

# PROJECT MANUAL



DENVER  
INTERNATIONAL  
AIRPORT

**Hydronic System Optimization**

CONTRACT NO. 201102945

CONTRACTOR

**TRAUTMAN  
&  
SHREVE,  
INC.**

## PART I

## PROJECT REQUIREMENTS

*Issued for Construction December 2011*

CITY & COUNTY OF DENVER  
DEPARTMENT OF AVIATION



DENVER INTERNATIONAL AIRPORT

HYDRONIC SYSTEM OPTIMIZATION  
CONTRACT NO. 201102945

**ADDENDUM NUMBER ONE**

October 19, 2011

This Addendum Number One supersedes and/or supplements all portions of the Contract Documents with which it conflicts. Bidders must acknowledge receipt of this addendum on page B-1 of the Bid Forms.

---

David I Rhodes, P.E.  
Deputy Manager of Aviation  
Planning & Development

DENVER INTERNATIONAL AIRPORT

HYDRONIC SYSTEM OPTIMIZATION  
CONTRACT NO. 201102945

## ADDENDUM NUMBER ONE

### Scope of this Addendum

Addendum Number One includes modifications to the following Contract Documents issued October 3, 2011. These modifications are deemed necessary by the City and County of Denver.

### PART ONE, VOL. 1 - CONTRACT DOCUMENTS

INSTRUCTIONS TO BIDDERS, PREVAILING WAGES: **Replace** the Prevailing Wage Rate Schedule for BUILDING CONSTRUCTION PROJECTS, Modification #19, with Modification #20, attached hereto.

The total number of pages (including cover sheet) contained in this Addendum Number One is two (2) plus one (1) attachment.

\* \* \* \* \*

*End of Addendum Number One*

DENVER INTERNATIONAL AIRPORT

HYDRONIC SYSTEM OPTIMIZATION  
CONTRACT NO. 201102945

**ADDENDUM NUMBER TWO**

October 25, 2011

This Addendum Number Two supersedes and/or supplements all portions of the Contract Documents with which it conflicts. Bidders must acknowledge receipt of this addendum on page B-1 of the Bid Forms.



---

David I Rhodes, P.E.  
Deputy Manager of Aviation  
Planning & Development



DENVER INTERNATIONAL AIRPORT

HYDRONIC SYSTEM OPTIMIZATION  
CONTRACT NO. 201102945

**ADDENDUM NUMBER TWO**

Scope of this Addendum

Addendum Number Two includes modifications to the following Contract Documents issued October 3, 2011. These modifications are deemed necessary by the City and County of Denver.

**PART ONE, VOL. 1 - CONTRACT DOCUMENTS**

NOTICE OF INVITATION FOR BIDS: The time and date for receipt of bids is hereby changed to 2:00 PM, LOCAL TIME, TUESDAY, NOVEMBER 8, 2011.

The total number of pages (including cover sheet) contained in this Addendum Number Two is two (2).

\* \* \* \* \*

*End of Addendum Number Two*

DENVER INTERNATIONAL AIRPORT

HYDRONIC SYSTEM OPTIMIZATION  
CONTRACT NO. 201102945

## ADDENDUM NUMBER THREE

November 1, 2011

This Addendum Number THREE supersedes and/or supplements all portions of the Contract Documents with which it conflicts. Bidders must acknowledge receipt of this addendum on page B-1 of the Bid Forms.



---

David I Rhodes, P.E.  
Deputy Manager of Aviation  
Planning & Development

DENVER INTERNATIONAL AIRPORT

HYDRONIC SYSTEM OPTIMIZATION  
CONTRACT NO. 201102945

**ADDENDUM NUMBER THREE**

Scope of this Addendum

Addendum Number THREE includes modifications to the following Contract Documents issued October 3, 2011. These modifications are deemed necessary by the City and County of Denver.

**PART TWO, VOL. 1 – TECHNICAL SPECIFICATIONS**

1. Specification Section 01010 – Summary of Work, Replace paragraph 1.01 B in its entirety with the following paragraph:
  - B. The Work in this Contract has the potential to significantly impact operations of Denver International Airport. The Contractor shall bid, plan and execute the Work so as to minimize disruption of operations and inconvenience to the airport operations, airport tenants and public and perform the work within the following guidelines:
    1. Milestone 1 – Mobilization, Submittals and Construction Sequence and Control Plan
      - a. Milestone 1 shall be completed 60 days from Notice to Proceed (NTP).
      - b. The Contractor shall prepare all submittals as required by Contract Documents.
      - c. The Contractor shall prepare a Construction Sequence and Control Plan. This Plan shall describe in detail how the contractor will complete all the construction activities and maintain heating and cooling to all tenants at all times. The Maximum outage – Shutdown duration is Ninety-six continuous hours for any system. ALL shutdowns must be coordinated in advance with all affected tenants or a DIA person that will represent all of the affected tenants. All Shutdowns must be reviewed and approved in advance by the DIA Project Manager and the DIA HVAC Maintenance Supervisor.
      - d. The shutdown of the heating system will be permitted during the normal system offline times that typically occur between June 15 and September 15. These dates may change due to extreme weather conditions.
        - i. Work on this system may occur outside these dates at the DIA Project Manager's discretion. The contractor shall provide a plan to maintain the existing heating capacity to any area that may require cooling on a 24/7 basis during construction.
      - e. The shutdown of the cooling system will be permitted between October 15 and March 15 providing the 5 day forecast indicates the high temperature for the day is not expected to be above 50 degrees F. The contractor shall take into consideration that shutdowns will be more difficult since there is an almost universal demand for cooling in many or most areas during the entire year. Therefore the contractor shall provide a plan to maintain the existing cooling capacity to any area that may require cooling on a 24/7 basis during construction.

- f. Systems will be refilled on a section by section basis from the Central Plant. Contractor shall coordinate refilling operations with DIA PM
  - g. This Comprehensive Sequence and Control plan must be submitted no later than 21 calendar days after Notice to Proceed. The total maximum time for phase 1 shall be 56 calendar days after NTP.
  - h. DIA and the Designer will review the plan. If the plan is not accepted, meetings will be scheduled to discuss the reasons the plan is not accepted. If the Contractor cannot establish a plan that is acceptable to DIA, then DIA shall have the right to cancel the complete contract for CAUSE.
  - i. If the plan is acceptable to DIA, the contractor shall proceed to Phase 2 as described below.
2. Milestone 2 – Concourse C Demonstration
- a. Milestone 2 shall be completed 167 days from NTP.
  - b. Milestone 2 shall be a demonstration of the contractor's plan. The contractor shall implement the plan on Concourse C. All contract requirements for submittals, shutdowns, prework meetings, and any other contract requirement or approval must comply with the requirements of the contract. The demonstration phase must provide a complete and functioning system and the results of the system must be acceptable to DIA.
  - c. If the demonstration phase is found to not meet the expectations of DIA or for any reason, DIA decides that it is not in its best interest to proceed with the work, DIA shall terminate the contract for CAUSE and only the cost of the demonstration line item in the bid shall be required to be paid by DIA.
  - d. If the demonstration phase is complete and approved by DIA, then DIA will authorize the work to proceed on the next phases of the work as described below.
3. Milestone 3 - Heating Water System
- a. Milestone 3 shall be completed 259 days from NTP
  - b. This portion of the work shall perform all heating water system modifications for each of the major buildings that require work – (1) Terminal, (2) AOB, (3) Central Plant, (4) Concourse A, (5) Concourse B and (6) remaining heating water work for Concourse C.
  - c. The contractor will be given the latitude to schedule the work as will be most expeditious. However, the contractor shall not start work in more than any two buildings at a time. Should the contractor propose working in more than two buildings at a time, the Contractor shall prepare a detail plan on how he will man and manage the work and provide assurance to not interfere in any way with the heating or cooling requirements of the buildings and building users. The DIA Project Manager shall determine whether or not the proposed work plan is accepted or not. The DIA Project Manager shall have the right to cancel approval of any work plan for CAUSE at any time at no cost to DIA.
  - d. For each phase of work the contractor shall propose the duration for the phase. These durations will be subject to review and acknowledgement by DIA. The proposed durations must be proportional to the amount of work in each major building. The completion of the phases 3-7 must be proportionally spread through the total calendar days available. Once the durations are accepted by the DIA Project Manager and DIA Scheduler, these durations shall establish contract Milestones.
  - e. If the contractor fails to complete a milestone in the established time the liquidated damages shall be \$1000.00 per calendar day until

substantial completion is established by the DIA Project Manager.  
These damages can be assessed on each project milestone.

4. Milestone 4 - Chilled Water System
  - a. Milestone 4 shall be completed 540 days from NTP
  - b. The work on the balance of the contract shall be divided into phases, one for each of the remaining major buildings that require work – (1) Terminal, (2) AOB, (3) Central Plant, (4) Concourse A, and (5) Concourse B.
  - c. The contractor will be given the latitude to schedule the work as will be most expeditious. However, the contractor shall not start work in more than any two buildings at a time. Should the contractor propose working in more than two buildings at a time, the Contractor shall prepare a detail plan on how he will man and manage the work and provide assurance to not interfere in any way with the heating or cooling requirements of the buildings and building users. The DIA Project Manager shall determine whether or not the proposed work plan is accepted or not. The DIA Project Manager shall have the right to cancel approval of any work plan for CAUSE at any time at no cost to DIA.
  - d. For each phase of work the contractor shall propose the duration for the phase. These durations will be subject to review and acknowledgement by DIA. The proposed durations must be proportional to the amount of work in each major building. The completion of the phases 3-7 must be proportionally spread through the total calendar days available. Once the durations are accepted by the DIA Project Manager and DIA Scheduler, these durations shall establish contract Milestones.
  - e. If the contractor fails to complete a milestone in the established time the liquidated damages shall be \$1000.00 per calendar day until substantial completion is established by the DIA Project Manager. These damages can be assessed on each project milestone.
2. Specification Section 01014 – Work Sequence and Constraints, paragraph 1.03 A.1: ADD the following to the end of the sentence: "or as directed by the DIA PM."
3. Specification Section 01014 – Work Sequence and Constraints, paragraph 1.03 A.3: ADD the following to the end of the first sentence: "or as directed by the DIA PM."
4. Specification Section 01014 – Work Sequence and Constraints, paragraph 1.03 A.5: ADD the following words to the end of the first sentence: "or as required by DIA Ops security."
5. Specification Section 01014 – Work Sequence and Constraints, paragraph 1.03 B.1: ADD the following words to the end of the second sentence: "or as limited elsewhere in these contract documents and only as approved by the DIA PM."
6. Specification Section 01014 – Work Sequence and Constraints, paragraph 1.03 B.4: DELETE "two", REPLACE with "five".
7. Specification Section 1500 – Temporary Facilities, paragraph 1.01 B.9: DELETE paragraph in its entirety.
8. Specification Section 1500 – Temporary Facilities, , paragraph 3.01 A: DELETE the first sentence in its entirety.

9. Specification Section 15050 – Basic Mechanical Materials and Methods, paragraph 1.02, INSERT new paragraph D. Section 05999 – Welding
10. Specification Section 15050 – Basic Mechanical Materials and Methods, paragraph 1.04 D, ADD the following to the end of the sentence: “and Spec 05999 – Welding.
11. Specification Section 15050 – Basic Mechanical Materials and Methods, paragraph 3.06 C ADD the following to the end of the sentence: “and Spec 05999 – Welding”
12. Specification Section 15050 – Basic Mechanical Materials and Methods, paragraph 3.07 A ADD the following after “DIVISION 1”: “and refer to Specification Section 15072 for Mechanical Demolition Requirements.”
13. Specification Section 15072 – Mechanical Removals and Demolition, paragraph 3.01A, ADD the following to the end of the sentence: “or as directed by the DIA PM”
14. Specification Section 15135 – Gauges and Meters, paragraph 1.04 C, ADD the following to the end of the first sentence: “and as required by Division 1”
15. Specification Section 15135 – Gauges and Meters, paragraph 2.03 D – DELETE this paragraph in its entirety.
16. Specification Section 15510 -- Hydronic Piping, paragraph 1.09 ADD the following new paragraph: “D. Comply with requirements of spec 05999 – Welding”
17. Specification Section 15515 – Hydronic Specialties, paragraph A. DELETE and REPLACE with “A. Maintenance Data: Provide all manufacturers’ Operating and Maintenance Data including installation instructions, assembly views, lubrication instructions, and replacement parts list.”
18. Specification Section 15952 – Controls and Instrumentation, paragraph 1.01A – DELETE and REPLACE to read as follows: “A. Provide all labor, equipment, and material necessary for the complete integration of the new control elements into the existing control system, so that the existing control system is fully operational.”
19. Specification Section 15952 – Controls and Instrumentation, paragraph 1.01 - ADD the following new paragraph I: “Contractor shall field verify all electronic and mechanical systems tie points and shall complete a design based on these actual field conditions and in compliance with the requirements of the contract.”
20. Specification Section 15952 – Controls and Instrumentation, paragraph 1.07B – DELETE “not less than 10 days”, REPLACE with “in accordance with Section 15010”
21. Specification Section 15952 – Controls and Instrumentation, paragraph 3.11 Paragraph A.1 – DELETE “damper”, REPLACE with “valve”.
22. Specification Section 15952 – Controls and Instrumentation, paragraph 3.11 Paragraph B.1 – DELETE paragraph in its entirety.



23. Specification Section 15953 – Building Automation System (Krueter), paragraph 1.08 C first sentence: DELETE “and damper”
24. Specification Section 15955 – Building Automation System (Honeywell EBI), paragraph 1.04 C DELETE “and dampers”
25. Specification Section 15955 – Building Automation System (Honeywell EBI), paragraph 3.11A DELETE “control damper”, REPLACE with “valve”
26. Specification Section 15955 – Building Automation System (Honeywell EBI), paragraph 3.11B.1 DELETE paragraph in its entirety.
27. Specification Section 15990 – Testing, Adjusting and Balancing, Part 3.04: ADD new paragraph F:

F.Existing Temperature Transmitters and Flow Elements

1. Contractor shall test for accuracy and recalibrate as required, the temperature transmitters and flow elements that were originally part of the BRDG-TNDR system but remain in the chilled water and hot water system.
28. ADD Specification Section 16110 - RACEWAYS AND FITTINGS, attached.
  29. ADD Specification Section 16120 - WIRES AND CABLES attached.
  30. ADD Specification Section 16142 - ELECTRICAL CONNECTIONS FOR EQUIPMENT, attached.

## PART TWO, VOL. 2 – CONTRACT DRAWINGS

1. DELETE and REPLACE the following drawings with the drawings attached: MD2.402, MD2.503, MD4.101, MD4.102, MD4.103, MD4.104, MD4.105, MD4.107, MD4.108, MD4.109, MD4.110, MD4.111, M2.40, M2.503, M4.101, M4.102, M4.103, M4.104, M4.105, M4.107, M4.108, M4.109, M4.110, M4.111, M2.402, ED3.209, ED3.400, ED6.201 and ED3.209
2. ADD new drawing ED6.300 – Panel Schedules for AOB

The total number of pages (including cover sheet) contained in this Addendum Number Two is fifty-nine [59] (6 pages of this addendum, 28 drawings, 25 pages of specifications).

\* \* \* \* \*

*End of Addendum Number THREE*

**CITY AND COUNTY OF DENVER  
DEPARTMENT OF AVIATION  
DENVER INTERNATIONAL AIRPORT  
HYDRONIC SYSTEM OPTIMIZATION  
CONTRACT NUMBER 201102945**

**MASTER TABLE OF CONTENTS**

**PART I PROJECT REQUIREMENTS**

VOLUME 1:	Notice of Invitation for Bids Instructions to Bidders Prevailing Wage Schedule Bid Forms Notice to Apparent Low Bidder Contract Performance Bond Payment Bond Notice to Proceed Final Receipt Table of Contents to General Conditions* Special Conditions Certificate of Insurance Equal Employment Opportunity Provisions Federal Requirements
-----------	---

Separately Published*:	General Contract Conditions
------------------------	-----------------------------

\*City and County of Denver, Department of Aviation and Department of Public Works, Standard Specifications for Construction, General Contract Conditions, 1999 Edition

**PART II TECHNICAL PROVISIONS**

VOLUME 2:	DIVISION 1: GENERAL REQUIREMENTS  DIVISION 2: Technical Specifications (See Index in Technical Specifications)
VOLUME 3:	CONTRACT DRAWINGS



**CITY AND COUNTY OF DENVER  
DEPARTMENT OF AVIATION  
DENVER INTERNATIONAL AIRPORT  
Hydronic System Optimization  
CONTRACT NUMBER 201102945**

**PART I  
TABLE OF CONTENTS**

	Page Numbers
Notice of Invitation for Bids	NI-1 - NI-3
Instructions to Bidders	IBB-1 - IBB-22
Prevailing Wage Schedule	
Bid Forms	B-1 - B-29
Notice to Apparent Low Bidder	NA-1
Contract	C-1 - C-5
Performance Bond	PB-1 - PB-2
Payment Bond	PA-1 - PA-2
Notice to Proceed	NTP-1
Final Receipt	R-1
Table of Contents of General Conditions*	GCC-i – GCC-v
Special Conditions	SCC-1 -- SCC-11
Certificate of Insurance	
Partial Release Form	PR-1 – PR-2
Equal Employment Opportunity Provisions	EEO-1 – EEO-5
Appendix A, Equal Opportunity Clause	EEO-A1 – EEO-A2
Appendix F, Affirmative Action Requirements	EEO-F1 - EEO-F6
Federal Requirements	FR-1 - FR-4
Construction Contract General Conditions	Separate Book*

\*City and County of Denver, Department of Aviation and Department of Public Works, Standard Specifications for Construction, General Contract Conditions, 1999 Edition

**CITY AND COUNTY OF DENVER  
DEPARTMENT OF AVIATION  
NOTICE OF INVITATION FOR BIDS  
CONTRACT NO. 201102945  
Hydronic System Optimization**

Denver, Colorado

October 3, 2011

Sealed bids for Contract No. 201102945, Hydronic System Optimization will be received no later than:

**2:00 PM, Monday, October 31, 2011 Local Time**

in the triple wide trailer, located within the DIA South Campus at 27301 E. 71<sup>st</sup> Avenue, Unit #2, Denver, CO 80249. Bids must be time stamped no later than 2:00 PM, Monday, October 31, 2011, immediately after which a public bid opening will commence. Any bids to be submitted more than one hour prior to Bid Opening shall be submitted at the office of Business Management Services, attention Nathan Jones, Room 8810, Airport Office Building (AOB), Denver International Airport, 8500 Peña Blvd., Denver, CO 80249-6340.

**GENERAL STATEMENT OF WORK**

The project will remove all the tertiary building pumps and proprietary BRDG-TNDR controls. New independent pressure controls valves will be installed at each air handling unit, in place of each tertiary pumps and at select heating water pumps. The controls for each air-handling unit and each secondary building pump will be modified for the control sequences. Commissioning will be performed on all valves and buildings.

**DOCUMENTS AVAILABLE**

Contract documents, including specifications, will be available on the DIA Contract Procurement website at <http://business.flydenver.com/bizops/bids.asp> beginning October 3, 2011.

**PREQUALIFICATION**

Each bidder must be pre-qualified in the category of 7(a) Buildings: General OR 7(c) Buildings: Mechanical, at the \$7,500,000.00 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](http://www.denvergov.org/prequalification) or call 720-865-2539 for prequalification information ONLY.

**PRE-BID CONFERENCE AND INSPECTION**

All bidders are invited to a pre-bid conference at 10:00 AM, Monday, October 17, 2011, in the triple wide trailer, located within the DIA South Campus at 27301 E. 71<sup>st</sup> Avenue, Unit #2, Denver, CO 80249. A site visit will be conducted immediately following the Pre-Bid Conference. All bidders must register for the site visit no later than October 13, 2011. 4:00 pm MST. E-mail

Lee Walinchus with name and driver's license # or airport ID #. Site visit will only examine a typical mechanical room with air handler and pumps. A complete walkthrough of all affected rooms will not be conducted.

### **MINORITY/WOMEN BUSINESS ENTERPRISE PARTICIPATION**

Construction, reconstruction and remodeling contracts made and entered into by the City and County of Denver are subject to Article VII, Division 1 of Chapter 28 of the Denver Revised Municipal Code, (D.R.M.C.) and all Minority/Women Business Enterprise Utilization and Equal Employment Opportunity Rules and Regulations adopted by the Director of the Division of Small Business Opportunity (DSBO).

Article VII, Division 1 of Chapter 28 of the D.R.M.C. directs the Director of the DSBO 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 21% MBE/WBE participation.**

Project goals must be met with certified participants as set forth in Section 28-206, D.R.M.C. or through the demonstration of sufficient good faith effort under Section 28-208, D.R.M.C. For compliance with good faith effort requirements under Section 28-62(b)(3), the MBE/WBE percentage solicitation level required for this project is 100%.

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

### **NON DISCRIMINATION IN THE AWARD OF CITY CONTRACTS**

It is the policy of the City and County of Denver to prohibit discrimination in the award of construction contracts and subcontracts for public improvements. Further, the City and County of Denver encourages contractors to utilize minority and women owned businesses and to divide the construction work into economically feasible units or segments to allow the most opportunity for subcontracting.

### **MISCELLANEOUS**

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

The work under the Contract is subject to minimum wage rates established by the City and County of Denver Career Service Board.

