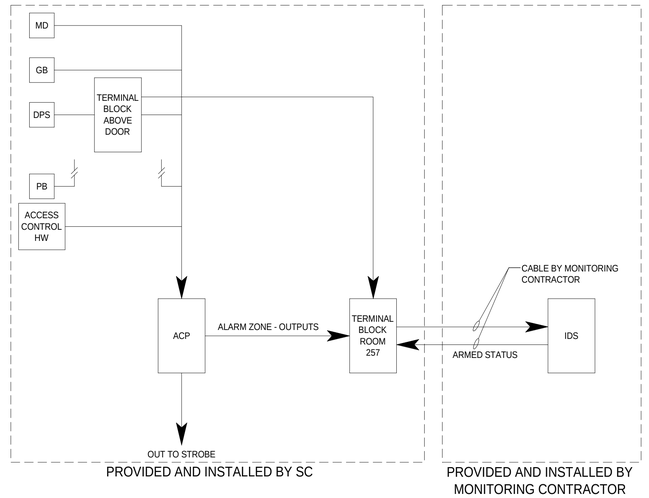
S1 CARD READER TO ACTIVATE REAR ELEVATOR DOOR INTO SORTING AREA.

S8 PROVIDE A WIRELESS CALL BUTTON AT THE CUSTOMER SERVICE DESK THAT WILL CHIME IN SORTING ROOM 120. ENSURE THAT CHIME IS DISTINCTLY DIFFERENT THAN THE BACK DOORBELL.

S9 DOORBELL - HARD WIRED BY EC.

S10 DOORBELL CHIME

S12 PROVIDE STROBE (P/N 869STR-A-AQ BY BACHARACH) TO NOTIFY STAFF OF INTRUSION EVENTS VIA OUTPUT FROM BAS.



2 BAS to IDS Integration Detail
NTS

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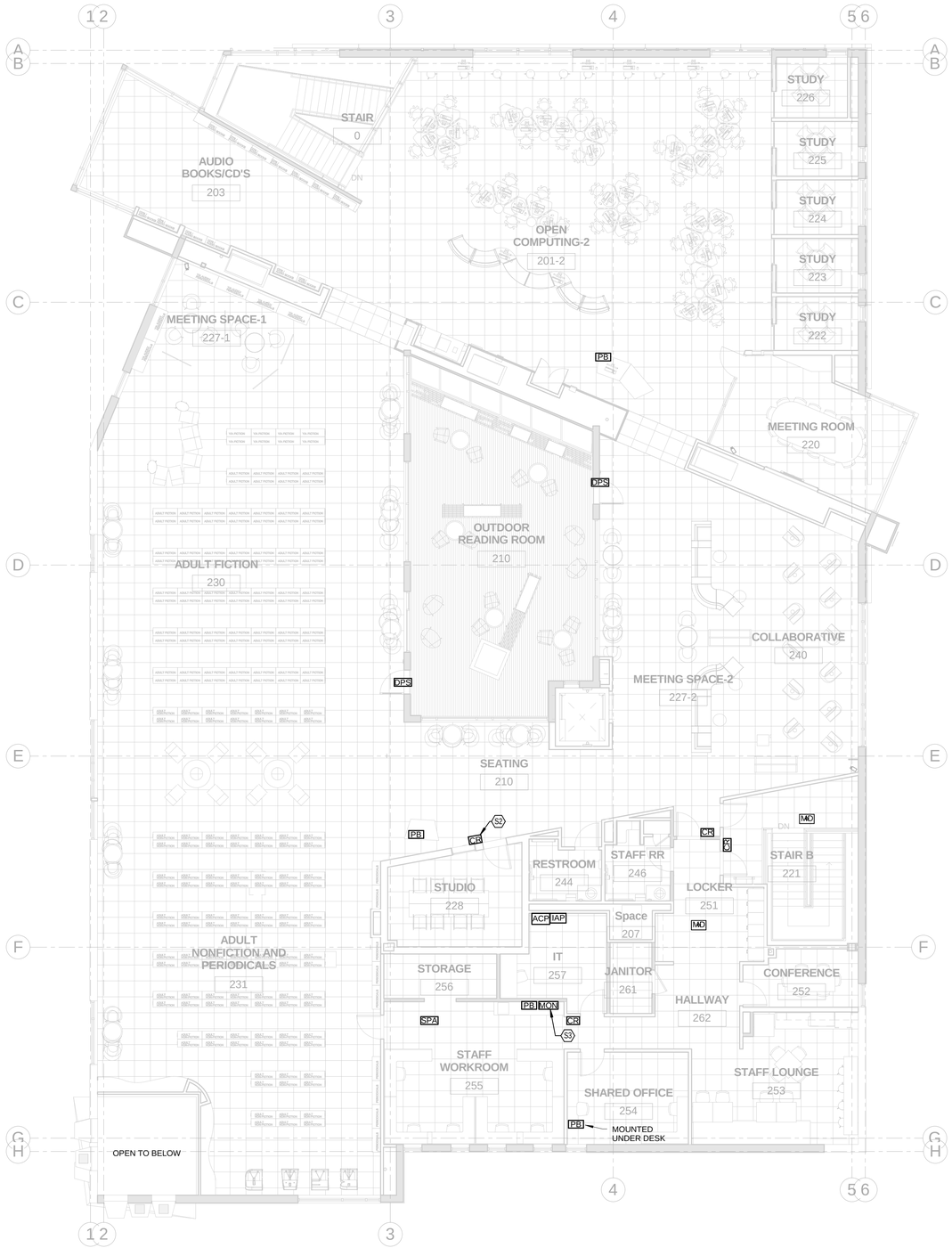

1 LEVEL 02
1/8" = 1'-0"

GENERAL SHEET NOTES:

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4. SC TO PROVIDE OUTPUTS FROM BAS TO IDS FROM INTRUSION DETECTION DEVICES. PROVIDE ONE OUTPUT FOR EACH ZONE AS FOLLOWS: ZONE 1 = PERIMETER DOORS, ZONE 2 = GLASS BREAK DETECTORS, ZONE 3 = MOTION DETECTORS, ZONE 4 = FORCED ACCESS CONTROL DOOR, ZONE 5 = PANIC BUTTONS.

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7. ACCESS CONTROL PANELS AND POWER SUPPLIES TO BE HARDWIRED BY EC TO 120 VAC SOURCE.

⎔ SHEET KEY NOTES:

S2 ROUGH-IN BACK BOX AND STUB-UP FOR FUTURE CARD READER.

S3 ROUGH-IN BACK BOX AND POWER FOR MONITOR.

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1 LEVEL 01
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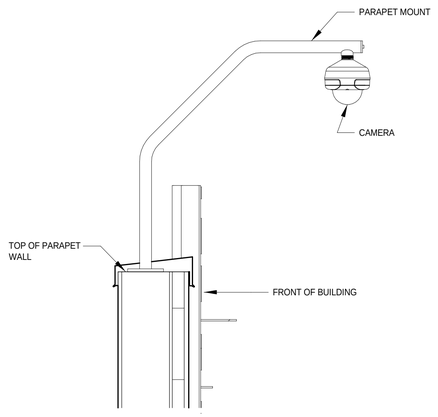

2 Camera Mount at Parapet
1" = 1'-0"

GENERAL SHEET NOTES:

1. FIELD VERIFY ALL CEILING MOUNTED SECURITY DEVICE LOCATIONS WITH OWNER.

2. FOR CEILING MOUNTED DEVICES LOCATED IN ACCESSIBLE CEILING, STUB CONDUIT DOWN INTO ACCESSIBLE FLOOR OR INTO ACCESSIBLE CEILING.

3. ALL INTERIOR CAMERAS TO BE MOUNTED AT 96" AFF UNLESS OTHERWISE NOTED.

⎔ SHEET KEY NOTES:

S4 EC TO PROVIDE 4X4 BACK BOX AT 144" AFG FLUSH MOUNTED IN EXTERIOR WALL SURFACE. ROUTE ½" CONDUIT TO ROOM 257.

S5 ROUGH-IN BACK BOX FOR FUTURE WALL MOUNTED CAMERA

S7 USE OWNER PROVIDED WALL MOUNT ARM. PROVIDE 1.5" NPT THREADED PENDANT ADAPTER WITH CAMERA

S11 ROUGH-IN FOR FUTURE CEILING MOUNTED CAMERA

S13 PROVIDE PARAPET CAMERA MOUNT. REFER TO DETAIL A.