Kim Day  
Manager of Aviation

Publication Dates: October 3, 2011, October 4, 2011, October 5, 2011  
Published in The Daily Journal

-----  
DO NOT PUBLISH ANYTHING BELOW THIS LINE



\_\_\_\_\_  
Manager of Aviation

8 Sept 2011  
\_\_\_\_\_  
Date



\_\_\_\_\_  
Deputy Manager for Planning and Development

9/7/11  
\_\_\_\_\_  
Date



\_\_\_\_\_  
Director, Division of Small Business Opportunity

8/31/11  
\_\_\_\_\_  
Date

**INSTRUCTIONS TO BIDDERS  
TABLE OF CONTENTS**

	Page
IB-1 INSTRUCTIONS TO BIDDERS	1
IB-2 BIDDING	1
IB-3 COMPLETING AND SIGNING BID FORMS	2
IB-4 UNACCEPTABLE BIDS	2
IB-5 ONLY ONE BID ACCEPTED	2
IB-6 OPENING OF BIDS	2
IB-7 CONSIDERATION OF BIDS	2
IB-8 INFORMAL AND UNBALANCED BIDS	3
IB-9 BASIS FOR SELECTING THE APPARENT LOW BIDDER	3
IB-10 NOTICE TO APPARENT LOW BIDDER - EXECUTION OF CONTRACT	4
IB-11 CONFORMED TECHNICAL SPECIFICATIONS AND CONTRACT DOCUMENTS	4
IB-12 QUANTITIES IN THE BID FORM ENTITLED SCHEDULE OF PRICES AND QUANTITIES (PART 2 OF THE BID FORMS)	5
IB-13 BID GUARANTEE; BONDS; INSURANCE	5
IB-14 RETURN OF BID GUARANTEE	5
IB-15 CONTRACTOR'S BULLETIN BOARD; WWW.FLYDENVER.COM	6
IB-16 SITE INSPECTION AND INVESTIGATIONS	6
IB-17 INTERPRETATION OF BID DOCUMENTS	6
IB-18 MATERIALS AND SUBSTITUTIONS	7
IB-19 WITHDRAWAL OF BID	8
IB-20 SUBCONTRACTOR LISTS IN BID	8
IB-21 PERMIT FEES	8
IB-22 TAXES	8
IB-23 NONDISCRIMINATION IN THE AWARD OF CITY CONTRACTS	9
IB-24 MINORITY/WOMEN BUSINESS ENTERPRISE (MBE/WBE) REQUIREMENTS	9
IB-25 WAGE RATE REQUIREMENTS	15
IB-26 CONSTRUCTION SCHEDULING	16
IB-27 EQUAL EMPLOYMENT OPPORTUNITY	16
IB-28 CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION	17
IB-29 BIDDER DISCLOSURE ORDINANCE	17
IB-30 INSURANCE REQUIREMENTS	18

**CITY AND COUNTY OF DENVER  
DEPARTMENT OF AVIATION**

**IB-1 INSTRUCTIONS 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 bound copy of these Contract Documents contains Bid Forms and Bid Data Forms. The bidder must complete these Bid Forms and submit them as its bid.

Each bid must be enclosed in a sealed envelope, addressed to the Manager of Aviation, showing on the face of the envelope the name of the bidder, the project number, and descriptive title of the work for which the offer is made. The Notice of Invitation for Bids identifies where and when the bid must be delivered.

Addenda to the contract documents will be issued by publication in their entirety on the DIA Contract Procurement Website, [www.flydenver.com/contracts](http://www.flydenver.com/contracts), from which each addendum document may be downloaded by planholders. Such addenda may include replacements for or additions to some or all of the pages of the Bid Forms, and all Bid Form pages added by addendum shall be submitted with the Bid Forms. Either a complete addendum or a notice of its issuance will be posted on the Contractor's Bulletin Board. Prior to submitting bids, Bidders shall read the Contractor's Bulletin Board and/or DIA Contract Procurement website to confirm that they have received all addenda.

If Sensitive Security Information ("SSI") will be provided to potential bidders prior to award of the Contract, each bidder shall be required to comply with Department of Aviation, Standard Policies and Procedures No. 6003, "Contractor Protection of Sensitive Security Information," or its successor. A copy of this Policies and Procedures document will be provided with the Bid Documents, or upon request by the Department of Aviation, Business Management Services Office.

Each bidder shall submit the following, completed and executed in accordance with the Contract Documents:

- (1) the separately bound Bid Forms booklet;
- (2) all Bid Form pages not bound in such booklet which are included in any addendum to the Contract Documents;
- (3) the Bidder's Bid Bond or Bid Guarantee in conformance with IB-13; and
- (4) the Bidder/Contractor Disclosure Form described in IB-29 and included with the Bid Forms, unless the Bidder has a current disclosure form on file with the City Clerk.



### **IB-3 COMPLETING AND SIGNING BID FORMS**

The bidder must complete the Bid Forms by legibly writing or printing in ink, words or figures, or both if required, all the bidder's offered prices for performing the work. All blank spaces which require a response of the bidder must be properly filled in. In filling out the Bid Forms, the bidder should avoid making changes to the extent possible, but, if changes are necessary, any interlineation, white outs, or erasures should be initialed.

For any contracts containing unit prices, the bidder shall specify in the Bid Forms a unit price for each item for which a quantity is given and shall write in figures the products of the respective unit prices and quantities in the "Amount" column provided for that purpose.

Each bidder must sign the Bid Forms 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 joint venture, by each joint venture participant in their individual capacity as a corporation, partnership, or individual; if a corporation, both the president or a vice 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 evidence satisfactory to the Manager to prove that the other persons are authorized to bind the bidder.

### **IB-4 UNACCEPTABLE BIDS**

The City will not accept Bids from bidders in arrears to the City upon debt or contract, or which are defaulters (as surety or otherwise) upon any obligation to the City, or that are deemed irresponsible or unreliable by the Manager of Aviation. A history or pattern of litigation against the City and County of Denver by any bidder, proposed subcontractor, interested party, or any person, firm, or corporation affiliated with any bidder, among other items, will be considered by the Manager in determining the responsibility and reliability of bidders. Bidders may be required to submit satisfactory evidence that they have a practical knowledge of the particular work bid upon and that they have the necessary financial resources to complete the proposed work.

### **IB-5 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 firm or corporation. Evidence of collusion among bidders shall be grounds for exclusion of any bidder who is a participant in any such collusion.

### **IB-6 OPENING OF BIDS**

Bidders are invited to be present at the bid opening which shall occur in the triple wide trailer, located within the DIA South Campus at 27301 E. 71<sup>st</sup> Avenue, Unit #2, Denver, CO 80249 on the date set forth in the Notice of Invitation for Bids.

### **IB-7 CONSIDERATION OF BIDS**

After the Bids are opened and read and any discrepancies have been reviewed, bids

will be compared based on the Total Contract Bid Amount written on page B-1 of the Bid Letter.

If a discrepancy exists between a price or amount written in words and the price or amount written in figures, the price or amount written in words shall govern, except that in the case where a price or amount shown in figures has been crossed out and replaced with a new, legible, initialed figure, the initialed figure shall govern.

Any bid discrepancies which the City corrects in accordance with the general rules described above shall be corrected with the understanding that the Apparent Low Bidder waives any claims against the City because of the bidder's mistakes in its bid.

The City reserves the right to waive informalities, to reject any and all bids, and to advertise for new bids where it is in the best interest of the City.

#### **IB-8      INFORMAL AND UNBALANCED BIDS**

Bids shall be considered informal and may be rejected for the following reasons:

- (a) If the bid is on a form other than the Bid Forms furnished by the City, or if the form is altered or any part thereof is detached.
- (b) If there are unauthorized additions, conditional or alternate bids, or irregularities of any kind which may tend to make the bid incomplete, indefinite, or ambiguous.
- (c) If the bidder fails to acknowledge in the bid receipt of any or all addenda current on the date of opening of bids.
- (d) If the bid does not contain a unit price or lump sum amount for each item listed except in the case of authorized alternative items.
- (e) If there is an interlineation, white out, or erasure in the Bid Forms.
- (f) If the bid is unbalanced so that (1) each pay item does not reasonably carry its own proportion of cost, or (2) any pay item contains an inadequate or unreasonable price.

#### **IB-9      BASIS FOR SELECTING THE APPARENT LOW BIDDER**

The selection of the Apparent Low Bidder will be made on the basis of the lowest responsive bid by a qualified bidder whose bid complies with all of the requirements prescribed herein. The lowest bidder shall be determined by the Total Contract Bid Amount. This selection shall be subject to the approval of such resulting contract in accordance with the Charter and ordinances of the City and County of Denver.



**IB-10 NOTICE TO APPARENT LOW BIDDER - EXECUTION OF CONTRACT**

The Apparent Low Bidder will be given written notice of such status on the form included in the Bid Documents within sixty (60) days from the date of opening of bids.

The Apparent Low Bidder shall execute the contract and return it to the City along with the required bonds and insurance forms within five (5) consecutive working days from and including the date of the Notice to Apparent Low Bidder. When the executed contract and the required bonds and insurance certificates are received, approval for the City to contract with the Apparent Low Bidder shall be sought in accordance with the Charter of the City and County of Denver. Such notice shall not create any rights in the Apparent Low Bidder to any contract with the City.

**IB-11 CONFORMED TECHNICAL SPECIFICATIONS AND CONTRACT DOCUMENTS**

The bidder understands that the City may elect, in its sole discretion, to deliver either one of the contract documents described below for execution.

- (a) A bound document containing the original Bid Documents and all of the prebid addenda, or
- (b) A bound document containing Part I of the original Bid Documents, the portions of the addenda which apply to Part I, and a single conformed set of Technical Specifications and Contract Documents which are produced by posting or otherwise incorporating in Part II of the original Bid Documents all of the changes to Part II which are described in the prebid addenda. If the City elects to prepare a conformed set of Technical Specifications and Contract Drawings, the following provision shall be incorporated in the Conformed Technical Specifications after the first page of its Table of Contents:

**CONFORMED CONSTRUCTION DOCUMENTS**

The Technical Specifications and the Contract Drawings which were included in the Bid Documents, hereinafter referred to as the "bid Document Specifications and Drawings," have been conformed by the City. The conformed Technical Specifications and Contract Drawings were prepared by posting or otherwise incorporating the changes noted in the prebid addenda into the Bid Document Specifications and Drawings to form a single set of construction documents. This set of construction documents is attached hereto and is hereinafter referred to in this document as the "Issued for Construction Documents."

The City's objective in preparing the Issued for Construction Documents is to produce a single set of documents which the Contractor and City will use during construction and which will facilitate the administration of the Contract. The city, however, recognizes that discrepancies between the Issued for Construction Documents and the prebid addenda could occur. Therefore, the Contractor and City agree that both parties shall have 90 days after a fully executed contract is delivered to the Contractor to identify any such discrepancies.

If the Contractor identifies any discrepancy, it shall describe it in a written notice delivered to the City's Project Manager within the 90-day period. If the City agrees that a discrepancy exists, the City shall correct the Issued for Construction Documents in accord with the written notice to assure that the Issued for Construction Documents accurately reflect and are consistent with the Bid Document Specifications and Drawings and changes thereto reflected in the prebid addenda.

If the City identifies a discrepancy, it shall describe it in a written notice delivered to the Contractor's Superintendent within the above-described 90-day period. The City shall, thereafter, correct the Issued for Construction Documents in accord with the written notice. If the Contractor disagrees with any City proposed correction or any City refusal to

accept a Contractor proposed correction, the Contractor shall have the right to submit a Contractor Change Request and request a Change order in accordance with General Condition 1103.

During the 90-day period, the Bid Document Specifications and Drawings and the prebid addenda shall be part of the Contract Documents and are incorporated herein by this reference. After the 90-day period has elapsed, the parties (1) agree that the Issued for Construction Documents, as corrected pursuant to this provision, accurately reflect all of the changes to the Bid Document Specifications and Drawings contained in the addenda, and (2) agree that the Bid Document Specifications and Drawings and the portions of the prebid addenda which pertain thereto shall no longer be considered Contract Documents.

#### **IB-12 QUANTITIES IN THE BID FORM ENTITLED SCHEDULE OF PRICES AND QUANTITIES (PART 2 OF THE BID FORMS)**

Except for items designated as Lump Sum, the quantities appearing in the Bid Forms are approximate only and are included for the purpose of comparing of bids.

Payment to the Contractor will be based on the actual quantities of work performed, measured, and accepted or materials furnished in accordance with the Contract Documents.

Any of the estimated quantities of work and materials shown in the Bid Forms may each be increased, decreased, or omitted as provided in the General Conditions, Special Conditions, or Technical Specifications.

#### **IB-13 BID GUARANTEE; BONDS; INSURANCE**

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 corporation 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 of Aviation that it is considered to be the Apparent Low Bidder and said bidder fails to (1) execute a contract in the form prescribed, (2) furnish the payment and performance bonds described in Title 15 of the General Conditions, (3) furnish the required evidence of insurance described in Title 16 of the General Conditions or in the Special Conditions, or (4) satisfy any other condition precedent to contract execution within its power within five (5) working 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 Contract Bid Amount written in the Bid Letter of the Bid Forms. A Bid Bond form for execution by the bidder is supplied with each set of contract documents. IF A BID BOND IS USED, IT MUST BE THE FORM OF BID BOND SUPPLIED WITH THE CONTRACT DOCUMENTS.

#### **IB-14 RETURN OF BID GUARANTEE**

As soon as bid prices have been compared, bid guarantees of all except the three lowest bidders will be returned. When the Apparent Low Bidder executes the contract and delivers to the City satisfactory performance and payment bonds and required insurance documentation, and any other conditions precedent to contract execution by the City have been satisfied, including, where applicable, City Council contract approval, the bid guarantees of the three lowest bidders shall be returned to them.

#### **IB-15 CONTRACTOR'S BULLETIN BOARD; WWW.FLYDENVER.COM**

It shall be conclusively presumed that the Bidder did, before submitting a bid, read all addenda, posted decisions, and other information items relevant to the Bid which appeared on the Contractor's Bulletin Board and the DIA Contract Procurement website at [www.flydenver.com/contracts](http://www.flydenver.com/contracts).

The Contractor's Bulletin Board is located at Denver International Airport, 8500 Peña Blvd., Denver, CO 80249-6340, on the wall south of the entrance to the Airport Office Building (AOB). The AOB entrance is reached by way of the corridor leading to Concourse A from the North end of the Terminal on Level 6, and is located west of the Concourse A security screening area. The AOB entrance and the Contractor's Bulletin Board are both located outside the security screening area.

#### **IB-16 SITE INSPECTION AND INVESTIGATIONS**

Prior to submitting an offer, the bidder shall inspect the work site and its surroundings. A site visit will be undertaken at the time of the pre-bid conference. Requests for additional site visits must be made at least five (5) working days prior to the bid opening and such visits must be requested in a letter sent to Lee Walinchus, Planning & Development Office, 7th Floor, Airport Office Building, 8500 Peña Boulevard, Denver, Colorado, 80249-6340. For purposes of the contract, it shall be conclusively presumed that the bidder has made a thorough inspection of the site and has waived the right to later claim extra payment or time extensions for conditions which would have been evident during that inspection.

Drawings and specifications, defining the work to be done, were prepared on the basis of interpretation by design professionals of information derived from investigations of the work site and site condition data provided by the City. 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 additional investigations as the bidder's judgment dictates the need for such investigations. If the bidder desires to perform site investigations, it shall request in writing the right to do so. This request shall be sent to Lee Walinchus, Planning & Development Office, 7th Floor, Airport Office Building, 8500 Peña Boulevard, Denver, Colorado, 80249-6340; fax number: 303-342-2617.

Because the bid information cannot be guaranteed, the Contractor shall have assumed the risks attendant to successful performance of the work except for the risk of encountering differing site conditions which are defined in the General Conditions and shall never make claim for additional payments 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 bidding.

#### **IB-17 INTERPRETATION OF BID DOCUMENTS**

During the Bid period, Bidder shall request, in writing, clarification or interpretation of any apparent errors or omissions in the contract documents, any apparent inconsistencies between different provisions of the contract documents, or any other



point in the contract documents which the Bidder believes requires clarification or interpretation by the City. Any such request must be submitted in writing by email to [contract.procurement@flydenver.com](mailto:contract.procurement@flydenver.com), must have the words "Request for Clarification" and "Contract No. 201102945" in the email subject line, and must be received not later than ten (10) calendar days before the date and time set for receipt of Bids. For purposes of the contract, it shall be conclusively presumed that prior to bidding, the Bidder requested clarification or interpretation of any apparent errors, inconsistencies, or other point in the contract documents believed to require clarification or interpretation, and has waived the right to later claim extra payment or time extensions on account of any such error, omission, inconsistency, or other matter in the contract documents.

Information about any interpretation or clarification made by the City in response to such request will be posted on the DIA Contract Procurement website, [www.flydenver.com/contracts](http://www.flydenver.com/contracts). It shall be the Bidder's responsibility to ensure it has reviewed all such interpretations or clarifications. After Bids are opened, all Bidders must abide by the decision of the Manager of Aviation or his authorized representative as to the interpretation or clarification. If the Manager of Aviation or his authorized representative determines that his decision or interpretation requires that an addendum to the Bid documents be issued, such addendum will be posted on the DIA Contract Procurement website and either the complete addendum or a notice of its issuance will be posted on the Contractor's Bulletin Board. It shall be the Bidder's responsibility to ensure it has received all such addenda, and each Bidder must acknowledge receipt of all addenda on the Bid Forms when it submits its Bid.

The City shall not be bound by and the Bidder shall not rely on any oral interpretation or clarification of the Bid Documents.

## **IB-18 MATERIALS AND SUBSTITUTIONS**

It is often convenient and practical to specify materials and equipment to be incorporated into the work by a proprietary name or by the name of its manufacturer. When so specified and further qualified by the phrases "or equal" or "or equivalent," it shall be understood that such specification is not intended to limit the material and equipment selection process. Rather, the specification is intended to indicate a standard of quality and capability which will be accepted. However, all bidders desiring to use materials other than the specified material must obtain the written approval of the Project Manager. All such requests for approval of equal or or equivalent material must be made in writing and, except as hereinafter provided, be received by the Designer of Record, Dennis Whitney, Burns & McDonnell, 9785 Maroon Circle, Ste. 400, Centennial, CO 80112; phone 303-721-9292; and Lee Walinchus, Project Manager, Planning & Development, Denver International Airport, 7th Floor, Airport Office Building, 8500 Peña Boulevard, Denver, Colorado 80249-6340, fax 303-342-2617, not later than ten (10) days prior to the date and time set for opening of bids so that all such approvals will be included in addenda to insure full and complete disclosure to all potential bidders of all approved equal or equivalent materials. All requests for approval of equal or equivalent material shall contain adequate technical data to clearly demonstrate equivalency. Incomplete submittals will not be reviewed. Requests must be submitted on the attached form titled "Request for 'or equal' Approval." Requests containing inadequate or incomplete information will not be considered.

If the bidder is awarded the contract and elects to use an "OR EQUAL" which has been added by addendum, the bidder shall be deemed to have warranted that:

- (a) the use of the "OR EQUAL" fulfills the specification requirements contained in the Contract Documents.
- (b) the installation of the "OR EQUAL" will not impact the spatial requirements for the Work or the scheduling of work performed by the City or other contractors.

Additionally, the bidder agrees that it shall modify any building system(s) (HVAC, structural, electrical, etc.) impacted by the use of an "OR EQUAL" at no cost to the City or other contractors under contract with the City and shall make no claims for delay or disruption arising out of such modification.

#### **IB-19 WITHDRAWAL OF BID**

A bidder may withdraw its Bid at any time prior to the time for opening of bids set forth in the Notice of Invitation for Bids by making written request to the Manager of Aviation. After the expiration of the bid period, no bid can be withdrawn for one hundred twenty (120) calendar days after the date bids are opened or until after a contract for the work described in these Bid Documents is fully executed by the City, whichever date is earlier.

Such a request must be signed by persons authorized to bind the bidder as defined in IB-3, "Completing and Signing Bid Forms."

#### **IB-20 SUBCONTRACTOR LISTS IN BID**

The bidder shall, on the forms included in the Bid Forms, identify each element of the work which the bidder plans to subcontract, provide an estimate of the total cost to perform each element, and include the name and address of the proposed subcontractor.

#### **IB-21 PERMIT FEES**

The Contractor agrees to pay the permit fees associated with the construction of this project described in General Condition 316, and in the Special Conditions and Technical Specifications.

#### **IB-22 TAXES**

1. General. Bidders are referred to the General Conditions, G.C. 322, 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 Conditions and not in lieu of them.
2. 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 at Denver International Airport 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.

3. Exemption Certificates – Sales and Use Tax. It is 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.
4. 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-23 NONDISCRIMINATION IN THE AWARD OF CITY CONTRACTS**

It is the policy of the City and County of Denver to prohibit discrimination in the award of construction contracts and subcontracts for public improvements. Further, the City and County of Denver encourages contractors to utilize minority and women owned businesses and to divide the construction work into economically feasible units or segments to allow the most opportunity for subcontracting.

#### **IB-24 MINORITY/WOMEN BUSINESS ENTERPRISE (MBE/WBE) REQUIREMENTS**

Divisions 1 and 3, Article III of Chapter 28 of the Denver Revised Municipal Code (Sections 28-31 to 28-36 and 28-52 to 28-90, D.R.M.C.) (the "Ordinance") apply to this Project and are incorporated into this Contract by reference. Generally, the 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/Women Business Enterprises (MBE/WBEs). As such, each bidder must comply with the terms and conditions of the Ordinance in making its bid and, if awarded the Contract, in performing all Work thereunder. A bidder's failure to comply with the 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 Ordinance requirements during the performance of the contract is a material breach of the contract, which may result in the termination of this contract, the imposition of sanctions or such other remedy, as deemed appropriate by DSBO. Copies of the 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 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 Ordinance. In preparing a bid to meet the established Project goal, bidders should

consider the following instructions relating to compliance with the Ordinance:

1. Under the 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 Minority/Women Business Enterprise Bidders, Subcontractors, Suppliers, Manufacturers, Manufacturers' Representatives or Brokers" the name, address, work description/supply, committed level of participation and other required information for each MBE/WBE of any tier which the bidder intends to use in performing the work on this Project. **Only the MBE/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. MBE/WBE bidders may count self-performance or joint venture activity in meeting the MBE/WBE project goal, but only for the scope of work performed as a commercially useful function and at a percentage level the MBE/WBE will be performing itself.**
3. All MBE/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 an MBE/WBE Construction Directory ("Directory"), which is a current listing of MBE/WBEs that have been certified by the City. A copy of the Directory is available from DSBO, located at 201 W. Colfax, Dept. 907, Denver, Colorado, or on the website located at [www.denvergov.org/DSBO](http://www.denvergov.org/DSBO) and will also be made available at the pre-bid meeting. Bidders are encouraged to use the Directory to assist in locating MBE/WBEs for the work and supplies required on the Project. Bidders are reminded that changes may be made to the Directory at any time in accordance with the City's MBE/WBE Ordinance and procedures established to administer this program, and that a current copy of the Directory must always be used in preparing a bid. MBE/WBE certification or listing in the Directory is not a representation or warranty by the City as to the qualifications of any listed MBE/WBE.
4. In accordance with the provisions of the Ordinance, DSBO will evaluate each bid to determine the responsiveness of the bid to the requirements of the Ordinance. In determining whether a bidder's committed level of participation meets or exceeds the stated MBE/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 MBE/WBE percentage established for the project to determine the exact dollar amount of required MBE/WBE participation for the Project. This amount will then be



compared against the exact dollar amounts for the MBE/WBEs committed for participation by the bidder. If the total dollar amount of participation listed meets or exceeds the established MBE/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 MBE/WBE by dividing the dollar amount listed for each MBE/WBE by the total base bid dollar amount submitted by the bidder. These individual percentages, when totaled for all listed MBE/WBEs, will establish the total committed percentage level of MBE/WBE participation that the bidder must comply with during the life of the contract. In all cases, the committed percentage level of MBE/WBE participation must equal or exceed the assigned MBE/WBE goal for the Project.
- c. In providing the exact dollar amount of participation for each listed MBE/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 MBE/WBE goal.
- d. As previously mentioned, compliance with the MBE/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 MBE/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 MBE/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 MBE/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 MBE/WBE suppliers shall count toward satisfaction of the Project goal. On Projects under Five Million Dollars (\$5,000,000.00) the value of the commercially useful function of



MBE/WBE supplier(s) will count at a one hundred percent (100%) level. Manufacturers' representatives and packagers shall be counted in the same manner as brokers.

- g. **In utilizing the MBE/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.
5. On or before the third (3<sup>rd</sup>) working day after bid opening, all of the Bidders are required to submit an executed "MBE/WBE Letter of Intent" for each MBE/WBE listed on the Bid Form as a joint venture member, subcontractor, supplier, manufacturer, manufacturers' representative or broker of any tier. A MBE/WBE Bidder does not need to submit a Letter of Intent, however they must list themselves and their level of participation on the designated MBE/WBE participation page bound herein. Each Letter of Intent shall be submitted only for the MBE/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 MBE/WBE Letter of Intent is included with the Bid Form. The MBE/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 MBE/WBE or that its subcontractor(s) and supplier(s), manufacturer(s), manufacturers' representative(s) and broker(s) will do so. Each MBE/WBE Letter of Intent shall be accompanied by a copy of the City and County of Denver's MBE/WBE certification letter for each proposed MBE/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.

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

1. If any Bidder has not met the designated Project goal at the time the bids are opened or elects to present a good faith effort in lieu of or in addition to attempting to satisfy the designated Project goal, that Bidder shall submit, on or before the third (3<sup>rd</sup>) working day after the bid opening a detailed statement, with supporting documentation, setting forth its good faith efforts, made prior to bid opening, attempting to meet the established goal in accordance with Section 28-62 of the Ordinance. This statement shall address each of the items in Subsection (b) of that Section and any additional criteria that the DSBO Director may establish by rule or regulation. A Bidder who fails to meet the Project goal and cannot show that it made a good faith effort to meet the goal shall be considered non-responsive.
2. The statement of good faith efforts shall include a specific response to each of the following as further defined by rule or regulation.. A Bidder may include any additional information the Bidder believes may be relevant. Failure of a Bidder to show good faith efforts as to any one of the following items shall

render its overall good faith showing insufficient and its bid non-responsive. Items (1) through (10) of Section 28-62, Subsection (b) of the Ordinance are set forth below:

- (1) 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.
- (2) 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.
- (3) 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.
- (4) 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.
- (5) 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.

- (6) 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.
- (7) 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.
- (8) 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.
- (9) 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.
- (10) The bidder or proposer must use the DSBO MBE/WBE directories to identify, recruit, and place MBEs and WBEs.

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

1. The bidder understands it must maintain MBE/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 MBE/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 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 MBE/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 MBE/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 MBE/WBEs in accordance with Section 28-73 of the Ordinance as applicable, or the contractor must show each element of modified good faith set out in Section 28-75 (c) of the Ordinance. The contractor or consultant shall supply to the director the documentation described in Section 28-75 (c) of the 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 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 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 Ordinance or contact the Project's designated DSBO representative at (720) 913-1700.

## **IB-25 WAGE RATE REQUIREMENTS**

Pursuant to Section 20-76 of the Revised Municipal Code, the bidder selected to perform this contract shall pay mechanics, laborers and workers employed directly upon the site of the work the full amounts accrued at the time of payment, computed wage rates not less than those shown on the current prevailing wage rate schedule



included in the contract bid documents and any addenda thereto. If the City's Career Service Board issues a modification to those wage rates more than ten (10) days prior to the scheduled bid opening, those modifications will be published in an addendum issued by the City to all prospective bidders. The City may, in its sole discretion, determine on a case-by-case basis whether wage rate modifications issued by the Career Service Board ten (10) days or less before the bid opening will be included in an addendum. If they are included in an addendum, the City may, in its sole discretion, elect to postpone the date of bid opening.

If the term of the contract extends for more than one year, the minimum City prevailing wage rates which contractors and subcontractors shall pay during any 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 after the first anniversary of the contract 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 such contract with the City.

#### **IB-26 CONSTRUCTION SCHEDULING**

The bidder should refer to the General Conditions, Special Conditions, and Division I of the Technical Specifications for scheduling requirements for this contract.

#### **IB-27 EQUAL EMPLOYMENT OPPORTUNITY**

1. Article III, Division 2 of Chapter 28 applies to this contract. It is the policy of the City to provide equal opportunity in employment without regard to race, color, creed, sex, national origin, religion, marital status, or political opinion or affiliation. It is hereby deemed and declared to be for the public welfare and in the best interest of the City to require bidders, contractors and subcontractors soliciting and receiving, directly or indirectly, compensation from or through the City, for the performance of such contracts, to meet certain affirmative action and equal employment opportunity requirements. Additionally, contractors and subcontractors that hold any contracts which are federally-assisted shall be required to adhere to the Department of Labor's Contract Compliance program under Executive Order 11246 as defined in the regulations of the Secretary of Labor at 41 CFR Chapter 60-4.
2. After the Notice to Apparent Low Bidder has been issued, the Apparent Low Bidder shall submit the following to the Division of Small Business Opportunity:
  - (a) A statement that the bidder shall implement the affirmative action steps set forth in the Rules and Regulations and Bid Conditions of the Manager of Public Works pertaining to Equal Employment Opportunity, attached hereto, or the bidder's affirmative action plan which meets these requirements, and
  - (b) A projection of its anticipated workforce for this contract on the attached "EEO Questionnaire." Both of these submittals are required before the Division of Small Business Opportunity will approve the Notice to Proceed.
3. The bidder which is awarded this contract shall comply with the provisions and

requirements, including the goals of minority and female participation and specific affirmative action steps, set forth in the Rules and Regulations and Bid Conditions of the Manager of Public Works pertaining to Equal Employment Opportunity, as said rules and regulations may be amended or readopted from time to time by the Manager of Public Works or the Director of the Division of Small Business Opportunity.

**IB-28 CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION**

The bidder certifies, by submission of its bid or acceptance of this contract, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or involuntarily excluded from participation in any government contract by any Federal, State, or local government department or agency. It further agrees by submitting its bid that it will include this clause without modification in all lower tier transactions, solicitations, proposals, contracts, and subcontracts. Where the bidder or any lower tier participant is unable to certify to this statement, it shall attach an explanation to its bid.

**IB-29 BIDDER DISCLOSURE ORDINANCE**

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-30 INSURANCE REQUIREMENTS**

In preparing its Bid, the Bidders shall assure that insurance requirements contained in the Contract Documents are met. In accordance with the provisions of General Contract Condition 1601, **INSURANCE**, the minimum insurance requirements for this Contract are set forth in the form **CITY AND COUNTY OF DENVER INSURANCE CERTIFICATE** contained in the Special Conditions Section of the Contract Documents. Bidders are urged to consider in preparing a bid hereunder that the Contractor and all subcontractors performing Work on the Project must comply with each condition, requirement or specification set forth in the form certificate, unless such requirements are specifically excepted in writing by the City's Risk Management Administrator. The Contractor must either include all subcontractors performing work hereunder as insureds under each required policy or furnish a separate certificate (on the form certificate provided) for each subcontractor.

**REQUEST FOR "OR EQUAL" APPROVAL**

Contract No.: 201102945  
 Title: Hydronic System Optimization

This request, **in duplicate**, must be received by the City Project Manager and Designer of Record at the following addresses, by noon at least 10 days prior to bid date.

<p>City Project Manager:</p> <p>Lee Walinchus                  Planning &amp; Development Office                  Denver International Airport                  7<sup>th</sup> Floor, Airport Office Building                  8500 Peña Boulevard                  Denver, CO 80249-6240                  Fax: 303-342-2617</p>	<p>Designer of Record:</p> <p><b>Dennis Whitney</b>  <b>Burns &amp; McDonnell</b>  <b>9785 Maroon Circle, Ste. 400</b>  <b>Centennial, CO 80112</b>  <b>Fax: 303-721-0563</b></p>
--	---

**To be completed and signed by requesting party:**

Specification Section/Drawing Number:	Page No./Paragraph No./Subparagraph No.:
Specified Product:	Specified Manufacturer:
	Specified Model No.:
"Or Equal" Product:	"Or Equal" Manufacturer:
	"Or Equal" Model No.
Reason for "Or Equal" substitution:	
Prior Applications [Installations of at least 3 years length]:	
(1) Project: _____	Date: _____
(2) Project: _____	Date: _____
(3) Project: _____	Date: _____

[PAGE 1 OF 2 PAGES]



**General product literature/catalog cuts/drawings or other appropriate information detailing the "Or Equal" product with respect to the project specifications must be attached to this form for approval.**

I have reviewed the attached product literature and certify the following:

- (1) That the above described "Or Equal" product fulfills the specification requirements as detailed in the Contract Documents.
- (2) That the installation of the above described "Or Equal" product in no way impacts the spatial requirements of the project.
- (3) That I, if selected as the Contractor, shall modify any building system(s) (HVAC, structural, electrical, etc.) impacted by the use of the above described "Or Equal" product at no additional cost to the City and County of Denver and shall make no claim for delay with respect to any such modification.
- (4) That the above described "Or Equal" product meets all physical and performance attributes of the specified material or equipment except (if no difference, so state):

**REQUESTING PARTY:** \_\_\_\_\_

Date: \_\_\_\_\_ By: \_\_\_\_\_

Title: \_\_\_\_\_

**For City use:**

Approved       Disapproved      Date: \_\_\_\_\_  
Reason for disapproval [if applicable]:

**DESIGNER OF RECORD:**

[Signature]

**PROJECT MANAGER:**

Date:

[Signature]

**DEPUTY MANAGER:**

Date:

[Signature]

Bidder(s) Notified By

Addendum No.

Date:

THIS IS PAGE 2 OF 2 PAGES

**EEO QUESTIONNAIRE**  
**Contract No: 201102945**

1. Name of Business: \_\_\_\_\_
2. Address: \_\_\_\_\_
3. City, State, Zip Code: \_\_\_\_\_
4. Telephone Number: (\_\_\_\_) \_\_\_\_\_
5. Name and title of your firm's EEO Contact: \_\_\_\_\_
6. Are you an affiliate or a subsidiary of another business organization (branches, etc.)?  
 Yes  No
7. Type of business you are engaged in: \_\_\_\_\_
8. Does the organization have a procedure for resolving discrimination complaints?  
 Yes  No
9. Has your firm been charged with discrimination within the past eighteen (18) months?  
 Yes  No
10. Is your firm required to submit an EEO-1 annually to the EEOC?  
 Yes  No
11. Are you now working or have you worked on a City and County of Denver contract during the past twelve (12) months? If yes, complete the following information:

<u>Type of Contract</u>	<u>Contract Number</u>	<u>Total Cost of Each Contract</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

(You may use additional sheets if necessary)

(Page 1 of 2 pages)

**PROJECTION OF ANTICIPATED WORKFORCE  
Contract No. 201102945**

12. List the number of anticipated new employees needed by the contractor to perform this contract by trade/craft positions.

**ANTICIPATED NUMBER OF NEW EMPLOYEES FOR THIS CONTRACT**

Trade Craft	Estimated Total Manpower	Estimated Total Hours	Number of Employees Minority/Female	Total Estimated Employees Minority/Female
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

13. What is the anticipated number of employees from the apparent low bidder's current work force to be utilized to perform this contract? \_\_\_\_\_

14. Estimate manpower utilization for the project below:

**ESTIMATE OF MANPOWER UTILIZATION**

Trade Craft	Estimated Total Manpower	Estimated Total Hours	Number of Employees Minority/Female	Total Estimated Employees Minority/Female
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

15. Will the estimated total manpower (anticipated new hires and current staff to be utilized on this contract) meet the City's minority employment and female employment goals?

Yes \_\_\_\_\_ No \_\_\_\_\_

**PREVAILING  
WAGES**



**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](http://www.denvergov.org/csa)

**TO:** All Users of the City of Denver Prevailing Wage Schedules  
**FROM:** Meredith Creme, Associate Human Resources Professional  
**DATE:** Friday October 7, 2011  
**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 October 7, 2011** 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. CO080004  
Superseded General Decision No. CO20070004  
Modification No. 20  
Publication Date: 09-30-2011  
(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 (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: CO100004 09/30/2011 CO4

Superseded General Decision Number: CO20080004

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	03/12/2010
1	05/21/2010
2	06/04/2010
3	07/02/2010
4	07/09/2010
5	07/16/2010
6	08/06/2010
7	08/13/2010
8	09/24/2010
9	10/08/2010
10	01/21/2011
11	01/28/2011
12	02/11/2011
13	03/25/2011
14	05/06/2011
15	06/03/2011
16	06/24/2011
17	07/08/2011
18	07/15/2011
19	08/12/2011
20	09/30/2011

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 3% 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 07/01/2009

	Rates	Fringes
GLAZIER.....	\$ 27.95	7.10

-----  
PLAS0577-001 05/01/2010

	Rates	Fringes
Cement Mason/Concrete Finisher...	\$ 24.60	10.10

-----  
PLUM0003-001 06/01/2011

	Rates	Fringes
PLUMBER		
(Excluding HVAC work).....	\$ 32.69	11.18

-----  
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)).

---

In the listing above, the "SU" designation means that rates listed under the identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

---

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.

-----  
END OF GENERAL DECISION



**Career Service Authority**  
**Supplemental to the Davis-Bacon *Building* Construction Project rates**  
**(Specific to the Denver projects)**  
**Supp #96, Date: 10-07-2011**

<b>Classification</b>		<b>Base</b>	<b>Fringe</b>
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 INTERNATIONAL AIRPORT

## BID FORMS

**CONTRACT NAME: Hydronic System Optimization**  
**Contract No.: 201102945**

### Table of Contents

	Page
Bid Letter	B-1 to B-5
Schedule of Prices and Quantities	B-6
Bid Data Forms	B-7
Information About Contractor	B-8 to B-9
List of Proposed Subcontractors	B-10 to B-11
Equal Opportunity Report Statement	B-12
Certificate of Non-Segregated Facilities	B-13
Bid Bond	B-14 to B-15
List of Proposed Minority/Women Business Enterprise Bidders, Subcontractors, Suppliers (Manufacturers) or Brokers	B-16 to B-19
Commitment to Minority/Women Business Enterprise Participation	B-20
MBE/WBE Letter of Intent	B-21 to B-22
Joint Venture Affidavit	B-23 to B-24
Joint Venture Eligibility Form	B-25 to B-27
Bidder/Contractor/Vendor/Proposer Disclosure	B-28
Bidder/Contractor/Vendor/Proposer Certified Statement In Lieu of Disclosure of Names of Spouses and Children	B-29



The undersigned agrees that this bid is a firm offer to the City to perform and complete the Contract described above which cannot be withdrawn for one hundred twenty (120) calendar days after the bids are opened or until after a contract for the work described in these bid documents is fully executed by the City, whichever date is earlier.

The undersigned Bidder hereby agrees to appear at Denver International Airport, Business Management Services Office, Room 8810, Airport Office Building, at any time within five (5) working days from the date of a written notice from the Manager to do so, mailed and/or faxed to the business address of Bidder and at that time the Bidder shall: (1) deliver an executed Contract which conforms with this bid; (2) furnish the required performance and payment bonds in the sum of the Total Contract Bid Amount shown above, executed by a surety company acceptable to the Manager; and (3) furnish the required insurance documents.

Enclosed herewith is a bid guarantee, as defined in the Instructions to Bidders, in the amount of which bid guarantee the undersigned Bidder agrees is to be paid to and become the property of the City as liquidated damages should the bid be considered to be the best by the City and the undersigned Bidder notified that it is the apparent low bidder and it fails to enter into contract in the form prescribed and to furnish the required performance and payment bonds and evidences of insurance within five (5) working days as stipulated above.

Attached and incorporated herein as the proposed Schedule of Prices and Quantities and Bid Data Forms. All of the forms must be completed. Bidder acknowledges that the City may incorporate, at its option, any or all of the data submitted by the Bidder into a contract arising out of this Bid.

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

The undersigned certifies that it has examined and is fully familiar with all of the provisions of the Contract Documents and is satisfied that they are accurate; that it has carefully checked all words and figures and all statements made in these Bid forms; and that it has satisfied itself with respect to the actual site conditions and the nature and location of the Work, the general and local conditions which may be encountered in the performance of the Work, and other matters which in any way affect the Work or the cost thereof.

[CERTIFICATION AND SIGNATURE ON FOLLOWING PAGES]

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.

Dated this 8th day of November, 2011.

**BUSINESS ADDRESS OF BIDDER:** 4406 Race Street

City, State, Zip Code: Denver, CO 80216

Telephone Number of Bidder: (303) 295-1414

Fax Number of Bidder: (303) 295-0324

Social Security or Employer Id. No. of Bidder: 13-363-0476

**SIGNATURE OF BIDDER:**

*If a Corporation:*

PRINT NAME OF CORPORATION:

Trautman & Shreve, Inc.

Attest:

(Corporate Seal)



Secretary, Dennis Pettitt

a Colorado Corporation

By: KA

Executive Vice President, Kevin D. Larrington

*If a Limited Liability Company:*

PRINT NAME OF LIMITED LIABILITY COMPANY:

\_\_\_\_\_

Organized in the State of \_\_\_\_\_

By: \_\_\_\_\_

Manager

[signature blocks for partnerships, limited partnerships and joint ventures are on following pages]



***If a Partnership:***

PRINT NAME OF PARTNERSHIP:

\_\_\_\_\_

By: \_\_\_\_\_

General Partner

***If an Individual:***

\_\_\_\_\_, doing

business as \_\_\_\_\_

Signature:

\_\_\_\_\_

(Signature blocks for joint ventures are on the next page)

***If a Joint Venture, signature of all Joint Venture partners is required:***

PRINT NAME OF JOINT VENTURE:

<hr/>	
Joint Venture Partner -- Name of Firm:	Joint Venture Partner -- Name of Firm:
_____ Corporation ( ) or Partnership ( )	_____ Corporation ( ) or Partnership ( )
By: _____ Signature	By: _____ Signature
Title: _____	Title: _____
<i>Required for a corporation:</i>	<i>Required for a corporation:</i>
ATTEST: (Corporate Seal)	ATTEST: (Corporate Seal)
_____ Secretary	_____ Secretary
Joint Venture Partner -- Name of Firm:	Joint Venture Partner -- Name of Firm:
_____ Corporation ( ) or Partnership ( )	_____ Corporation ( ) or Partnership ( )
By: _____ Signature	By: _____ Signature
Title: _____	Title: _____
<i>Required for a corporation:</i>	<i>Required for a corporation:</i>
ATTEST: (Corporate Seal)	ATTEST: (Corporate Seal)
_____ Secretary	_____ Secretary

**SCHEDULE OF PRICES AND QUANTITIES**

**(not applicable to this contract)**

**DENVER INTERNATIONAL AIRPORT**

**Hydronic System Optimization  
Contract No. 201102945**

**Bid Data Forms**

Bidder shall submit its Bid Data in accordance with the format shown on each of the following Bid Data Forms. Bidder shall prepare and use as many sheets as are necessary to provide the information required. Bidder shall ensure that each page of its Bid Data is completed and properly identified with the Bid Data form name, Bidder's name, and page number.

**DENVER INTERNATIONAL AIRPORT**

**Hydronic System Optimization  
Contract No. 201102945**

**Bid Data Forms  
INFORMATION ABOUT CONTRACTOR**

1. Name of Bidder/Contractor: Trautman & Shreve, Inc.
2. Type of business entity: Corporation  
NOTE: If bidder is a **partnership** or **joint venture**, give full names of all partners or joint venturers. Bid must be signed by all joint venturers. If bidder is a **limited liability company**, bid must be signed by authorized manager (may be signed by member-manager if LLC is organized to allow management by members).
3. Prequalified by City and County of Denver as Construction Contractor : Categories: 7c - Mechanical  
Monetary Limit: \$25,000,000
4. Address of Contractor: 4406 Race Street  
Denver, CO 80216  
Telephone: 303-295-1414 Fax: 303-295-0324
5. Established where and when: Denver, Colorado; September 30, 1947
6. Contractor's Banks: JP Morgan Chase - Phoenix, Arizona  
Harris Trust & Savings Bank - Chicago, Illinois
7. Principal Officers of Contractor (managers and members if LLC):  
Name: Jim Durant Name: Kevin D. Larington  
Title: President & CEO Title: Executive Vice President  
Name: Dennis Pettitt Name: Frank Montoya  
Title: Senior Vice President/COO Title: Vice President Sheet Metal Division



8. Bidder's/Contractor's City and License No.: #1146; #239158  
County of Denver Contractor  
License if it has obtained one: Class: Refrigeration A & Plumbing A; H&VA

A contractor license is required prior to start of construction but not prior to bid submittal.

9. Bidder's/Contractor's state of incorporation (state of organization if an LLC or partnership): Colorado

10. Bidder's Surety: Travelers Casualty & Surety of America

11. Surety's State of Incorporation: Connecticut

12. Address of Contractor in other areas (if different from No. 4):  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

13. Name and address of person to receive payments: Trautman & Shreve, Inc.  
4406 Race Street  
Denver, CO 80216  
\_\_\_\_\_

14. If the Bidder/Contractor is a joint venture, it shall attach a certified copy of the joint venture agreement. The joint venture agreement will not be included as a Contract Document.

15. The Bidder/Contractor shall identify all applicable labor agreements (if any) to be used in the performance of the Work:

Denver Local #3 - Plumbers  
Denver Local #208 - Pipefitters  
Colorado Local #9 - Sheet Metal

Bidder Trautman & Shreve, Inc.

**DENVER INTERNATIONAL AIRPORT**

**Hydronic System Optimization  
Contract No. 201102945**

**Bid Data Forms**

**LIST OF PROPOSED SUBCONTRACTORS**

Bidder shall list below the name, business address, work assignment and dollar value of each subcontractor which will perform work or labor or provide services to the Bidder relating to this contract in an amount greater than one and one-half percent of the Bidder's total bid. Only one subcontractor for each portion of the work shall be listed. Any proposed subcontractors to be utilized by the Bidder that are certified as a Minority/Women Business Enterprise shall also be listed on the "List of Proposed Subcontractors" attached to these Bid Forms.