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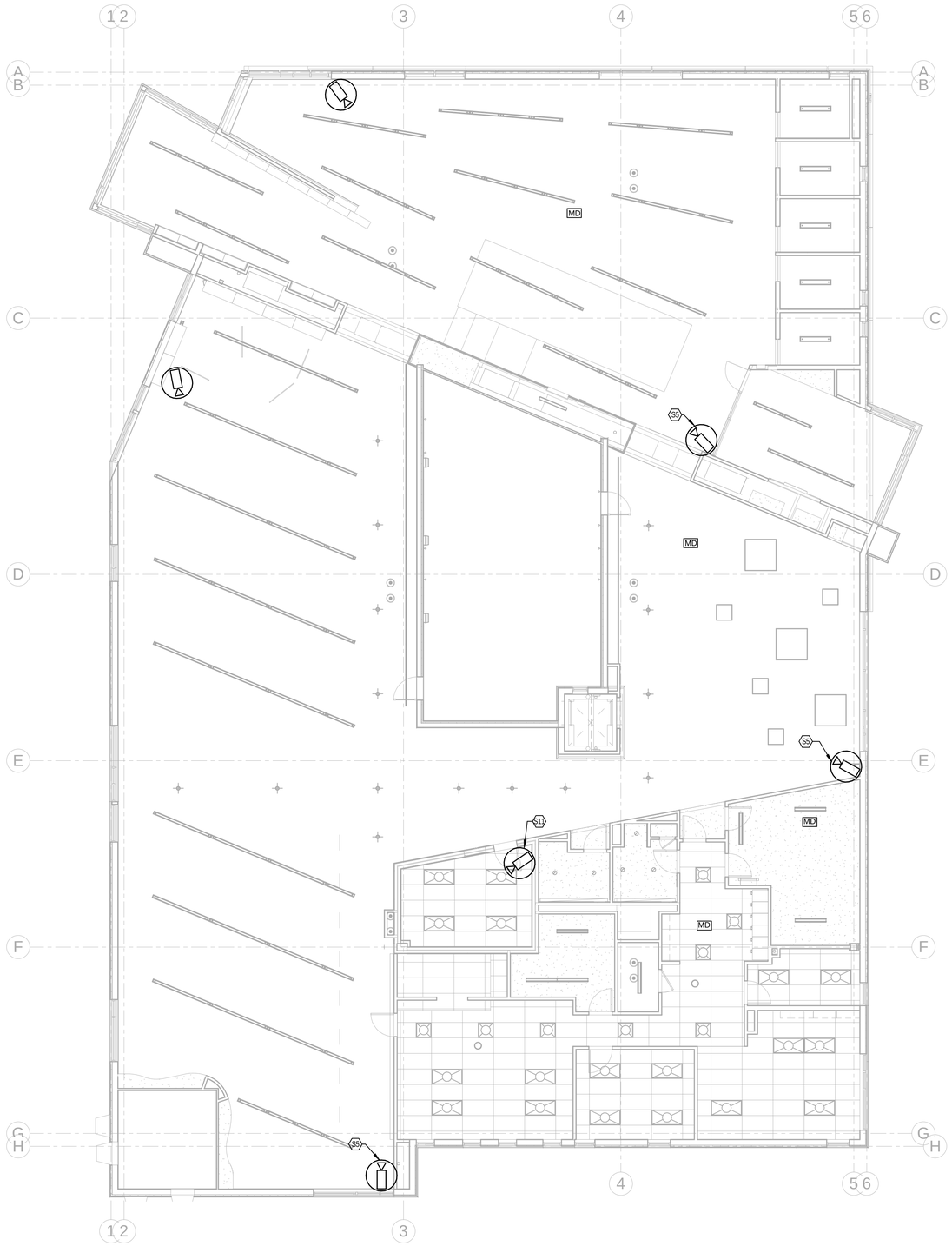

1 LEVEL 02
1/8" = 1'-0"

GENERAL SHEET NOTES:

1. FIELD VERIFY ALL CEILING MOUNTED SECURITY DEVICE LOCATIONS WITH OWNER.

2. FOR CEILING MOUNTED DEVICES LOCATED IN ACCESSIBLE CEILING, STUB CONDUIT DOWN INTO ACCESSIBLE FLOOR OR INTO ACCESSIBLE CEILING.

3. ALL INTERIOR CAMERAS TO BE MOUNTED AT 96" AFF UNLESS OTHERWISE NOTED.

SHEET KEY NOTES:

S5 ROUGH-IN BACK BOX FOR FUTURE WALL MOUNTED CAMERA

S11 ROUGH-IN FOR FUTURE CEILING MOUNTED CAMERA

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