If the bidder does not identify a subcontractor to perform portions of the work which could be subcontracted on this form, the Bidder, if it is awarded the contract, agrees not to subcontract such portions that exceed one and one half percent of the total bid amount until the Contractor has advised the Deputy Manager of Aviation - Planning and Development ("Deputy Manager") in writing of the reasons why the subcontractor was not listed in the bid and complied with the requirements of General Condition 502.

If the bidder is awarded the contract and does not enter into a subcontract with a subcontractor listed below, the Contractor agrees not to subcontract any of the work assignment identified for that subcontractor until the Contractor has advised the Deputy Manager in writing of the reasons why a different subcontractor is being used and has obtained approval of the Deputy Manager of the substitution. This requirement does not affect the applicability of General Condition 502.

<b>Subcontractor</b>	<b>Work Assignment</b>	<b>Subcontract Dollar Value</b>
NAME: <u>C&amp;D Insulation</u> ADDRESS: <u>PO Box 276</u> <u>Larkspur, CO 80118</u> PHONE: <u>303-681-9099</u>	Mechanical Insulation	\$228,754.00

Subcontractor	Work Assignment	Subcontract Dollar Value
NAME: <u>JPG Engineering</u> ADDRESS: <u>1833 Mountain View Road</u> <u>Seadalia, CO</u> PHONE: <u>303-688-9044</u>	Test & Balance	\$98,475.00
NAME: <u>Honeywell</u> ADDRESS: <u>345 Inverness Drive South</u> <u>Englewood, CO 80112</u> PHONE: <u>303-792-1667</u>	Temperature Controls	\$2,495,636.00
NAME: <u>JCOR Mechanical Inc.</u> ADDRESS: <u>15800 W. 5th Avenue</u> <u>Golden, CO 80401</u> PHONE: <u>303-271-9787</u>	Mechanical Concourse C	\$573,983.00
NAME: <u>St. Andrews Construction Services</u> ADDRESS: <u>12520 First Street</u> <u>Eastlake, CO 80614</u> PHONE: <u>303-439-7999</u>	Electrical	\$143,819.00
NAME: <u>Intermountain Testing</u> ADDRESS: <u>2965 S. Shoshone</u> <u>Englewood, CO 80110</u> PHONE: <u>303-761-0650</u>	Testing	\$91,806.00
NAME: _____ ADDRESS: _____ PHONE: _____		
NAME: _____ ADDRESS: _____ PHONE: _____		
NAME: _____ ADDRESS: _____ PHONE: _____		

(This page can be duplicated if additional sheets are required.)

Bidder Trautman & Shreve, Inc.

**DENVER INTERNATIONAL AIRPORT**

**Hydronic System Optimization  
Contract No. 201102945**

**Bid Data Forms  
EQUAL OPPORTUNITY REPORT STATEMENT**

Each Bidder shall complete and sign the Equal Opportunity Report Statement. A Bid may be considered unresponsive and may be rejected, in the Owner's sole discretion, if the Bidder fails to provide the fully executed Statement or fails to furnish required data. The Bidder shall also, prior to award, furnish such other pertinent information regarding its own employment policies and practices as well as those of its proposed subcontractors as the FAA, the Owner, or the Executive Vice Chairman of the President's Committee may require.

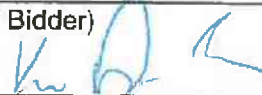
The Bidder shall furnish similar Statements executed by each of its first-tier and second-tier subcontractors and shall obtain similar compliance by such subcontractors, before awarding subcontracts. No subcontract shall be awarded to any non-complying subcontractor.

Equal Opportunity Report Statement  
as Required in 41 CFR 60-1.7(b)

The Bidder shall complete the following statements by checking the appropriate blanks. Failure to complete these blanks may be grounds for rejection of bid:

1. The Bidder has X has not \_\_\_ developed and has on file at each establishment affirmative action programs pursuant to 41 CFR 60-1.40 and 41 CFR 60-2.
2. The Bidder has X has not \_\_\_ participated in any previous contract or subcontract subject to the equal opportunity clause prescribed by Executive Order 11246, as amended.
3. The Bidder has X has not \_\_\_ filed with the Joint Reporting Committee the annual compliance report on Standard Form 100 (EEO-1 Report).
4. The Bidder does X does not \_\_\_ employ fifty or more employees.

Dated: 11/08/2011

Trautman & Shreve, Inc.  
(Name of Bidder)  
By:   
Kevin D. Larrington  
Title: Executive Vice President

Bidder Trautman & Shreve, Inc.

**DENVER INTERNATIONAL AIRPORT**

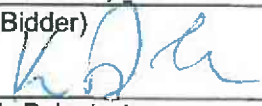
**Hydronic System Optimization  
Contract No. 201102945**

**Bid Data Forms**

**CERTIFICATION OF NON-SEGREGATED FACILITIES  
(Must be completed and submitted with the Bid)**

The Bidder certifies that it does not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Bidder certifies further that it will not maintain or provide for its employees segregated facilities at any of its establishments, and that it will not permit its employees to perform their services at any location under its control, where segregated facilities are maintained. The Bidder agrees that a breach of this certification is a violation of the equal opportunity clause in this contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and washrooms, restaurants and other eating areas, parking lots, drinking fountains, recreation or entertainment areas, transportation and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin, because of habit, local custom, or any other reason. The Bidder agrees that (except where it has obtained identical certification from proposed subcontractors for specific time period) it will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the equal opportunity clause, and that it will retain such certification in its files.

DATED: 11/08/2011

Trautman & Shreve, Inc.  
(Name of Bidder)  
By:   
Kevin D. Larington  
Title: Executive Vice President

Bidder Trautman & Shreve, Inc.

**DENVER INTERNATIONAL AIRPORT  
Hydronic System Optimization  
Contract No. 201102945**

**Bid Bond**

**KNOW ALL MEN BY THESE PRESENTS**

THAT Trautman & Shreve, Inc., as Principal, and \*, a corporation organized and existing under and by virtue of the laws of the State of CT, and authorized to do business within the State of Colorado as Surety, are held and firmly bound unto the City and County of Denver, Colorado, as Obligee, in the full and just sum of Five Percent of the Amount Bid Dollars and NIL Cents (\$ 5% of Amt. Bid) lawful money of the United States, for the payment of which sum, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents:

\*Travelers Casualty and Surety Company of America

WHEREAS, the said Principal is herewith submitting its Bid, dated on October 31st, 2011, for the construction of Contract No. 201102945, Hydronic System Optimization, Denver International Airport, as set forth in detail in the contract documents for the City and County of Denver, Colorado, and said Obligee has required as a condition for receiving said Bid that the Principal deposit specified bid security in the amount of not less than five percent (5%) of the amount of said Bid, as it relates to work to be performed for the City, conditioned that in event of failure of the Principal to execute the Contract for such construction and furnish required Performance and Payment Bond if the Contract is offered him, that said sum be paid immediately to the Obligee as liquidated damages, and not as a Penalty, for the Principal's failure to perform.

The condition of this obligation is such that if the aforesaid Principal shall, within the period specified therefor, on the prescribed form presented to him for signature, enter into a written Contract with the Obligee in accordance with his bid as accepted, and give Performance and Payment Bond with good and sufficient surety or sureties, upon the form prescribed by the Obligee, for the faithful performance and the proper fulfillment of said Contract, or in the event of withdrawal of said bid within the time specified, or upon the payment to the Obligee of the sum determined upon herein, as liquidated damages and not as a Penalty, in the event the Principal fails to enter into said Contract and give such Performance and Payment Bond within the time specified, then this Obligation shall be null and void, otherwise to remain in full force and effect.

[END OF PAGE]



Signed, sealed and delivered this 18th day of October, 2011.

Attest:

  
Secretary  
[SEAL if bidder a corporation]

Dennis Pettit

**PRINCIPAL** Trautman & Shreve, Inc  
4406 Race Street Denver, CO 80216

By:   
Executive Vice President Kevin D. Larington

Travelers Casualty and Surety Company of America  
One Tower Square, Hartford, CT 06183

SURETY

By:   
Attorney-in-Fact, Rita Sagistano

(ATTACH POWER OF ATTORNEY)

Power of Attorney shall be certified as to the date of bid.



POWER OF ATTORNEY

Farmington Casualty Company
Fidelity and Guaranty Insurance Company
Fidelity and Guaranty Insurance Underwriters, Inc.
St. Paul Fire and Marine Insurance Company
St. Paul Guardian Insurance Company

St. Paul Mercury Insurance Company
Travelers Casualty and Surety Company
Travelers Casualty and Surety Company of America
United States Fidelity and Guaranty Company

Attorney-In Fact No. 222895

Certificate No. 004431100

KNOW ALL MEN BY THESE PRESENTS: That St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company and St. Paul Mercury Insurance Company are corporations duly organized under the laws of the State of Minnesota, that Farmington Casualty Company, Travelers Casualty and Surety Company, and Travelers Casualty and Surety Company of America are corporations duly organized under the laws of the State of Connecticut, that United States Fidelity and Guaranty Company is a corporation duly organized under the laws of the State of Maryland, that Fidelity and Guaranty Insurance Company is a corporation duly organized under the laws of the State of Iowa, and that Fidelity and Guaranty Insurance Underwriters, Inc., is a corporation duly organized under the laws of the State of Wisconsin (herein collectively called the "Companies"), and that the Companies do hereby make, constitute and appoint:

Thomas Bean, Rita Sagistano, Gerard S. Macholz, Susan Lupski, Robert T. Pearson, Camille Maitland, George O. Brewster, and Colette R. Chisholm

of the City of Garden City, State of New York, their true and lawful Attorney(s)-in-Fact, each in their separate capacity if more than one is named above, to sign, execute, seal and acknowledge any and all bonds, recognizances, conditional undertakings and other writings obligatory in the nature thereof on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

IN WITNESS WHEREOF, the Companies have caused this instrument to be signed and their corporate seals to be hereto affixed, this 22nd day of July, 2011.

Farmington Casualty Company
Fidelity and Guaranty Insurance Company
Fidelity and Guaranty Insurance Underwriters, Inc.
St. Paul Fire and Marine Insurance Company
St. Paul Guardian Insurance Company

St. Paul Mercury Insurance Company
Travelers Casualty and Surety Company
Travelers Casualty and Surety Company of America
United States Fidelity and Guaranty Company



State of Connecticut
City of Hartford ss.

By: [Signature]
George W. Thompson, Senior Vice President

On this the 22nd day of July, 2011, before me personally appeared George W. Thompson, who acknowledged himself to be the Senior Vice President of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company, and that he, as such, being authorized so to do, executed the foregoing instrument for the purposes therein contained by signing on behalf of the corporations by himself as a duly authorized officer.

In Witness Whereof, I hereunto set my hand and official seal.
My Commission expires the 30th day of June, 2016.



[Signature]
Marie C. Tetreault, Notary Public

This Power of Attorney is granted under and by the authority of the following resolutions adopted by the Boards of Directors of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company, which resolutions are now in full force and effect, reading as follows:

**RESOLVED**, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President, any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary may appoint Attorneys-in-Fact and Agents to act for and on behalf of the Company and may give such appointee such authority as his or her certificate of authority may prescribe to sign with the Company's name and seal with the Company's seal bonds, recognizances, contracts of indemnity, and other writings obligatory in the nature of a bond, recognizance, or conditional undertaking, and any of said officers or the Board of Directors at any time may remove any such appointee and revoke the power given him or her; and it is

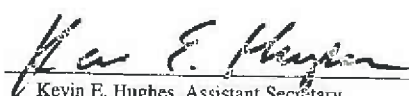
**FURTHER RESOLVED**, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President may delegate all or any part of the foregoing authority to one or more officers or employees of this Company, provided that each such delegation is in writing and a copy thereof is filed in the office of the Secretary; and it is

**FURTHER RESOLVED**, that any bond, recognizance, contract of indemnity, or writing obligatory in the nature of a bond, recognizance, or conditional undertaking shall be valid and binding upon the Company when (a) signed by the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary and duly attested and sealed with the Company's seal by a Secretary or Assistant Secretary; or (b) duly executed (under seal, if required) by one or more Attorneys-in-Fact and Agents pursuant to the power prescribed in his or her certificate or their certificates of authority or by one or more Company officers pursuant to a written delegation of authority; and it is

**FURTHER RESOLVED**, that the signature of each of the following officers: President, any Executive Vice President, any Senior Vice President, any Vice President, any Assistant Vice President, any Secretary, any Assistant Secretary, and the seal of the Company may be affixed by facsimile to any Power of Attorney or to any certificate relating thereto appointing Resident Vice Presidents, Resident Assistant Secretaries or Attorneys-in-Fact for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, and any such Power of Attorney or certificate bearing such facsimile signature or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by such facsimile signature and facsimile seal shall be valid and binding on the Company in the future with respect to any bond or understanding to which it is attached.

I, Kevin E. Hughes, the undersigned, Assistant Secretary, of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company do hereby certify that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which is in full force and effect and has not been revoked.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed the seals of said Companies this 18th day of October, 2011.

  
Kevin E. Hughes, Assistant Secretary



To verify the authenticity of this Power of Attorney, call 1-800-421-3880 or contact us at [www.travelersbond.com](http://www.travelersbond.com). Please refer to the Attorney-In-Fact number, the above-named individuals and the details of the bond to which the power is attached.

**TRAVELERS CASUALTY AND SURETY COMPANY OF AMERICA  
HARTFORD, CT. 06183**

**ATTORNEY-IN-FACT JUSTIFICATION  
PRINCIPAL'S ACKNOWLEDGMENT— IF A CORPORATION**

Colorado

State of ~~New York~~, County of **Denver**, ss.

On this **18th** day of **October**, 20 **11**, before me personally appeared **Kevin D. Larington** to me known, who, being by me duly sworn, deposes and says: That he/she resides in the City of **Littleton, Colorado**; that he/she is the **Executive Vice President** of **Trautman & Shreve, Inc.**, the corporation described in and which executed the within instrument; that he/she knows the seal of said corporation; that the seal affixed to said instrument is such corporate seal; that it was so affixed by order of the Board of Directors of said corporation, and that he/she signed his/her name thereto by like order.

*Pauline Atkinson*

**PRINCIPAL'S ACKNOWLEDGMENT— IF INDIVIDUAL OR FIRM**

**My Commission Expires 04/02/2015**

State of New York, County of \_\_\_\_\_, ss.

On this \_\_\_\_\_ day of \_\_\_\_\_, 20 \_\_\_\_\_, before me personally appeared \_\_\_\_\_ to me known to be (the individual) (one of the firm of \_\_\_\_\_) described in and who executed the within instrument, and he/she thereupon duly acknowledged to me that he/she executed the same (as the act and deed of said firm).

**SURETY COMPANY'S ACKNOWLEDGMENT**

State of New York, County of **Nassau**, ss.

On this **18th** day of **October**, 20 **11**, before me personally appeared **Rita Sagistano** to me known, who, being by me duly sworn, did depose and say: That he/she resides in the ~~City of~~ **County of Nassau, NY**; that he/she is Attorney-in-Fact of **TRAVELERS CASUALTY AND SURETY COMPANY OF AMERICA**, the corporation described in and which executed the within instrument; that he/she knows the corporate seal of said Company; that the seal affixed to said instrument is such corporate seal; and that he/she signed said instrument as Attorney-in-Fact by authority of the Board of Directors of said Company; and affiant did further depose and say that the Superintendent of Insurance of the State of New York has, pursuant to Chapter 882 of the Laws of the State of New York for the year 1939, constituting chapter 28 of the Consolidating Laws of the State of New York as the Insurance Law as amended, issued to **TRAVELERS CASUALTY AND SURETY COMPANY OF AMERICA** his/her certificate that said Company is qualified to become and be accepted as surety or guarantor on all bonds, undertakings, recognizances, guaranties, and other obligations required or permitted by law; and that such certificate has not been revoked.

*Camille Matland*

Notary Public

**TRAVELERS CASUALTY AND SURETY COMPANY OF AMERICA  
Hartford, Connecticut 06183**

**FINANCIAL STATEMENT AS OF DECEMBER 31, 2010  
AS FILED WITH THE INSURANCE DEPT. OF THE STATE OF NEW YORK  
CAPITAL STOCK \$ 6,480,000**

<b>CAMILLE MATLAND NOTARY PUBLIC STATE OF NEW YORK KINGS COUNTY L.C. #01MAB006044 COMM. EXP. APRIL 20, 2014</b>
---

ASSETS		LIABILITIES	
CASH AND INVESTED CASH	\$ 40,788,178	UNEARNED PREMIUMS	\$ 813,054,297
BONDS	3,617,487,280	LOSSES	920,220,402
INVESTMENT INCOME DUE AND ACCRUED	83,908,217	REINSURANCE PAYABLE ON PAID LOSSES / LOSS ADJ. EXPENSES	2,528,742
PREMIUM BALANCES	179,028,702	LOSS ADJUSTMENT EXPENSES	477,495,045
NET DEFERRED TAX ASSET	67,793,379	COMMISSIONS	31,867,838
REINSURANCE RECOVERABLE	28,960,885	TAXES, LICENSES AND FEES	53,078,869
RECEIVABLES FROM PARENT, SUBSIDIARIES AND AFFILIATES	34,025,060	OTHER EXPENSES	34,523,822
SECURITIES LENDING REINVESTED COLLATERAL ASSETS	11,844,000	FUNDS HELD UNDER REINSURANCE TREATIES	86,187,983
UNDISTRIBUTED PAYMENTS	4,607,856	CURRENT FEDERAL AND FOREIGN INCOME TAXES	3,320,537
OTHER ASSETS	513,768	REMITTANCES AND ITEMS NOT ALLOCATED	9,429,732
		AMOUNTS WITHHELD / RETAINED BY COMPANY FOR OTHERS	25,981,365
		RETROACTIVE REINSURANCE RESERVE ASSUMED	3,289,979
		POLICYHOLDER DIVIDENDS	7,473,605
		PROVISION FOR REINSURANCE	5,258,854
		PAYABLE FOR SECURITIES LENDING	11,844,000
		CEDED REINSURANCE NET PREMIUMS PAYABLE	(60,348,827)
		OTHER ACCRUED EXPENSES AND LIABILITIES	1,053,675
		<b>TOTAL LIABILITIES</b>	<b>\$ 2,436,593,238</b>
		CAPITAL STOCK	\$ 6,480,000
		PAID IN SURPLUS	483,803,780
		OTHER SURPLUS	1,882,041,525
		<b>TOTAL SURPLUS TO POLICYHOLDERS</b>	<b>\$ 1,882,041,525</b>
<b>TOTAL ASSETS</b>	<b>\$ 4,238,268,623</b>	<b>TOTAL LIABILITIES &amp; SURPLUS</b>	<b>\$ 4,238,268,623</b>

Securities carried at \$7,754,488 in the above statement are deposited with public authorities, as required by law



**LIST OF PROPOSED MINORITY/WOMEN BUSINESS ENTERPRISE  
BIDDERS, SUBCONTRACTORS, SUPPLIERS (MANUFACTURERS) OR BROKERS**

**CITY OF DENVER  
DEPARTMENT OF AVIATION  
CONTRACT NO. 201102945**

The undersigned Bidder proposes to utilize the following Minority/Women Business Enterprises (MBE/WBEs) for the project. All listed firms are **CURRENTLY** certified by the City and County of Denver. Only the level of MBE/WBE participation listed at the bid opening will count toward satisfaction of the project goal. Only bonafide commissions may be counted for Brokers. MBE/WBE prime bidders must detail their bid information below. Please copy and attach this page to list additional MBE/WBEs for this project.

The undersigned bidder hereby certifies that the subcontractors and suppliers listed below 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 MBE/WBE/DBEs 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 executed and completed MBE/WBE/DBE letters of Intent within three working days for an MBE/WBE project, or within five working days for a DBE project, for each of its MBE, WBE and DBE subcontractors. The Letter of Intent form is contained in the Contract Documents.

CHECK BOX IF APPLICABLE:

<input type="checkbox"/>	MBE/WBE Prime Bidder
--------------------------	----------------------

Business Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Type of Service: \_\_\_\_\_  
Contact Person: \_\_\_\_\_  
Dollar Amount: \$ \_\_\_\_\_ Percent of Project: \_\_\_\_\_ %

CHECK ONE BOX:

<input checked="" type="checkbox"/> Subcontractor	or	<input type="checkbox"/> Supplier	Or	<input type="checkbox"/> Manufacturer	or	<input type="checkbox"/> Broker
---	----	-----------------------------------	----	---------------------------------------	----	---------------------------------

Business Name: JACOR Mechanical Inc.  
Address: 15800 W. 5th Avenue, Golden, CO 80401  
Type of Service: Mechanical services  
Contact Person: Cody Overstreet  
Dollar Amount: \$ 573,983.00 Percent of Project: 7.75 %

CHECK ONE BOX:

<input type="checkbox"/> Subcontractor	or	<input checked="" type="checkbox"/> Supplier	or	<input type="checkbox"/> Manufacturer	or	<input type="checkbox"/> Broker
--	----	--	----	---------------------------------------	----	---------------------------------

Business Name: American Industrial Construction Supply  
Address: 975 E. 58th Avenue, Unit C Denver, CO 80216

Type of Service: Supply control valves  
Contact Person: Vinne LeDoux  
Dollar Amount: \$ 1,057,317.00 Percent of Project: 14.28 %

CHECK ONE BOX:

Subcontractor or  Supplier or  Manufacturer or  Broker

Business Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Type of Service: \_\_\_\_\_  
Contact Person: \_\_\_\_\_  
Dollar Amount: \$ \_\_\_\_\_ Percent of Project: \_\_\_\_\_ %

CHECK ONE BOX:

Subcontractor or  Supplier or  Manufacturer or  Broker

Business Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Type of Service: \_\_\_\_\_  
Contact Person: \_\_\_\_\_  
Dollar Amount: \$ \_\_\_\_\_ Percent of Project: \_\_\_\_\_ %

CHECK ONE BOX:

Subcontractor or  Supplier or  Manufacturer or  Broker

Business Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Type of Service: \_\_\_\_\_  
Contact Person: \_\_\_\_\_  
Dollar Amount: \$ \_\_\_\_\_ Percent of Project: \_\_\_\_\_ %

CHECK ONE BOX:

Subcontractor or  Supplier or  Manufacturer or  Broker

Business Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Type of Service: \_\_\_\_\_  
Contact Person: \_\_\_\_\_  
Dollar Amount: \$ \_\_\_\_\_ Percent of Project: \_\_\_\_\_ %

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: 4406 Race Street



City, State, Zip Code: Denver, CO 80216

Telephone Number of Bidder: 303-295-1414 Fax No. 303-295-0324

Social Security or Federal Employer ID Number of Bidder: 13-363-0476

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

\_\_\_\_\_

For information relative thereto, please refer to:

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Address: \_\_\_\_\_

Dated this 8th day of November, ~~2002~~ 2011.

**Signature of Bidder:**

If an Individual: \_\_\_\_\_

doing business as \_\_\_\_\_

If a Partnership: \_\_\_\_\_

by: \_\_\_\_\_, General Partner.

If a Corporation: Trautman & Shreve, Inc.

a Colorado, Corporation,

by:  \_\_\_\_\_, Exec. Vice  
its President.

Kevin D. Larrington

Attest:



Dennis Pettitt

Secretary

(Corporate Seal)

**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)

CITY AND COUNTY OF DENVER  
DEPARTMENT OF AVIATION

COMMITMENT TO MINORITY/WOMEN BUSINESS ENTERPRISE PARTICIPATION

CONTRACT NO. 201102945

The undersigned has satisfied the MBE and WBE participant requirements in the following manner: (please check the appropriate space)

The Bidder is committed to a minimum of 21 % **MBE and WBE** utilization on the Project, and will submit Letters of Intent for each MBE and WBE listed in the Bid Forms within three (3) working days after the bid opening.

The Bidder is unable to meet the project goal of 21% MBE and WBE participation and is committed to a minimum of \_\_\_\_\_% **MBE and WBE** utilization on this project. The Bidder understands that it must submit a detailed statement of its good faith efforts, which occurred prior to the bid opening, to meet the project goal, and must submit Letters of Intent for each MBE/WBE listed in the Bid Forms within three (3) working days after the bid opening.

Bidder: Trautman & Shreve, Inc.

Name of Firm

By:  Executive Vice President  
Signature Title

Address: 4406 Race Street  
Street

Denver, CO 80216  
City / State / Zip Code

Telephone: 303-295-1414 303-295-0324  
Phone Fax

Bid Documents

\_\_\_\_\_

Contract Number: 201102945

Bid Forms

Date: 11/08/2011



DENVER  
THE MILE HIGH CITY

Office of Economic Development  
Division of Small Business Opportunity  
Compliance Unit – DIA  
EMAIL: [small.business@flydenver.com](mailto:small.business@flydenver.com)  
8500 Pena Blvd, AOB, Suite 7810  
Denver, CO 80249  
Phone: 303 342-2189  
Fax: 303-342-2190

### LETTER OF INTENT (LOI)

All lines must be completed or marked N/A for Not Applicable  
Submit the attached completed checklist with this letter.

Project No.:	Project Name:
--------------	---------------

**A. The Following Section Is To Be Completed by the Bidder/Consultant  
This Letter of Intent Must be Signed by the Bidder/Consultant and M/WBE, SBE or DBE**

Name of Bidder/Consultant:		Phone:	
Contact Person:	Email:	Fax:	
Address:	City:	State:	Zip:

**B. The Following Section is To Be Completed by the M/WBE, SBE or DBE, at any Tier  
This Letter of Intent Must be Signed by the M/WBE, SBE or DBE and Bidder/Consultant**

Name of Certified Firm:		Phone:	
Contact Person:	Email:	Fax:	
Address:	City:	State:	Zip:

Please check the designation which applies to the certified firm.	<input type="checkbox"/> MBE/WBE (√)	<input type="checkbox"/> SBE (√)	<input type="checkbox"/> DBE (√)
---	--------------------------------------	----------------------------------	----------------------------------

**Indirect Utilization:** If this M/WBE, SBE or DBE is not a direct first tier subcontractor/subconsultant, supplier or broker to the Bidder/ Consultant, please indicate the name of the subcontractor/subconsultant, supplier or broker which is utilizing the participation of this firm:

**A Copy of the M/WBE, SBE or DBE Letter of Certification must be Attached**

Identify the scope of the work to be performed or supply item that will be provided by the M/WBE/SBE/DBE. **On unit price bids only, identify which bid line items the M/WBE/SBE/DBEs scope of work or supply corresponds to.**


<input type="checkbox"/> Subcontractor/Subconsultant (√)	<input type="checkbox"/> Supplier (√)	<input type="checkbox"/> Broker (√)
--	---------------------------------------	-------------------------------------

**Bidder** intends to utilize the aforementioned M/WBE, SBE or DBE for the Work/Supply described above. The cost of the work and percentage of the total subcontractor M/WBE, SBE or DBE bid amount is:

\$	%
----	---

**Consultant** intends to utilize the aforementioned M/WBE, SBE or DBE for the Work/Supply described above. The percentage of the work of the total subconsultant M/WBE, SBE or DBE will perform is:

If the fee amount of the work to be performed is requested, the fee amount, is:	\$
---	----

Bidder/Consultant's Signature:	Date:
--------------------------------	-------

Title:
--------

M/WBE, SBE or DBE Firm's Signature:	Date:
-------------------------------------	-------

Title:
--------

If the above named Bidder/Consultant is not determined to be the successful Bidder/Consultant, this Letter of Intent shall be null and void.

## Letter of Intent (LOI) Checklist

*All lines must be completed or marked N/A for Not Applicable*

*Submit the attached completed checklist with this letter.*

<b>Completed</b>	
<input type="checkbox"/>	Project Number & Project Name
<input type="checkbox"/>	<b>Section A:</b> Name of Bidder/Consultant, Contact Person, Address, City, State, Zip, Phone, Email
<input type="checkbox"/>	<b>Section B:</b> Name of Certified Firm, Contact Person, Address, City, State, Zip, Phone, Email
<input type="checkbox"/>	Designation checked for MBE/WBE, SBE or DBE
<input type="checkbox"/>	<b>Indirect Utilization:</b> Name of subcontractor/subconsultant, supplier or broker is indicated if using the participation of a 2 <sup>nd</sup> tier subcontractor/subconsultant, supplier or broker.
<input type="checkbox"/>	Scope of work performed or item supplied by M/WBE, SBE or DBE
<input type="checkbox"/>	Line items performed, if line-item bid.
<input type="checkbox"/>	Copy of M/WBE, SBE or DBE Letter of Certification Attached
<input type="checkbox"/>	Designation checked for Subcontractor/Subconsultant, Supplier or Broker
	<b>If project is a hard bid...</b>
<input type="checkbox"/>	Bidder has indicated dollar amount for value of work going to Subcontractor/ Subconsultant, Supplier or Broker
<input type="checkbox"/>	Bidder has indicated percentage for value of work going to Subcontractor/ Subconsultant, Supplier or Broker
	<b>If project is an RFP/RFQ...</b>
<input type="checkbox"/>	Consultant has indicated percentage for value of work going to Subcontractor/ Subconsultant, Supplier or Broker Name & contact name for MWBE.
<input type="checkbox"/>	Fee amount if fee amount of work to be performed is requested.
<input type="checkbox"/>	Bidder/Consultant's Signature, Title & Date
<input type="checkbox"/>	M/WBE, SBE or DBE Firm's Signature, Title and Date

**The complete and accurate information that is required for the Letter of Intent is based on the following sections of the Ordinance: Section 28-63 and Section 28-68. Failure to complete this information on the Letter of Intent (LOI) may automatically deem a bid or proposal non-responsive.**

**Division of Small Business Opportunity**

**JOINT VENTURE AFFIDAVIT**

"The Undersigned swear that the foregoing statements are correct and include all material information necessary to identify and explain the terms and operation of our joint venture and the intended participation by each joint venturer in the undertaking. Further, the Undersigned covenant and agree to provide the City current, complete, and accurate information regarding actual joint venture work and the payment thereof and any proposed changes in any of the joint venture arrangements and to permit the audit and examination of the books, records, and files of the joint venture, by authorized representatives of the City or Federal funding agency, if applicable. Any material misrepresentation will be grounds for terminating any contract which may be awarded and for initiating action under Federal or State laws concerning false statements."

_____ Name of Firm	
_____ Signature	_____ Date
_____ Name	_____ Title

(Name) \_\_\_\_\_ appeared to me personally known, who, being first duly sworn, did execute the foregoing affidavit, and subscribe and swear to such affidavit before me, and did state that he or she was properly authorized by (Name of Firm) \_\_\_\_\_ to execute the affidavit and did so as his or her free act and deed.

Date: \_\_\_\_\_ Notary Public \_\_\_\_\_  
State of \_\_\_\_\_ Commission Expires \_\_\_\_\_  
County of \_\_\_\_\_ (Seal)  
On this \_\_\_\_\_ day of \_\_\_\_\_ before me



_____ Name of Firm	
_____ Signature	_____ Date
_____ Name	_____ Title

(Name) \_\_\_\_\_ appeared to me personally known, who, being duly sworn, did execute the foregoing affidavit, and did state that he or she was properly authorized by (Name of Firm) \_\_\_\_\_ to execute the affidavit and did so at his or her free act and deed.

Date: \_\_\_\_\_ Notary Public \_\_\_\_\_  
 State of \_\_\_\_\_ Commission Expires \_\_\_\_\_  
 County of \_\_\_\_\_ (Seal)  
 On this \_\_\_\_\_ day of \_\_\_\_\_ before me

Rev 8/2000

**DIVISION OF SMALL BUSINESS OPPORTUNITY**

**JOINT VENTURE ELIGIBILITY FORM**

**Joint Venture** means an association of two (2) or more business enterprises to constitute a single business enterprise to perform a City construction or professional design and construction services contract for which purpose they combine their property, capital, efforts, skills and knowledge, and in which endeavor each joint venturer is responsible for a distinct, clearly defined portion of the work of the contract, performs a commercially useful function, and whose share in the capital contribution, control, management responsibilities, risks and profits of the joint venture are equal to its ownership interest. Joint ventures must have an agreement in writing specifying the terms and conditions of the relationships between the joint venturers and their relationship and responsibility to the contract. *D.R.M.C.28-54 (29)*.

1. Name of Joint Venture \_\_\_\_\_

2. Address of Joint Venture: \_\_\_\_\_

Address

\_\_\_\_\_ City

\_\_\_\_\_ State

\_\_\_\_\_ Zip Code

3. Telephone number of joint venture:(\_\_\_\_\_)\_\_\_\_\_

4. Identify the firms which comprise the joint venture

A. Name: \_\_\_\_\_

Address: \_\_\_\_\_

B. Name: \_\_\_\_\_

Address: \_\_\_\_\_

C. Name: \_\_\_\_\_

Address: \_\_\_\_\_

1) Describe the role of the MBE/WBE in the Joint Venture:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ (Attach additional information if necessary)

2) Briefly describe the experience and business qualifications of each non-MBE/WBE Joint Venturer.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ (Attach additional information if necessary)

5. Name of the Joint Venture's Business: \_\_\_\_\_

6. Provide a copy of the signed Joint Venture Agreement

7. What is the claimed percentage of MBE/WBE ownership? \_\_\_\_\_ %

8. Ownership of Joint Venture: (This need not be filled in if described in the joint venture agreement provided in question 6.)

(a) Profit and loss sharing: \_\_\_\_\_  
\_\_\_\_\_

(b) Capital contributions, including equipment: \_\_\_\_\_  
\_\_\_\_\_

Other applicable ownership interests: \_\_\_\_\_  
\_\_\_\_\_

Duration of the joint venture:

From: \_\_\_\_\_ To: \_\_\_\_\_

9. Control of and participation in this contract. Identify which firm and those individuals (and their titles) who are responsible for the day-to-day management and policy decision making, including but not limited to those with prime responsibility for:

(a) Financial Decisions:

Firm: \_\_\_\_\_

Name: \_\_\_\_\_

Title: \_\_\_\_\_

(b) Management Decisions:

(1) Estimating

Firm: \_\_\_\_\_

Name: \_\_\_\_\_

Title: \_\_\_\_\_

(2) Marketing and Sales

Firm: \_\_\_\_\_

Name: _____ Title: _____ (3) Hiring and firing of management personnel Firm: _____ Name: _____ Title: _____  (4) Purchasing of major items or supplies Firm: _____ Name: _____ Title: _____
---

**Note:** (1) An MBE/WBE performs a commercially useful function when it is responsible for execution of a distinct element of the work of the contract and carrying out its responsibilities by actually performing, managing, and supervising the work involved. To determine whether an MBE/WBE is performing a commercially useful function, the amount of work subcontracted, industry practices, and other relevant factors shall be evaluated.

(2) An MBE/WBE does not perform a commercially useful function if its role is limited to that of an extra participant in a transaction, contract, or project through which funds are passed in order to obtain the appearance of MBE/WBE participation or the MBE/WBE subcontracts a greater portion of the work of a contract than would be expected on the basis of normal industry practice for the type of work involved.

(3) A joint venture which includes one (1) or more MBE/WBEs is subject to the review and approval by the Director of DSBO and the participation will count toward satisfaction of the MBE/WBE goal upon confirmation of the utilization in the joint venture of joint management and full integration of work forces by the joint venture partners.

If there are any significant changes in this submittal, the joint venture members must immediately notify the Division of Small Business Opportunity.

**BIDDER/CONTRACTOR/VENDOR/PROPOSER DISCLOSURE**

\_\_\_\_\_  
Bidding Entity's/ Proposer's Name

\_\_\_\_\_  
Date this form was completed

\_\_\_\_\_  
Address

(\_\_\_\_\_) \_\_\_\_\_  
Telephone Number

\_\_\_\_\_  
City, State, Zip Code

\_\_\_\_\_  
Signature of Officer/Owner

Section 20-69, D.R.M.C. requires the disclosure of the name of each officer, director, shareholder who owns or controls 5% or more of the business entity, principal, and owner of each bidding or proposing entity, AND either (1) disclosure of the names of the spouses of those individuals and the names of their children under the age of eighteen (18), or (2) a statement in lieu of the disclosure of the names of such spouses and children as set forth below in the "Certified Statement in Lieu of Disclosure." The names of officers, directors, 5% shareholders, principals and owners must be disclosed in either event. Required disclosures also include the names of any subcontractor/supplier receiving more than \$100,000.00 of work and the names of any unions with which the bidder/proposer has a collective bargaining agreement. This page may be photocopied if additional space is required.

The individuals listed below are disclosed as having the noted relationship with the business entity/proposer listed above. Show appropriate letter in the box to the left. Use center box for relationship to another line number: A=Officer, B=Director, C=Principal, D=Owner, E=Controller of 5% or more of the stock, F=Spouse, G=Child under age 18, H=Subcontractor, I=Supplier, J=Union. Identify with an asterisk (\*) all listed persons who have made a contribution or contribution in-kind, as defined by Section 15-32, D.R.M.C., within the last five years.

1. <input type="checkbox"/> <input type="checkbox"/>	9. <input type="checkbox"/> <input type="checkbox"/>
2. <input type="checkbox"/> <input type="checkbox"/>	10. <input type="checkbox"/> <input type="checkbox"/>
3. <input type="checkbox"/> <input type="checkbox"/>	11. <input type="checkbox"/> <input type="checkbox"/>
4. <input type="checkbox"/> <input type="checkbox"/>	12. <input type="checkbox"/> <input type="checkbox"/>
5. <input type="checkbox"/> <input type="checkbox"/>	13. <input type="checkbox"/> <input type="checkbox"/>
6. <input type="checkbox"/> <input type="checkbox"/>	14. <input type="checkbox"/> <input type="checkbox"/>
7. <input type="checkbox"/> <input type="checkbox"/>	15. <input type="checkbox"/> <input type="checkbox"/>
8. <input type="checkbox"/> <input type="checkbox"/>	16. <input type="checkbox"/> <input type="checkbox"/>

THIS IS PAGE 1 OF 2 PAGES

**BIDDER/CONTRACTOR/VENDOR/PROPOSER CERTIFIED STATEMENT  
IN LIEU OF DISCLOSURE OF NAMES OF SPOUSES AND CHILDREN**

I hereby certify that, except as identified by an asterisk above, no officer, director, shareholder who owns or controls 5% or more of the business entity, principal, or owner or his or her spouse or child under eighteen years of age has made a contribution, as defined at Section 15-32 D.R.M.C., or a contribution in-kind, as defined at Section 15-32 D.R.M.C., to a candidate, as defined at Section 15-32 D.R.M.C., during the last five years.

---

Signature of Officer/Owner of Bidding/Proposing Entity



**CITY AND COUNTY OF DENVER**  
**DEPARTMENT OF AVIATION**  
**NOTICE TO APPARENT LOW BIDDER**

Date: [Date]

To: [Bidder name and address]

The Manager of Aviation, having considered the Bids submitted for the construction of Contract No. 201102945, Hydronic System Optimization, Denver International Airport, as set forth in detail in the Contract Documents for the City and County of Denver, Colorado and it appearing that your Bid is fair, equitable and in the best interest of said City and County, the said Bid with a Total Contract Bid Amount of \_\_\_\_\_ Dollars (\$\_\_\_\_\_) is hereby declared to be acceptable, subject to the approval of the execution of the contract by the City in accordance with the Charter of the City and County of Denver.

In accordance with the terms of the Contract Documents, you are required to execute the formal Contract and furnish the required Performance Bond, Payment Bond and insurance certificates within five (5) consecutive working days from and including the date of this Notice. In addition, you are required to submit the EEO information described in IB-27 before a Notice to Proceed may be issued.

The bid security submitted with your Bid will be returned upon execution of the Contract, the City's receipt of the required Performance and Payment Bonds and insurance certificates, and, if required, City Council approval of the contract. If you should fail to execute the Contract and furnish the Performance and Payment Bonds and insurance certificate 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.

All construction contracts made and entered into by the City and County of Denver are subject to applicable City and/or Federal Affirmative Action and Equal Employment Opportunity Rules and Regulations, and each contract requiring payment by the City of Five Million Dollars (\$5,000,000.00) 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 Affirmative Action and Equal Employment Opportunity requirements must be completed.

CITY AND COUNTY OF DENVER

By \_\_\_\_\_  
Manager of Aviation

## C O N T R A C T

**THIS CONTRACT**, made and entered into as of the date indicated on the City signature page below, 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 **TRAUTMAN & SHREVE, INC.**, a corporation organized and existing under and by virtue of the laws of the State of COLORADO, hereinafter referred to as the "CONTRACTOR", Party of the Second Part;

### W I T N E S S E T H

**WHEREAS**, the City, for at least three (3) consecutive days, advertised that sealed bids would be received for furnishing all labor, tools, supplies, equipment, materials and everything necessary and required for the construction and installation of Contract No. 201102945, Hydronic System Optimization, Denver International Airport;

**WHEREAS**, bids to said advertisement have been received by the Manager of Aviation, 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 therefor; and

**WHEREAS**, said Contractor is now willing and able to perform all of said work in accordance with the Contract Documents and its bid;

**NOW, THEREFORE**, for and 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:

**ARTICLE I - CONTRACT DOCUMENTS**: It is agreed by the parties hereto that the following list of instruments, drawings and documents which are attached hereto and bound herewith or incorporated herein by reference constitute and shall be referred to either as the Contract Documents or the Contract, and all of said instruments, drawings and documents 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
- Addenda (if any)
- Bid Forms
  - Bid letter
  - Schedule of Prices and Quantities
  - Bid Data Forms
  - Commitment to Minority/Women Business Enterprise Participation
- Notice to Apparent Low Bidder
- Contract
- Performance Bond
- Payment Bond
- Notice to Proceed
- Form of Final Receipt
- Construction Contract General Conditions.
- Special Conditions
- Prevailing wage schedules.
- Insurance certificate(s)

Equal Employment Opportunity Provisions  
Technical Specifications  
Contract Drawings  
Approved Shop Drawings  
Change Directives  
Change Orders

**ARTICLE II - SCOPE OF WORK:** The Contractor agrees to and shall furnish all labor and tools, supplies, equipment, superintendence, 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.

**ARTICLE III - TERMS OF PERFORMANCE:** The Contractor agrees to begin the performance of the work required under this Contract within ten (10) days after being notified to commence work by the Deputy Manager of Aviation – Planning and Development and agrees to fully complete the Work in its entirety within five hundred forty (540) consecutive calendar days from the date of said Notice to Proceed. This period of performance is also referred to as Contract Time. The Contractor is not authorized to commence work prior to its receipt of the Notice to Proceed.

**ARTICLE IV - LIQUIDATED DAMAGES:** It is understood and agreed by and between the City and the Contractor that, if the Contractor fails to achieve Substantial Completion of the Work within the Contract Time or fails to substantially complete the Work described in a Milestone Area within the time set forth in the Special Conditions, the City will suffer substantial damages, which damages would be difficult to accurately determine. The parties hereto have considered the possible elements of damages and have agreed that the amount of liquidated damages for the Contractor's failure to substantially complete the work within the Contract Time or to substantially complete the work described in Milestone Areas within the time set forth in the Special Conditions shall be those amounts listed in the Special Conditions. If the Contractor shall fail to pay such liquidated damages promptly upon demand therefor, the Surety on its Performance Bond and Payment Bond shall pay such damages. Also, the City may withhold all, or any part of, such liquidated damages from any payment due the Contractor. Additional provisions relating to liquidated damages are set forth in the Construction Contract General Conditions and Special Conditions.

**ARTICLE V - TERMS OF PAYMENT:** The City agrees to pay the Contractor for the performance and completion of all of the Work as required by the Contract Documents, and the Contractor agrees to accept as its full and only compensation therefor, a total amount of SEVEN MILLION, THREE HUNDRED EIGHTY-TWO THOUSAND, FOUR HUNDRED SIXTY-FIVE AND NO/100 Dollars (\$7,382,465.00).

Payments will be made to the Contractor in accordance with the City's Prompt Payment Ordinance, D.R.M.C., Section 20-107, et. seq., subject to the maximum contract amount stated above. Contractor agrees that interest and late fees shall be payable by the City hereunder only to the extent authorized and provided for in the City's Prompt Payment Ordinance.

Payment hereunder will be in accordance with the provisions of the Contract Documents, including Title 9 of the General Conditions, and will be made solely and exclusively from funds appropriated and otherwise lawfully made available for the purposes of this Contract from the City and County of Denver Airport System, Operations and Maintenance and Capital Improvement funds. The City has no obligation to make payments from any other fund or source

or to make additional appropriations or allocations to such fund to satisfy such costs or other obligations.

**ARTICLE VI - DISPUTES:** It is agreed and understood by the parties hereto that disputes regarding this contract shall be resolved by administrative hearing under procedures described in Revised Municipal Code Section 5-17.

**ARTICLE VII - 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.

**ARTICLE VIII - SEVERABILITY:** If any part, portion or provision of this Contract shall be found or declared null, void, or unenforceable for any reason whatsoever by any court of competent jurisdiction or any governmental agency having authority thereover, only such part, portion, or provision shall be affected thereby and all other parts, portions and provisions of this Contract shall remain in full force and effect.

**ARTICLE IX - ASSIGNMENT:** The Contractor shall not assign the whole or any part of its duties, rights, and interests in this Contract without first obtaining the written consent of the Manager.

**ARTICLE X - APPROVALS:** In the event this Contract calls for the payment by the City of Five Million Dollars (\$5,000,000.00) 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 performance of this Contract.

**ARTICLE XI - JOINT VENTURE:** If the Contractor is a Joint Venture, the partners to the Joint Venture shall be jointly and severally liable to the City for the performance of all duties and obligations of the Contractor which are set forth in the Contract.

**ARTICLE XII - NO DISCRIMINATION IN EMPLOYMENT:** In connection with the performance of 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, gender variance, marital status, or physical or mental disability; and the Contractor further agrees to insert the foregoing provision in all subcontracts hereunder.

**ARTICLE XIII – 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. Contractors 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. Contractor's indemnification obligation hereunder is not limited to third party claims.
- E. This defense and indemnification obligation shall survive the expiration or termination of this Contract.

**ARTICLE XIV - WAIVER OF CRS 13-20-801, et seq.:** Notwithstanding any other provision of this Contract, the Contractor specifically waives all of the provisions of Colorado Revised Statutes §§ 13-20-801 – 80 as they may relate to the Contractor's performance under this Contract.

**ARTICLE XV - COORDINATION OF SERVICES:** The Contractor agrees to perform its work under this Contract in accordance with the operational requirements of DIA, and all work and movement of personnel or equipment on areas included within the DIA site shall be subject to the regulations and restrictions established by the City or its authorized agents.

**ARTICLE XVI - COMPLIANCE WITH ALL LAWS AND REGULATIONS:** All of the work performed under this Contract by the Consultant shall comply with all applicable laws, rules, regulations and codes of the United States and the State of Colorado, and with the charter, ordinances and rules and regulations of the City and County of Denver.

**ARTICLE XVII – PROMPT PAY:** The Contractor is subject to D.R.M.C. Section 20-112 wherein the Contractor is to pay its subcontractors in a timely fashion. A payment is timely if it is mailed to the subcontractor no later than seven days after receipt of any payment from City. Any late payments are subject to a late payment penalty as provided for in the prompt pay ordinance (Section 20-107 through 20-118).

**ARTICLE XVIII – COLORADO OPEN RECORDS ACT:** The Contractor acknowledges that the City is subject to the provisions of the Colorado Open Records Act, Colorado Revised Statutes §24-72-201 et seq., and the Contractor agrees that it will fully cooperate with the City in the event of a request or lawsuit arising under such act for the disclosure of any materials or information which the Contractor asserts is confidential and exempt from disclosure. Any other provision of this Contract notwithstanding, including exhibits, attachments and other documents incorporated into this Contract by reference, all materials, records and information provided by the Contractor to the City shall be considered confidential by the City only to the extent provided in the Open Records Act, and the Contractor agrees that any disclosure of information by the City consistent with the provisions of the Open Records Act shall result in no liability of the City.

[END OF PAGE]

IN WITNESS WHEREOF, the parties have caused this Agreement to be executed at Denver, Colorado as of the date indicated on the City signature page.

Contract Control Number: 201102945

Vendor Name: TRAUTMAN & SHREVE, INC.

By: 

Name: Kevin O. Loring  
(please print)

Title: President  
(please print)

ATTEST: (if required)

By: \_\_\_\_\_

Name: \_\_\_\_\_  
(please print)

Title: \_\_\_\_\_  
(please print)





**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 \_\_\_\_\_



**PERFORMANCE BOND**

**KNOW ALL MEN BY THESE PRESENTS**, that we, the undersigned **TRAUTMAN & SHREVE, INC.**, a corporation organized under the laws of the State of **COLORADO**, hereinafter referred to as the "Contractor" and Travelers Casualty and Surety Company of America & Federal Insurance Company, a corporation organized under the laws of the State of **CT & IN**, and authorized to transact business in the State of Colorado, hereinafter referred to 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 **SEVEN MILLION, THREE HUNDRED EIGHTY-TWO THOUSAND, FOUR HUNDRED SIXTY-FIVE AND NO/100 Dollars (\$7,382,465.00)**, lawful money of the United States of America, for the payment of which sum the Contractor and Surety bind themselves and their heirs, executors, administrators, successors and assigns, jointly and severally by these presents.

**WHEREAS**, the above Contractor has entered into a written contract with the City for furnishing all labor, materials, equipment, tools, superintendence, and other facilities and accessories for the construction of Contract No. 201102945, Hydronic System Optimization, Denver International Airport, in accordance with the Technical Specifications, Contract Drawings and all other Contract Documents therefor which are incorporated herein by reference and made a part hereof, and are herein referred to as the Contract.

**NOW, THEREFORE**, the condition of this performance bond is such that if the Contractor:

1. Promptly and faithfully observes, abides by and performs each and every covenant, condition and part of said Contract, including, but not limited to, its warranty provisions, in the time and manner prescribed in the Contract, and
2. Pays the City all losses, damages (liquidated or actual, including, but not limited to, damages caused by delays in the performance of the Contract), expenses, costs and attorneys' fees, that the City sustains resulting from any breach or default by the Contractor under the Contract, then this bond is void; otherwise, it shall remain in full force and effect.

**IN ADDITION**, if said Contractor fails to duly pay for any labor, materials, team hire, sustenance, provisions, provender, or any other supplies used or consumed by said Contractor or its subcontractors in its 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 shall pay the same in an 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 any and all changes in the Contract or compliance or noncompliance with the formalities in the Contract for making such changes shall not affect the Surety's obligations under this bond and the Surety hereby waives notice of any such changes.

(End of Page)

IN WITNESS WHEREOF, said Contractor and said Surety have executed these presents as of this 19th day of December, 2011.

Trautman & Shreve, Inc.  
4406 Race Street, Denver, CO 80216

**CONTRACTOR**

By: [Signature]  
President

Travelers Casualty and Surety Company of America  
One Tower Square, Hartford, CT 06183-6014 &  
Federal Insurance Company, 15 Mountain View Road, Warren, NJ 07059

**SURETY**

By: [Signature]  
Attorney-in-Fact, Camille Maitland

(Accompany this bond with Attorney-in-Fact's authority from the Surety to execute bond, certified to include the date of the bond.)

**CITY AND COUNTY OF DENVER**

By: [Signature]  
MAYOR

By: [Signature]  
Manager of Aviation

**APPROVED AS TO FORM:**

DOUGLAS J. FRIEDNASH, Attorney for the  
City and County of Denver

By: [Signature]  
Assistant City Attorney



POWER OF ATTORNEY

Farmington Casualty Company
Fidelity and Guaranty Insurance Company
Fidelity and Guaranty Insurance Underwriters, Inc.
St. Paul Fire and Marine Insurance Company
St. Paul Guardian Insurance Company

St. Paul Mercury Insurance Company
Travelers Casualty and Surety Company
Travelers Casualty and Surety Company of America
United States Fidelity and Guaranty Company

Attorney-In Fact No. 222895

Certificate No. 004553264

KNOW ALL MEN BY THESE PRESENTS: That St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company and St. Paul Mercury Insurance Company are corporations duly organized under the laws of the State of Minnesota, that Farmington Casualty Company, Travelers Casualty and Surety Company, and Travelers Casualty and Surety Company of America are corporations duly organized under the laws of the State of Connecticut, that United States Fidelity and Guaranty Company is a corporation duly organized under the laws of the State of Maryland, that Fidelity and Guaranty Insurance Company is a corporation duly organized under the laws of the State of Iowa, and that Fidelity and Guaranty Insurance Underwriters, Inc., is a corporation duly organized under the laws of the State of Wisconsin (herein collectively called the "Companies"), and that the Companies do hereby make, constitute and appoint

Thomas Bean, Rita Sagistano, Gerard S. Macholz, Susan Lupski, Robert T. Pearson, Camille Maitland, George O. Brewster, and Colette R. Chisholm

of the City of Garden City, State of New York, their true and lawful Attorney(s)-in-Fact, each in their separate capacity if more than one is named above, to sign, execute, seal and acknowledge any and all bonds, recognizances, conditional undertakings and other writings obligatory in the nature thereof on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

IN WITNESS WHEREOF, the Companies have caused this instrument to be signed and their corporate seals to be hereto affixed, this 21st day of September, 2011

Farmington Casualty Company
Fidelity and Guaranty Insurance Company
Fidelity and Guaranty Insurance Underwriters, Inc.
St. Paul Fire and Marine Insurance Company
St. Paul Guardian Insurance Company

St. Paul Mercury Insurance Company
Travelers Casualty and Surety Company
Travelers Casualty and Surety Company of America
United States Fidelity and Guaranty Company



State of Connecticut
City of Hartford ss.

By: [Signature]
George W. Thompson, Senior Vice President

On this the 21st day of September, 2011, before me personally appeared George W. Thompson, who acknowledged himself to be the Senior Vice President of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company, and that he, as such, being authorized so to do, executed the foregoing instrument for the purposes therein contained by signing on behalf of the corporations by himself as a duly authorized officer.

In Witness Whereof, I hereunto set my hand and official seal.
My Commission expires the 30th day of June, 2016.



[Signature]
Marie C. Tetreault, Notary Public

**TRAVELERS CASUALTY AND SURETY COMPANY OF AMERICA  
HARTFORD, CT. 06183**

**ATTORNEY-IN-FACT JUSTIFICATION  
PRINCIPAL'S ACKNOWLEDGMENT — IF A CORPORATION**

State of New York, County of \_\_\_\_\_ ) ss.

On this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, before me personally appeared \_\_\_\_\_ to me known, who, being by me duly sworn, deposes and says: That he/she resides in the City of \_\_\_\_\_ that he/she is the \_\_\_\_\_ of \_\_\_\_\_ the corporation described in and which executed the within instrument; that he/she knows the seal of said corporation; that the seal affixed to said instrument is such corporate seal; that it was so affixed by order of the Board of Directors of said corporation, and that he/she signed his/her name thereto by like order.

**PRINCIPAL'S ACKNOWLEDGMENT — IF INDIVIDUAL OR FIRM**

State of New York, County of \_\_\_\_\_ ) ss.

On this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, before me personally appeared \_\_\_\_\_ to me known to be (the individual) (one of the firm of \_\_\_\_\_ ) described in and who executed the within instrument, and he/she thereupon duly acknowledged to me that he/she executed the same (as the act and deed of said firm).

**SURETY COMPANY'S ACKNOWLEDGMENT**

State of New York, County of **Nassau** ) ss.

On this **19th** day of **December**, 20**11**, before me personally appeared **Camille Maitland** to me known, who, being by me duly sworn, did depose and say: That he/she resides in **Brooklyn Kings County, NY** that he/she is Attorney-in-Fact of **TRAVELERS CASUALTY AND SURETY COMPANY OF AMERICA**, the corporation described in and which executed the within instrument; that he/she knows the corporate seal of said Company; that the seal affixed to said instrument is such corporate seal; and that he/she signed said instrument as Attorney-in-Fact by authority of the Board of Directors of said Company; and affiant did further depose and say that the Superintendent of Insurance of the State of New York has, pursuant to Chapter 882 of the Laws of the State of New York for the year 1939, constituting chapter 28 of the Consolidating Laws of the State of New York as the Insurance Law as amended, issued to **TRAVELERS CASUALTY AND SURETY COMPANY OF AMERICA** his/her certificate that said Company is qualified to become and be accepted as surety or guarantor on all bonds, undertakings, recognizances, guaranties, and other obligations required or permitted by law; and that such certificate has not been revoked.

*Milly Renciwich*  
Notary Public

**TRAVELERS CASUALTY AND SURETY COMPANY OF AMERICA**  
Hartford, Connecticut 06183

**MILLY RENCIWICH**  
Notary Public, State of New York  
No. 01RE6218153  
Qualified in Queens County  
Commission Expires March 1, 2014

**FINANCIAL STATEMENT AS OF DECEMBER 31, 2010**  
**AS FILED WITH THE INSURANCE DEPT. OF THE STATE OF NEW YORK**  
**CAPITAL STOCK \$ 8,480,000**

ASSETS		LIABILITIES	
CASH AND INVESTED CASH	\$ 40,788,178	UNEARNED PREMIUMS	\$ 813,064,297
BONDS	3,817,487,280	LOSSES	820,220,402
INVESTMENT INCOME DUE AND ACCRUED	53,308,217	REINSURANCE PAYABLE ON PAID LOSSES / LOSS ADJ. EXPENSES	2,628,742
PREMIUM BALANCES	179,028,702	LOSS ADJUSTMENT EXPENSES	477,486,945
NET DEFERRED TAX ASSET	67,793,379	COMMISSIONS	31,987,828
REINSURANCE RECOVERABLE	28,980,685	TAXES, LICENSES AND FEES	53,079,069
RECEIVABLES FROM PARENT, SUBSIDIARIES AND AFFILIATES	34,026,680	OTHER EXPENSES	34,623,822
SECURITIES LENDING REINVESTED COLLATERAL ASSETS	11,844,000	FUNDS HELD UNDER REINSURANCE TREATIES	98,187,983
UNDISTRIBUTED PAYMENTS	4,507,656	CURRENT FEDERAL AND FOREIGN INCOME TAXES	3,320,537
OTHER ASSETS	513,768	REMITTANCES AND ITEMS NOT ALLOCATED	9,428,732
		AMOUNTS WITHHELD / RETAINED BY COMPANY FOR OTHERS	26,591,385
		RETROACTIVE REINSURANCE RESERVE ASSUMED	3,269,979
		POLICYHOLDER DIVIDENDS	7,479,805
		PROVISION FOR REINSURANCE	5,286,654
		PAYABLE FOR SECURITIES LENDING	11,844,000
		CEDED REINSURANCE NET PREMIUMS PAYABLE	(80,388,827)
		OTHER ACCRUED EXPENSES AND LIABILITIES	1,053,975
		<b>TOTAL LIABILITIES</b>	<b>\$ 2,436,938,238</b>
		CAPITAL STOCK	\$ 8,480,000
		PAID IN SURPLUS	433,803,760
		OTHER SURPLUS	1,362,041,525
		<b>TOTAL SURPLUS TO POLICYHOLDERS</b>	<b>\$ 1,802,325,285</b>
<b>TOTAL ASSETS</b>	<b>\$ 4,238,258,823</b>	<b>TOTAL LIABILITIES &amp; SURPLUS</b>	<b>\$ 4,238,258,823</b>

Securities carried at \$7,754,486 in the above statement are deposited with public authorities, as required by law



**Chubb  
Surety**

**POWER  
OF  
ATTORNEY**

**Federal Insurance Company  
Vigilant Insurance Company  
Pacific Indemnity Company**

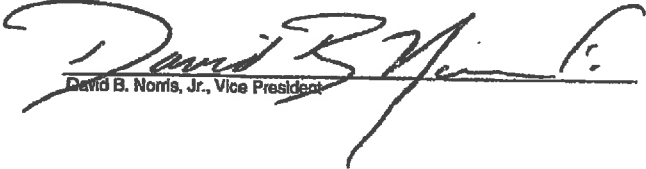
**Attn: Surety Department  
15 Mountain View Road  
Warren, NJ 07059**

**Know All by These Presents, That FEDERAL INSURANCE COMPANY, an Indiana corporation, VIGILANT INSURANCE COMPANY, a New York corporation, and PACIFIC INDEMNITY COMPANY, a Wisconsin corporation, do each hereby constitute and appoint Thomas Bean, George O. Brewster, Colette R. Chisholm, Susan Lupski, Gerard S. Macholz, Camille Maitland, Robert T. Pearson, Rita Sagistano of Garden City, New York**

each as their true and lawful Attorney-in-Fact to execute under such designation in their names and to affix their corporate seals to and deliver for and on their behalf as surety thereon or otherwise, bonds and undertakings and other writings obligatory in the nature thereof (other than bail bonds) given or executed in the course of business, and any instruments amending or altering the same, and consents to the modification or alteration of any instrument referred to in said bonds or obligations.

In Witness Whereof, said FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY have each executed and attested these presents and affixed their corporate seals on this 8th day of December, 2010.

  
Kenneth C. Wendel, Assistant Secretary

  
David B. Norris, Jr., Vice President

STATE OF NEW JERSEY

County of Somerset

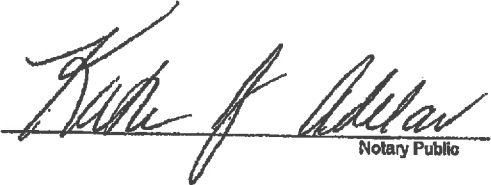
ss.

On this 8th day of December, 2010 before me, a Notary Public of New Jersey, personally came Kenneth C. Wendel, to me known to be Assistant Secretary of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY, the companies which executed the foregoing Power of Attorney, and the said Kenneth C. Wendel, being by me duly sworn, did depose and say that he is Assistant Secretary of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY and knows the corporate seals thereof, that the seals affixed to the foregoing Power of Attorney are such corporate seals and were thereto affixed by authority of the By-Laws of said Companies; and that he signed said Power of Attorney as Assistant Secretary of said Companies by like authority; and that he is acquainted with David B. Norris, Jr., and knows him to be Vice President of said Companies; and that the signature of David B. Norris, Jr., subscribed to said Power of Attorney is in the genuine handwriting of David B. Norris, Jr., and was thereto subscribed by authority of said By-Laws and in deponent's presence.

Notarial Seal



**KATHERINE J. ADELAAR  
NOTARY PUBLIC OF NEW JERSEY  
No. 2316685  
Commission Expires July 14, 2014**

  
Notary Public

**CERTIFICATION**

Extract from the By-Laws of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY:

"All powers of attorney for and on behalf of the Company may and shall be executed in the name and on behalf of the Company, either by the Chairman or the President or a Vice President or an Assistant Vice President, jointly with the Secretary or an Assistant Secretary, under their respective designations. The signature of such officers may be engraved, printed or lithographed. The signature of each of the following officers: Chairman, President, any Vice President, any Assistant Vice President, any Secretary, any Assistant Secretary and the seal of the Company may be affixed by facsimile to any power of attorney or to any certificate relating thereto appointing Assistant Secretaries or Attorneys-in-Fact for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, and any such power of attorney or certificate bearing such facsimile signature or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by such facsimile signature and facsimile seal shall be valid and binding upon the Company with respect to any bond or undertaking to which it is attached."

I, Kenneth C. Wendel, Assistant Secretary of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY (the "Companies") do hereby certify that

- (i) the foregoing extract of the By-Laws of the Companies is true and correct,
- (ii) the Companies are duly licensed and authorized to transact surety business in all 50 of the United States of America and the District of Columbia and are authorized by the U.S. Treasury Department; further, Federal and Vigilant are licensed in Puerto Rico and the U.S. Virgin Islands, and Federal is licensed in American Samoa, Guam, and each of the Provinces of Canada except Prince Edward Island; and
- (iii) the foregoing Power of Attorney is true, correct and in full force and effect.

Given under my hand and seals of said Companies at Warren, NJ this 19th Day of December, 2011



  
Kenneth C. Wendel, Assistant Secretary

IN THE EVENT YOU WISH TO NOTIFY US OF A CLAIM, VERIFY THE AUTHENTICITY OF THIS BOND OR NOTIFY US OF ANY OTHER MATTER, PLEASE CONTACT US AT ADDRESS LISTED ABOVE, OR BY Telephone (908) 903-3493 Fax (908) 903-3656 e-mail: surety@chubb.com



**ACKNOWLEDGMENT OF SURETY COMPANY**

STATE OF ..New York..... }  
COUNTY OF ...Nassau..... } ss

On this ..December 19, 2011....., before me personally came .....Camille Maitland.....  
to me known, who, being by me duly sworn, did depose and say; that he/she resides in  
.....Kings County....., State of .....NY....., that he/she is the Attorney-In-Fact of the  
.....Federal Insurance Company..... the corporation described in which executed the  
above instrument; that he/she knows the seal of said corporation; that the seal affixed to said instrument is  
such corporate seal; that it was so affixed by the Board of Directors of said corporation; and that he/she signed  
his/her name thereto by like order; and the affiant did further depose and say that the Superintendent of  
Insurance of the State of New York, has, pursuant to Section 1111 of the Insurance Law of the State of New  
York, issued to Federal Insurance Company..... (Surety) his/her certificate of  
qualification evidencing the qualification of said Company and its sufficiency under any law of the State of New  
York as surety and guarantor, and the propriety of accepting and approving it as such; and that such certificate  
has not been revoked.

*Nelly Renchiwicz*  
.....  
Notary Public

NY acknowledgement

**NELLY RENCHIWICZ**  
Notary Public, State of New York  
No. 01R66218158  
Qualified in Queens County  
Commission Expires March 1, 2014

# FEDERAL INSURANCE COMPANY

## STATEMENT OF ASSETS, LIABILITIES AND SURPLUS TO POLICYHOLDERS

Statutory Basis

DECEMBER 31, 2010

(in thousands of dollars)

<i>ASSETS</i>		<i>LIABILITIES AND SURPLUS TO POLICYHOLDERS</i>	
Cash and Short Term Investments.....	\$ 235,579	Outstanding Losses and Loss Expenses.....	\$ 12,051,257
United States Government, State and Municipal Bonds.....	10,931,173	Unearned Premiums.....	3,331,654
Other Bonds.....	4,110,731	Ceded Reinsurance Premiums Payable.....	329,476
Stocks.....	837,803	Provision for Reinsurance.....	70,491
Other Invested Assets.....	1,909,914	Other Liabilities.....	962,493
TOTAL INVESTMENTS.....	<u>18,025,200</u>	TOTAL LIABILITIES.....	<u>16,745,371</u>
Investments in Affiliates:		Special Surplus Funds.....	174,400
Chubb Investment Holdings, Inc.....	3,002,346	Capital Stock.....	20,980
Pacific Indemnity Company.....	2,424,142	Paid-In Surplus.....	3,106,808
Chubb Insurance Investment Holdings Ltd....	1,275,789	Unassigned Funds.....	<u>11,015,075</u>
Executive Risk Indemnity Inc.....	1,111,774		
CC Canada Holdings Ltd.....	752,455	SURPLUS TO POLICYHOLDERS.....	<u>14,317,263</u>
Great Northern Insurance Company.....	459,252		
Chubb Insurance Company of Australia Limited	313,107		
Chubb European Investment Holdings SLP..	234,636		
Vigilant Insurance Company.....	212,646		
Other Affiliates.....	381,791		
Premiums Receivable.....	1,441,826	TOTAL LIABILITIES AND SURPLUS TO POLICYHOLDERS.....	<u>\$ 31,062,634</u>
Other Assets.....	<u>1,427,670</u>		
TOTAL ADMITTED ASSETS.....	<u>\$ 31,062,634</u>		

Investments are valued in accordance with requirements of the National Association of Insurance Commissioners.  
Investments with a carrying value of \$452,427,638 are deposited with government authorities as required by law.

State, County & City of New York, — ss:

Yvonne Baker, Assistant Secretary

\_\_\_\_\_ of the Federal Insurance Company  
being duly sworn, deposes and says that the foregoing Statement of Assets, Liabilities and Surplus to Policyholders of said Federal Insurance Company on December 31, 2010 is true and correct and is a true abstract of the Annual Statement of said Company as filed with the Secretary of the Treasury of the United States for the 12 months ending December 31, 2010.

Subscribed and sworn to before me  
this March 31, 2011.

*Dorothy Baker*

Notary Public

DOROTHY M. BAKER  
Notary Public, State of New York  
No. 31-4904994

Qualified in New York County  
Commission Expires Sept. 14, 2013

*Yvonne Baker*

Assistant Secretary

**PAYMENT BOND**

**KNOW ALL MEN BY THESE PRESENTS**, that we, the undersigned **TRAUTMAN & SHREVE, INC.**, a corporation organized under the laws of the State of **COLORADO**, hereinafter referred to as the "Contractor" and **Travelers Casualty and Surety Company of America & Federal Insurance Company**, a corporation organized under the laws of the State of **CT & IN**, and authorized to transact business in the State of Colorado, hereinafter referred to 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 **SEVEN MILLION, THREE HUNDRED EIGHTY-TWO THOUSAND, FOUR HUNDRED SIXTY-FIVE AND NO/100 Dollars (\$7,382,465.00)**, lawful money of the United States of America, for the payment of which sum the Contractor and Surety bind themselves and their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

**WHEREAS**, the above Contractor has entered into a written contract with the City for furnishing all labor, materials, tools, superintendence, and other facilities and accessories for the construction of **Contract No. 201102945, Hydronic System Optimization, Denver International Airport**, in accordance with the **Technical Specifications, Contract Drawings and all other Contract Documents** therefor which are incorporated herein by reference and made a part hereof, and are herein referred to as the **Contract**.


**NOW, THEREFORE**, the condition of this payment bond obligation is such that if the 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 shall indemnify and save harmless the City to the extent of any and all payments in connection with the carrying out of such Contract which the City may be required to make under the law, then this obligation shall be null and void, otherwise, it shall remain in full force and effect;

**PROVIDED FURTHER**, that the said Surety, for value received, hereby stipulates and agrees that any and all changes in the Contract, or compliance or noncompliance with the formalities in the Contract for making such changes shall not affect the Surety's obligations under this bond and the Surety hereby waives notice of any such changes.


[END OF PAGE]

IN WITNESS WHEREOF, said Contractor and said Surety have executed these presents as of this 19th day of December, 2011.

Trautman & Shreve, Inc.  
4406 Race Street, Denver, CO 80216  
**CONTRACTOR**

By:   
\_\_\_\_\_  
President

Travelers Casualty and Surety Company of America  
One Tower Square, Hartford, CT 06183-6014 &  
Federal Insurance Company, 15 Mountain View Road, Warren, NJ 07059  
**SURETY**

By:   
\_\_\_\_\_  
Attorney-in-Fact, Camille Maitland

(Accompany this bond with Attorney-in-Fact's authority from the Surety to execute bond, certified to include the date of the bond.)

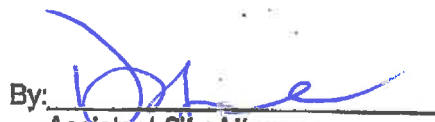
CITY AND COUNTY OF DENVER

By:   
\_\_\_\_\_  
MAYOR

By:   
\_\_\_\_\_  
Manager of Aviation

APPROVED AS TO FORM:

DOUGLAS J. FRIEDNASH, Attorney for the  
City and County of Denver

By:   
\_\_\_\_\_  
Assistant City Attorney



POWER OF ATTORNEY

Farmington Casualty Company
Fidelity and Guaranty Insurance Company
Fidelity and Guaranty Insurance Underwriters, Inc.
St. Paul Fire and Marine Insurance Company
St. Paul Guardian Insurance Company

St. Paul Mercury Insurance Company
Travelers Casualty and Surety Company
Travelers Casualty and Surety Company of America
United States Fidelity and Guaranty Company

Attorney-In Fact No. 222895

Certificate No. 004553265

KNOW ALL MEN BY THESE PRESENTS: That St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company and St. Paul Mercury Insurance Company are corporations duly organized under the laws of the State of Minnesota, that Farmington Casualty Company, Travelers Casualty and Surety Company, and Travelers Casualty and Surety Company of America are corporations duly organized under the laws of the State of Connecticut, that United States Fidelity and Guaranty Company is a corporation duly organized under the laws of the State of Maryland, that Fidelity and Guaranty Insurance Company is a corporation duly organized under the laws of the State of Iowa, and that Fidelity and Guaranty Insurance Underwriters, Inc., is a corporation duly organized under the laws of the State of Wisconsin (herein collectively called the "Companies"), and that the Companies do hereby make, constitute and appoint

Thomas Bean, Rita Sagistano, Gerard S. Macholz, Susan Lupski, Robert T. Pearson, Camille Maitland, George O. Brewster, and Colette R. Chisholm

of the City of Garden City, State of New York, their true and lawful Attorney(s)-in-Fact, each in their separate capacity if more than one is named above, to sign, execute, seal and acknowledge any and all bonds, recognizances, conditional undertakings and other writings obligatory in the nature thereof on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

IN WITNESS WHEREOF, the Companies have caused this instrument to be signed and their corporate seals to be hereto affixed, this 21st day of September, 2011

Farmington Casualty Company
Fidelity and Guaranty Insurance Company
Fidelity and Guaranty Insurance Underwriters, Inc.
St. Paul Fire and Marine Insurance Company
St. Paul Guardian Insurance Company

St. Paul Mercury Insurance Company
Travelers Casualty and Surety Company
Travelers Casualty and Surety Company of America
United States Fidelity and Guaranty Company



State of Connecticut
City of Hartford ss.

By: [Signature]
George W. Thompson, Senior Vice President

On this the 21st day of September, 2011, before me personally appeared George W. Thompson, who acknowledged himself to be the Senior Vice President of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company, and that he, as such, being authorized so to do, executed the foregoing instrument for the purposes therein contained by signing on behalf of the corporations by himself as a duly authorized officer.

In Witness Whereof, I hereunto set my hand and official seal.
My Commission expires the 30th day of June, 2016.



[Signature]
Marie C. Tetreault, Notary Public

**TRAVELERS CASUALTY AND SURETY COMPANY OF AMERICA  
HARTFORD, CT. 06183**

**ATTORNEY-IN-FACT JUSTIFICATION  
PRINCIPAL'S ACKNOWLEDGMENT — IF A CORPORATION**

State of New York, County of \_\_\_\_\_ ) ss.

On this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, before me personally appeared \_\_\_\_\_ to me known, who, being by me duly sworn, deposes and says: That he/she resides in the City of \_\_\_\_\_ that he/she is the \_\_\_\_\_ of \_\_\_\_\_ the corporation described in and which executed the within instrument; that he/she knows the seal of said corporation; that the seal affixed to said instrument is such corporate seal; that it was so affixed by order of the Board of Directors of said corporation, and that he/she signed his/her name thereto by like order.

**PRINCIPAL'S ACKNOWLEDGMENT — IF INDIVIDUAL OR FIRM**

State of New York, County of \_\_\_\_\_ ) ss.

On this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, before me personally appeared \_\_\_\_\_ to me known to be (the individual) (one of the firm of \_\_\_\_\_ ) described in and who executed the within instrument, and he/she thereupon duly acknowledged to me that he/she executed the same (as the act and deed of said firm).

**SURETY COMPANY'S ACKNOWLEDGMENT**

State of New York, County of **Nassau** ) ss.

On this **19th** day of **December**, 20**11**, before me personally appeared **Camille Maitland** to me known, who, being by me duly sworn, did depose and say: That he/she resides in **Brooklyn Kings County, NY** that he/she is Attorney-in-Fact of **TRAVELERS CASUALTY AND SURETY COMPANY OF AMERICA**, the corporation described in and which executed the within instrument; that he/she knows the corporate seal of said Company; that the seal affixed to said instrument is such corporate seal; and that he/she signed said instrument as Attorney-in-Fact by authority of the Board of Directors of said Company; and affiant did further depose and say that the Superintendent of Insurance of the State of New York has, pursuant to Chapter 882 of the Laws of the State of New York for the year 1939, constituting chapter 28 of the Consolidating Laws of the State of New York as the Insurance Law as amended, issued to **TRAVELERS CASUALTY AND SURETY COMPANY OF AMERICA** his/her certificate that said Company is qualified to become and be accepted as surety or guarantor on all bonds, undertakings, recognizances, guaranties, and other obligations required or permitted by law; and that such certificate has not been revoked.

*Nelly Reichwisch*  
Notary Public

**TRAVELERS CASUALTY AND SURETY COMPANY OF AMERICA  
Hartford, Connecticut 06183**

**NELLY REICHWISCH**  
Notary Public, State of New York  
No. 01RE6218158  
Qualified in Queens County  
Commission Expires March 1, 2014

**FINANCIAL STATEMENT AS OF DECEMBER 31, 2010  
AS FILED WITH THE INSURANCE DEPT. OF THE STATE OF NEW YORK  
CAPITAL STOCK \$ 6,480,000**

ASSETS		LIABILITIES	
CASH AND INVESTED CASH	\$ 40,788,178	UNEARNED PREMIUMS	\$ 813,054,297
BONDS	3,817,487,280	LOSSES	920,220,402
INVESTMENT INCOME DUE AND ACCRUED	53,309,217	REINSURANCE PAYABLE ON PAID LOSSES / LOSS ADJ. EXPENSES	2,528,742
PREMIUM BALANCES	179,028,702	LOSS ADJUSTMENT EXPENSES	477,486,945
NET DEFERRED TAX ASSET	87,783,379	COMMISSIONS	31,967,828
REINSURANCE RECOVERABLE	28,980,685	TAXES, LICENSES AND FEES	53,079,869
RECEIVABLES FROM PARENT, SUBSIDIARIES AND AFFILIATES	34,025,680	OTHER EXPENSES	34,623,822
SECURITIES LENDING REINVESTED COLLATERAL ASSETS	11,844,000	FUNDS HELD UNDER REINSURANCE TREATIES	98,187,983
UNDISTRIBUTED PAYMENTS	4,507,856	CURRENT FEDERAL AND FOREIGN INCOME TAXES	3,320,537
OTHER ASSETS	513,768	REMITTANCES AND ITEMS NOT ALLOCATED	8,428,732
		AMOUNTS WITHHELD / RETAINED BY COMPANY FOR OTHERS	25,591,395
		RETROACTIVE REINSURANCE RESERVE ASSUMED	3,269,979
		POLICYHOLDER DIVIDENDS	7,479,605
		PROVISION FOR REINSURANCE	5,256,854
		PAYABLE FOR SECURITIES LENDING	11,844,000
		CEDED REINSURANCE NET PREMIUMS PAYABLE	(80,388,627)
		OTHER ACCRUED EXPENSES AND LIABILITIES	1,053,975
		<b>TOTAL LIABILITIES</b>	<b>\$ 2,435,635,238</b>
		CAPITAL STOCK	\$ 6,480,000
		PAID IN SURPLUS	433,803,760
		OTHER SURPLUS	1,362,041,525
		<b>TOTAL SURPLUS TO POLICYHOLDERS</b>	<b>\$ 1,802,325,285</b>
<b>TOTAL ASSETS</b>	<b>\$ 4,238,258,623</b>	<b>TOTAL LIABILITIES &amp; SURPLUS</b>	<b>\$ 4,238,258,623</b>

Securities carried at \$7,754,488 in the above statement are deposited with public authorities, as required by law





**Chubb  
Surety**

**POWER  
OF  
ATTORNEY**

**Federal Insurance Company  
Vigilant Insurance Company  
Pacific Indemnity Company**

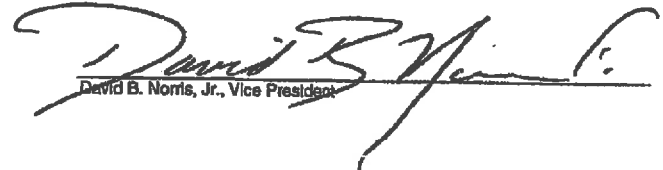
**Attn: Surety Department  
15 Mountain View Road  
Warren, NJ 07059**

**Know All by These Presents, That FEDERAL INSURANCE COMPANY, an Indiana corporation, VIGILANT INSURANCE COMPANY, a New York corporation, and PACIFIC INDEMNITY COMPANY, a Wisconsin corporation, do each hereby constitute and appoint Thomas Bean, George O. Brewster, Colette R. Chisholm, Susan Lupski, Gerard S. Macholz, Camille Maitland, Robert T. Pearson, Rita Sagistano of Garden City, New York**

each as their true and lawful Attorney-in-Fact to execute under such designation in their names and to affix their corporate seals to and deliver for and on their behalf as surety thereon or otherwise, bonds and undertakings and other writings obligatory in the nature thereof (other than bail bonds) given or executed in the course of business, and any instruments amending or altering the same, and consents to the modification or alteration of any instrument referred to in said bonds or obligations.

In Witness Whereof, said FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY have each executed and attested these presents and affixed their corporate seals on this 8th day of December, 2010.

  
Kenneth C. Wendel, Assistant Secretary

  
David B. Norris, Jr., Vice President

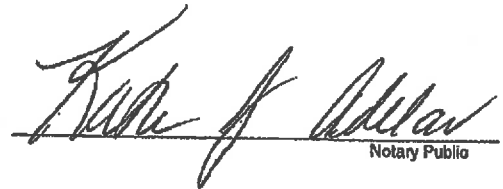
STATE OF NEW JERSEY  
County of Somerset

On this 8th day of December, 2010 before me, a Notary Public of New Jersey, personally came Kenneth C. Wendel, to me known to be Assistant Secretary of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY, the companies which executed the foregoing Power of Attorney, and the said Kenneth C. Wendel, being by me duly sworn, did depose and say that he is Assistant Secretary of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY and knows the corporate seals thereof, that the seals affixed to the foregoing Power of Attorney are such corporate seals and were thereto affixed by authority of the By-Laws of said Companies; and that he signed said Power of Attorney as Assistant Secretary of said Companies by like authority; and that he is acquainted with David B. Norris, Jr., and knows him to be Vice President of said Companies; and that the signature of David B. Norris, Jr., subscribed to said Power of Attorney is in the genuine handwriting of David B. Norris, Jr., and was thereto subscribed by authority of said By-Laws and in deponent's presence.

Notarial Seal



**KATHERINE J. ADELAAR  
NOTARY PUBLIC OF NEW JERSEY  
No. 2316685  
Commission Expires July 14, 2014**

  
Notary Public

**CERTIFICATION**

Extract from the By-Laws of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY:

"All powers of attorney for and on behalf of the Company may and shall be executed in the name and on behalf of the Company, either by the Chairman or the President or a Vice President or an Assistant Vice President, jointly with the Secretary or an Assistant Secretary, under their respective designations. The signature of such officers may be engraved, printed or lithographed. The signature of each of the following officers: Chairman, President, any Vice President, any Assistant Vice President, any Secretary, any Assistant Secretary and the seal of the Company may be affixed by facsimile to any power of attorney or to any certificate relating thereto appointing Assistant Secretaries or Attorneys-in-Fact for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, and any such power of attorney or certificate bearing such facsimile signature or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by such facsimile signature and facsimile seal shall be valid and binding upon the Company with respect to any bond or undertaking to which it is attached."

I, Kenneth C. Wendel, Assistant Secretary of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY (the "Companies") do hereby certify that

- (i) the foregoing extract of the By-Laws of the Companies is true and correct,
- (ii) the Companies are duly licensed and authorized to transact surety business in all 50 of the United States of America and the District of Columbia and are authorized by the U.S. Treasury Department; further, Federal and Vigilant are licensed in Puerto Rico and the U.S. Virgin Islands, and Federal is licensed in American Samoa, Guam, and each of the Provinces of Canada except Prince Edward Island; and
- (iii) the foregoing Power of Attorney is true, correct and in full force and effect.

Given under my hand and seals of said Companies at Warren, NJ this 19th Day of December, 2011



  
Kenneth C. Wendel, Assistant Secretary

IN THE EVENT YOU WISH TO NOTIFY US OF A CLAIM, VERIFY THE AUTHENTICITY OF THIS BOND OR NOTIFY US OF ANY OTHER MATTER, PLEASE CONTACT US AT ADDRESS LISTED ABOVE, OR BY Telephone (908) 903-3493 Fax (908) 903-3656 e-mail: surety@chubb.com

**ACKNOWLEDGMENT OF SURETY COMPANY**

STATE OF New York }  
COUNTY OF Nassau } ss

On this December 19, 2011, before me personally came Camille Maitland  
to me known, who, being by me duly sworn, did depose and say; that he/she resides in  
Kings County, State of NY, that he/she is the Attorney-in-Fact of the  
Federal Insurance Company

the corporation described in which executed the  
above instrument; that he/she knows the seal of said corporation; that the seal affixed to said instrument is  
such corporate seal; that it was so affixed by the Board of Directors of said corporation; and that he/she signed  
his/her name thereto by like order; and the affiant did further depose and say that the Superintendent of  
Insurance of the State of New York, has pursuant to Section 1111 of the Insurance Law of the State of New  
York, issued to Federal Insurance Company (Surety) his/her certificate of  
qualification evidencing the qualification of said Company and its sufficiency under any law of the State of New  
York as surety and guarantor, and the propriety of accepting and approving it as such; and that such certificate  
has not been revoked.

  
.....  
Notary Public

NY acknowledgment

**NELLY RENCHWICH**  
Notary Public, State of New York;  
No. 01RE6218158  
Qualified in Queens County  
Commission Expires March 1, 2014

# FEDERAL INSURANCE COMPANY

## STATEMENT OF ASSETS, LIABILITIES AND SURPLUS TO POLICYHOLDERS

Statutory Basis

DECEMBER 31, 2010

(in thousands of dollars)

<i>ASSETS</i>	<i>LIABILITIES AND SURPLUS TO POLICYHOLDERS</i>
Cash and Short Term Investments..... \$ 235,579	Outstanding Losses and Loss Expenses ..... \$ 12,051,257
United States Government, State and Municipal Bonds ..... 10,931,173	Unearned Premiums..... 3,331,654
Other Bonds..... 4,110,731	Ceded Reinsurance Premiums Payable..... 329,476
Stocks ..... 837,803	Provision for Reinsurance ..... 70,491
Other Invested Assets..... 1,909,914	Other Liabilities..... 962,493
<b>TOTAL INVESTMENTS ..... 18,025,200</b>	<b>TOTAL LIABILITIES ..... 16,745,371</b>
Investments in Affiliates:	Special Surplus Funds ..... 174,400
Chubb Investment Holdings, Inc. .... 3,002,346	Capital Stock..... 20,980
Pacific Indemnity Company..... 2,424,142	Paid-In Surplus..... 3,106,808
Chubb Insurance Investment Holdings Ltd... 1,275,789	Unassigned Funds ..... 11,015,075
Executive Risk Indemnity Inc..... 1,111,774	
CC Canada Holdings Ltd..... 752,455	<b>SURPLUS TO POLICYHOLDERS ..... 14,317,263</b>
Great Northern Insurance Company ..... 459,252	
Chubb Insurance Company of Australia Limited 313,107	
Chubb European Investment Holdings SLP .. 234,636	
Vigilant Insurance Company..... 212,646	
Other Affiliates ..... 381,791	
Premiums Receivable ..... 1,441,826	<b>TOTAL LIABILITIES AND SURPLUS</b>
Other Assets ..... 1,427,670	<b>TO POLICYHOLDERS..... \$ 31,062,634</b>
<b>TOTAL ADMITTED ASSETS ..... \$ 31,062,634</b>	

Investments are valued in accordance with requirements of the National Association of Insurance Commissioners.  
Investments with a carrying value of \$452,427,638 are deposited with government authorities as required by law.

State, County & City of New York, — ss:

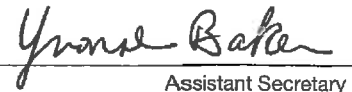
Yvonne Baker, Assistant Secretary \_\_\_\_\_ of the Federal Insurance Company

being duly sworn, deposes and says that the foregoing Statement of Assets, Liabilities and Surplus to Policyholders of said Federal Insurance Company on December 31, 2010 is true and correct and is a true abstract of the Annual Statement of said Company as filed with the Secretary of the Treasury of the United States for the 12 months ending December 31, 2010.

Subscribed and sworn to before me  
this March 31, 2011.

  
\_\_\_\_\_  
Dorothy M. Baker  
Notary Public

DOROTHY M. BAKER  
Notary Public, State of New York  
No. 31-4904994  
Qualified in New York County  
Commission Expires Sept. 14, 2013

  
\_\_\_\_\_  
Yvonne Baker  
Assistant Secretary

**CITY AND COUNTY OF DENVER**

**DEPARTMENT OF AVIATION**

\*\*\*\*\*

**NOTICE TO PROCEED**

Date:

TO: [Bidder name and address]

You are hereby authorized and directed to proceed on this date with the work of constructing Contract No. 201102945, Hydronic System Optimization, Denver International Airport, Denver, Colorado, as set forth in detail in the Contract Documents for the City and County of Denver.

The bid security submitted with your bid is herewith returned to you.

CITY AND COUNTY OF DENVER

By \_\_\_\_\_  
Deputy Manager of Aviation,  
Planning & Development

**CITY AND COUNTY OF DENVER**

**DEPARTMENT OF AVIATION**

\*\*\*\*\*

**FINAL RECEIPT**

Denver, Colorado

\_\_\_\_\_

Received this date of the City and County of Denver, as full and final payment of the cost of the construction of Contract No. 201102945, Hydronic System Optimization, Denver International Airport, Denver, Colorado, provided for in the foregoing Contract, [Payment amount] 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 from all claims whatsoever growing out of said Contract.

And these presents are to certify that all persons doing work upon or furnishing materials for said improvements under the foregoing Contract have been paid in full.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**CITY AND COUNTY OF DENVER**  
**DEPARTMENT OF AVIATION**  
**DEPARTMENT OF PUBLIC WORKS**  
**STANDARD SPECIFICATIONS FOR CONSTRUCTION**  
**CONSTRUCTION CONTRACT GENERAL CONDITIONS**  
**1999 EDITION**

**TABLE OF CONTENTS**

---

The General Contract Conditions are separately bound  
and may be purchased as described in the  
Special Conditions



**CONSTRUCTION CONTRACT GENERAL CONDITIONS  
1999 EDITION**

**TABLE OF CONTENTS**

**TITLE 1  
DEFINITIONS**

101	CITY .....	1
102	CONTRACT .....	1
103	CONTRACT AMOUNT .....	1
104	CONTRACT DOCUMENTS.....	1
105	CONTRACT TIME.....	2
106	CONTRACTOR.....	2
107	CONTRACTOR PERSONNEL .....	3
108	DAYS .....	3
109	DEPUTY MANAGER.....	3
110	DESIGNER.....	3
111	FINAL COMPLETION.....	4
112	MANAGER .....	4
113	PRODUCT DATA .....	5
114	PROJECT .....	5
115	PROJECT MANAGER.....	5
116	SAMPLES .....	5
117	SHOP DRAWINGS.....	5
118	SUBCONTRACTOR.....	6
119	SUBSTANTIAL COMPLETION.....	6
120	SUPPLIER.....	6
121	WORK.....	7

**TITLE 2**

**CITY ADMINISTRATIVE ORGANIZATIONS; LINE OF AUTHORITY**

201	DEPARTMENT OF AVIATION .....	9
202	MANAGER OF AVIATION.....	9
203	DEPARTMENT OF PUBLIC WORKS.....	10
204	MANAGER OF PUBLIC WORKS .....	10
205	BUILDING INSPECTION DIVISION .....	10
206	TRANSPORTATION DIVISION.....	10
207	DESIGN AND CONSTRUCTION MANAGEMENT DIVISION.....	11
208	WASTEWATER MANAGEMENT DIVISION .....	11
209	ZONING ADMINISTRATION .....	11
210	DIVISION OF SMALL BUSINESS OPPORTUNITY .....	12
211	CITY AUDITOR.....	12
212	CITY ATTORNEY.....	13
213	OFFICE OF RISK MANAGEMENT .....	13
214	CITY'S CONTRACT ADMINISTRATION LINE OF AUTHORITY.....	14
215	CITY'S COMMUNICATIONS WITH THE CONTRACTOR.....	14

**TITLE 3**

**CONTRACTOR PERFORMANCE AND SERVICES**

301	CONSIDERATION (CONTRACTOR'S PROMISE OF PERFORMANCE).....	17
302	NOTICE TO PROCEED AND COMPLETION OF THE WORK.....	18
303	EXACT CONTRACTOR PERFORMANCE.....	18
304	SUBSTITUTED PERFORMANCE.....	18
305	WORK PERFORMED UNDER ADVERSE WEATHER CONDITIONS.....	19
306	WORKING HOURS AND SCHEDULE.....	19
307	CONTRACTOR'S SUPERINTENDENT.....	22
308	COMMUNICATIONS.....	23
309	CONTRACTOR SUBMITTALS AND OTHER WRITTEN COMMUNICATIONS TO THE CITY.....	23
310	COMPETENCE OF CONTRACTOR'S WORK FORCE.....	24
311	CONDUCT OF CONTRACTOR'S PERSONNEL.....	24
312	SUGGESTIONS TO CONTRACTOR.....	25
313	WORK FORCE.....	26
314	CONSTRUCTION MACHINES AND STANDBY EQUIPMENT.....	26
315	CUTTING AND PATCHING THE WORK.....	27
316	PERMITS AND LICENSES.....	28
317	CONSTRUCTION SURVEYS.....	29
318	PRESERVATION OF PERMANENT LAND SURVEY CONTROL MARKERS.....	30
319	TRADEMARKS, COPYRIGHTS AND PATENTED DEVICES, MATERIALS, AND PROCESSES.....	31
320	PROJECT SIGNS.....	32
321	PUBLICITY AND ADVERTISING.....	33
322	TAXES.....	33
323	DOCUMENTS AND SAMPLES AT THE SITE.....	36
324	CLEANUP DURING CONSTRUCTION.....	36
325	SANITARY FACILITIES.....	38
326	POWER, LIGHTING, HEATING, VENTILATING, AIR CONDITIONING AND WATER SERVICES.....	38

**TITLE 4**

**CONTRACT DOCUMENTS (DRAWINGS AND SPECIFICATIONS)**

401	CONTRACT DOCUMENTS - REVIEW AND INTERPRETATION.....	41
402	OWNERSHIP OF CONTRACT DRAWINGS AND TECHNICAL SPECIFICATIONS..	44
403	CONTRACT DRAWINGS AND TECHNICAL SPECIFICATIONS ISSUED TO THE CONTRACTOR.....	45
404	REQUESTS FOR INFORMATION OR CLARIFICATION.....	46
405	SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.....	47
406	SUBSTITUTION OF MATERIALS AND EQUIPMENT.....	49

**TITLE 5**

**SUBCONTRACTS**

501	SUBCONTRACTS.....	53
502	SUBCONTRACTOR ACCEPTANCE.....	54

**TITLE 6**

**TIME OF COMMENCEMENT AND COMPLETION**

601	BEGINNING, PROGRESS AND TIME OF COMPLETION.....	59
602	LIQUIDATED DAMAGES; ADMINISTRATIVE COSTS; ACTUAL DAMAGES.....	59
603	DELAY DAMAGES.....	61

<b>TITLE 7</b>		
<b>COOPERATION, COORDINATION AND RATE OF PROGRESS</b>		
701	COOPERATION WITH OTHER WORK FORCES.....	63
702	COORDINATION OF THE WORK.....	65
703	COORDINATION OF PUBLIC CONTACT.....	65
704	RATE OF PROGRESS.....	67

<b>TITLE 8</b>		
<b>PROTECTION OF PERSONS AND PROPERTY</b>		
801	SAFETY OF PERSONS .....	69
802	PROTECTIVE DEVICES AND SAFETY PRECAUTIONS .....	71
803	PROTECTION OF PROPERTY AND WORK IN PROGRESS.....	72
804	PROTECTION OF MUNICIPAL, PUBLIC SERVICE OR PUBLIC UTILITY SYSTEMS.....	74
805	PROTECTION OF STREET AND ROAD SYSTEM.....	76
806	PROTECTION OF DRAINAGE WAYS .....	78
807	PROTECTION OF THE ENVIRONMENT.....	79
808	HAZARDOUS AND EXPLOSIVE MATERIALS OR SUBSTANCES.....	79
809	ARCHEOLOGICAL AND HISTORICAL DISCOVERIES.....	80

<b>TITLE 9</b>		
<b>COMPENSATION</b>		
901	CONSIDERATION (CITY'S PROMISE TO PAY).....	83
902	PAYMENT PROCEDURE .....	84
903	SCHEDULE OF VALUES IN LUMP SUM CONTRACTS.....	85
904	UNIT PRICE CONTRACTS.....	86
905	PROGRESS PERIOD .....	87
906	APPLICATIONS FOR PAYMENT.....	87
907	RELEASES AND CONTRACTOR'S CERTIFICATIONS OF PAYMENT.....	90
908	RETAINAGE.....	90
909	ADDITIONAL WITHHOLDING OF PROGRESS PAYMENTS.....	92
910	FINAL ESTIMATE AND PAYMENT.....	94
911	ACCOUNTING OF COSTS AND AUDIT .....	94

<b>TITLE 10</b>		
<b>WAGES</b>		
1001	PREVAILING WAGE ORDINANCE.....	97
1002	POSTING OF THE APPLICABLE WAGE RATES .....	97
1003	RATE AND FREQUENCY OF WAGES PAID.....	97
1004	REPORTING WAGES PAID.....	98
1005	FAILURE TO PAY PREVAILING WAGES.....	99

<b>TITLE 11</b>		
<b>CHANGES IN THE WORK, CONTRACT PRICE OR CONTRACT TIME</b>		
1101	CHANGE ORDER.....	101
1102	CITY INITIATED CHANGES .....	101
1103	CONTRACTOR CHANGE REQUEST.....	104
1104	ADJUSTMENT TO CONTRACT AMOUNT.....	110
1105	TIME EXTENSIONS.....	117

<b>TITLE 12</b>	
<b>CONTRACTOR CLAIMS FOR ADJUSTMENT AND DISPUTES</b>	
1201	NOTICE OF INTENT TO CLAIM .....121
1202	SUBMITTAL OF CLAIMS .....122
1203	WAIVER OF CLAIMS .....125
<b>TITLE 13</b>	
<b>DISPUTES</b>	
1301	DISPUTES .....127
<b>TITLE 14</b>	
<b>SITE CONDITIONS</b>	
1401	DIFFERING SITE CONDITIONS.....129
1402	SITE INSPECTIONS AND INVESTIGATIONS .....130
<b>TITLE 15</b>	
<b>PERFORMANCE AND PAYMENT BONDS</b>	
1501	SURETY BONDS .....133
1502	PERFORMANCE BOND .....133
1503	PAYMENT BOND.....134
<b>TITLE 16</b>	
<b>INSURANCE AND INDEMNIFICATION</b>	
1601	INSURANCE .....135
1602	INDEMNIFICATION.....135
<b>TITLE 17</b>	
<b>INSPECTION AND DEFECTS</b>	
1701	CONSTRUCTION INSPECTION BY THE CITY .....137
1702	AUTHORITY OF INSPECTORS.....138
1703	OBSERVABLE DEFECTS.....138
1704	DEFECTS - UNCOVERING WORK .....138
1705	LATENT DEFECTS .....139
1706	REMOVAL OF DEFECTIVE MATERIALS AND WORK.....140
<b>TITLE 18</b>	
<b>WARRANTIES, GUARANTEES AND CORRECTIVE WORK</b>	
1801	CONTRACTOR'S WARRANTIES, GUARANTEES AND CORRECTION OF WORK 141
1802	PERFORMANCE DURING WARRANTY PERIOD .....145
<b>TITLE 19</b>	
<b>SUBSTANTIAL COMPLETION OF THE WORK</b>	
1901	CONTRACTOR'S NOTICE OF SUBSTANTIAL COMPLETION .....147
1902	INSPECTION AND PUNCH LIST .....147
1903	CERTIFICATE OF SUBSTANTIAL COMPLETION.....148
1904	RIGHT OF EARLY OCCUPANCY OR USE.....149
<b>TITLE 20</b>	
<b>FINAL COMPLETION AND ACCEPTANCE OF THE WORK</b>	
2001	CLEAN-UP UPON COMPLETION.....151
2002	FINAL COMPLETION AND ACCEPTANCE OF THE WORK .....151

2003	FINAL SETTLEMENT.....	152
------	-----------------------	-----

**TITLE 21  
SUSPENSION OF WORK**

2101	SUSPENSION OF WORK.....	157
2102	SUSPENSION OF THE WORK FOR THE CITY'S CONVENIENCE.....	158
2103	SUSPENSION BECAUSE OF ORDER OF CITY, STATE OR FEDERAL COURT OR AGENCY .....	159
2104	SUSPENSION RESULTING FROM CONTRACTOR'S FAILURE TO PERFORM.....	159

**TITLE 22  
CITY'S RIGHT TO TERMINATE THE CONTRACT**

2201	TERMINATION OF CONTRACT FOR CAUSE.....	161
2202	TERMINATION OF CONTRACT FOR CONVENIENCE OF THE CITY.....	163

**TITLE 23  
MISCELLANEOUS PROVISIONS**

2301	PARTIES TO THE CONTRACT .....	169
2302	FEDERAL AID PROVISIONS.....	169
2303	NO WAIVER OF RIGHTS.....	169
2304	NO THIRD PARTY BENEFICIARY .....	170
2305	GOVERNING LAW; VENUE.....	170
2306	ABBREVIATIONS.....	171



**SPECIAL CONDITIONS**  
**Contract No. 201102945**

**TABLE OF CONTENTS**

<u>SCC</u>	<u>Page</u>
<b>SC-1 CONSTRUCTION CONTRACT GENERAL CONDITIONS</b>	<b>1</b>
<b>SC-2 DRAWINGS AND SPECIFICATIONS TO BE FURNISHED BY THE CITY</b>	<b>1</b>
<b>SC-3 REVISIONS TO G.C. 201</b>	<b>1</b>
<b>SC-4 CITY LINE OF AUTHORITY AND CONTACTS</b>	<b>2</b>
<b>SC-5 CONTRACTOR PERFORMANCE; SUBCONTRACTING</b>	<b>2</b>
<b>SC-6 COOPERATION WITH OTHERS</b>	<b>2</b>
<b>SC-7 PROSECUTION AND COMPLETION OF THE WORK:</b>	<b>3</b>
<b>SC-8 LIQUIDATED DAMAGES</b>	<b>3</b>
<b>SC-9 SECURITY AND PERSONNEL ACCESS</b>	<b>3</b>
<b>SC-10 CONSTRUCTION ACCESS</b>	<b>4</b>
<b>SC-11 VEHICLE PERMITTING</b>	<b>4</b>
<b>SC-12 VENDORS AND SUPPLIERS</b>	<b>5</b>
<b>SC-13 SITE COMMUNICATIONS</b>	<b>5</b>
<b>SC-14 USE, POSSESSION OR SALE OF ALCOHOL OR DRUGS</b>	<b>5</b>
<b>SC-15 ATTORNEY'S FEES</b>	<b>5</b>
<b>SC-16 INSURANCE TO BE PROVIDED BY THE CONTRACTOR</b>	<b>5</b>
<b>SC-17 SUBCONTRACTOR RELEASES</b>	<b>6</b>
<b>SC-18 REVISIONS TO G.C. 210</b>	<b>6</b>
<b>SC-19 ADDITIONAL AFFIRMATIVE ACTION REQUIREMENTS, FEDERAL PROVISIONS</b>	<b>7</b>
<b>SC-20 APPLICATIONS FOR PROGRESS PAYMENTS; G.C. 902.3</b>	<b>7</b>
<b>SC-21 ESTIMATED QUANTITIES OF UNIT PRICED ITEMS</b>	<b>7</b>
<b>SC-22 REVISIONS TO G.C. 1901</b>	<b>8</b>
<b>SC-23 REVISIONS TO G.C. 1102</b>	<b>8</b>
<b>SC-24 LISTING OF ACCEPTABLE MANUFACTURERS</b>	<b>8</b>
<b>SC-25 SUBCONTRACTOR ACCEPTANCE, G.C. 502.1</b>	<b>8</b>
<b>SC-26 ADDITIONAL WITHHOLDING OF PROGRESS PAYMENTS, G.C. 909.1(F)</b>	<b>9</b>
<b>SC-27 REPORTING WAGES PAID, G.C. 1004.2</b>	<b>9</b>
<b>SC-28 DISPUTES, G.C. 1301.1 and 1301.2</b>	<b>9</b>
<b>SC-29 TERMINATION OF CONTRACT FOR CAUSE, G.C. 2201.1(J)</b>	<b>9</b>



<b>SC-30 ACCESSIBLE PARKING SPACES, ACCESS AISLES AND ROUTES OF TRAVEL</b>	<b>9</b>
<b>SC-31 NO EMPLOYMENT OF ILLEGAL ALIENS TO PERFORM WORK UNDER THE AGREEMENT:</b>	<b>10</b>
<b>SC-32 RETAINAGE, G.C. 908</b>	<b>12</b>

## SPECIAL CONDITIONS

### SC-1 CONSTRUCTION CONTRACT GENERAL CONDITIONS

The Construction Contract General Conditions which constitute a part of the Contract Documents are set forth in a separately published document, entitled "City and County of Denver, Department of Aviation and Department of Public Works, Standard Specifications for Construction, General Contract Conditions," 1999 Edition, the Table of Contents to which is bound herein (which may be informally referred to as the Orange Book). The General Conditions book is available for purchase for \$10.00 per copy at the following locations during the business hours stated, Monday through Friday, excluding holidays:

Office of the Cashier  
Wellington E. Webb Municipal Office  
Building, 2nd Floor  
201 West Colfax Avenue  
Denver, Colorado, USA 80202  
7:30 a.m. to 4:30 p.m.

Business Management  
Services Office  
Department of Aviation  
Rm. 8810 Airport Office Bldg.  
8500 Peña Boulevard  
Denver, CO 80249  
8:00 A.M. to 4:00 P.M.

The General Conditions are also available on the DIA Contract Procurement website at [www.flydenver.com/contracts](http://www.flydenver.com/contracts).

### SC-2 DRAWINGS AND SPECIFICATIONS TO BE FURNISHED BY THE CITY

The City will provide the following Contract Documents to the Contractor at no expense to the Contractor:

Document	Quantity
Volumes 1 & 2 (See the Master Table of Contents, page TOC-ii, for the content of these volumes)	2 copies
Volume 3	1 copy
Contract Drawings – reproducible	
Change Orders and Change Directives	1 copy

Additional copies of the foregoing documents will be furnished to the Contractor at the Contractor's expense. The Contractor will be responsible for supplying all subcontractors with copies of the Contract Documents at its expense.

If Sensitive Security Information ("SSI") is provided to the Contractor, the Contractor shall be required to comply with Department of Aviation, Standard Policies and Procedures No. 6003, "Contractor Protection of Sensitive Security Information," or its successor, and 49 C.F.R. § 1520, or its successor.

The City will not supply any copies of the General Contract Conditions to the Contractor at City expense.

### SC-3 REVISIONS TO G.C. 201

The second sentence of General Condition 201 is amended to read: "The unit responsible for this management and control is the Planning & Development Office

under the supervision of the Deputy Manager of Aviation for Maintenance and Planning & Development.”

#### **SC-4 CITY LINE OF AUTHORITY AND CONTACTS**

In accordance with General Condition 214, the City's line of authority for administration of this Contract is:

Manager of Aviation (the “Manager” under G.C. 112). The Manager of Aviation is Kim Day, Executive Office, 9<sup>th</sup> Floor, Airport Office Building, 8500 Peña Boulevard, Denver, CO 80249.

Deputy Manager of Aviation for Planning and Development (the “Deputy Manager” under G.C. 109), who reports to the Manager. The Manager is David Rhodes, Planning & Development Office, 7<sup>th</sup> Floor, Airport Office Building, 8500 Peña Boulevard, Denver, CO 80249.

Assistant Manager of Aviation for Planning & Development (the “Assistant Manager”), reports to the Deputy Manager. The Project Manager reports to the Assistant Manager. The Assistant Manager is Michael Steffens Planning & Development Division, 7<sup>th</sup> Floor, Airport Office Building, 8500 Peña Boulevard, Denver, CO 80249.

Project Manager, the City representative who has day to day administrative responsibility of this Contract, and who reports to the Deputy Manager. All notices, requests, pay applications (pursuant to G.C. 902), and other correspondence from the Contractor shall be sent to the assigned Project Manager unless otherwise provided in this Contract. The Project Manager for this Contract is: Lee Walinchus, Planning & Development Office, 7<sup>th</sup> Floor, Airport Office Building, 8500 Peña Boulevard, Denver, CO 80249, phone 303-342-2200.

The Manager may from time to time substitute a different City official as the designated “Deputy Manager” hereunder, and any such change will be effective upon the issuance of written notice to the Contractor which identifies the successor Deputy Manager. The Deputy Manager may from time to time change the assigned Project Manager, and any such change will be effective upon the issuance of written notice to the Contractor which identifies the successor Project Manager.

#### **SC-5 CONTRACTOR PERFORMANCE; SUBCONTRACTING**

With respect to General Condition 501, no more than 85% of the work may be subcontracted.

#### **SC-6 COOPERATION WITH OTHERS**

The Technical Specifications describe the constraints on the physical work site areas. These descriptions are not exhaustive and the Contractor is required to coordinate its activities and work as may be required to meet FAA or City requirements while performing work on DIA.

Without limiting the foregoing, the following contracts administered by the City involve or may involve work overlapping or adjoining the Work under this Contract, and may

be prosecuted concurrently with the Work performed under this Contract. There may also be other adjoining or overlapping contracts which are not listed.

<u>Contract No.</u>	<u>Description</u>
CE-13012	HVAC Controls

**SC-7 PROSECUTION AND COMPLETION OF THE WORK:**

The Work to be performed under the Contract is described in the Technical Specifications and Contract Drawings. The Contractor shall complete the Work within five hundred forty (540) calendar days from Notice to Proceed.

The Work to be performed under the Contract is divided into the following Milestone Areas which are described in the Technical Specifications or Contract Drawings. The Contractor shall complete the work included within these areas within the number of days set forth below:

<u>Milestone</u>	<u>Date of Completion (or, days from NTP)</u>
1. Project Completion	540

**SC-8 LIQUIDATED DAMAGES**

If the Contractor fails to achieve Substantial Completion of the Work within the Contract Time, the Contractor shall be liable to the City for liquidated damages at the rate of \$1,000.00 per day until substantial completion is achieved. [Additionally, if the Contractor fails to substantially complete the Work described in a project Milestone within the time specified in SC-7 PROSECUTION AND COMPLETION OF THE WORK, the Contractor shall be liable to the City for liquidated damages at the following rates per day until such substantial completion is achieved:]

Failure to substantially complete the Work described in Milestone:

	<u>Amount per day</u>
1.	\$1000

Article IV of the Contract and General Condition 602 cover payment and withholding of liquidated damages.

**SC-9 SECURITY AND PERSONNEL ACCESS**

The Contractor shall conduct all its activities at the Airport in compliance with the Airport security system, which is administered by the Airport Operations Division. The Contractor shall obtain the proper access authorizations for its employees, subcontractors and suppliers (i.e., Badges and Permits), and shall be responsible for such persons' compliance with all the Airport rules and regulations, including those regarding security. A copy of the Contractors' section of the Airport Security rules and regulations are available for Contractor review at the Airport Access Services Office, Concourse A East Subcore, 4th Level. Persons regularly entering the construction areas must obtain personnel access from the Airport Access Services Office and must display same upon entering and be prepared to display same while

onsite. Any employee, subcontractor or supplier who violates such rules may be subject to revocation of his access authorization, including authorization for access to secured areas.

The security status of the Airport is subject to change without notice. These contract Special Conditions are applicable to the current security status of the Airport. Should the security status of the Airport change at any time during the term of this Contract, a written notice shall be issued to the Contractor detailing all applicable security modifications. The Contractor shall take **immediate steps** to comply with those security modifications.

If these security modifications involve any additional project cost, the Contractor shall submit a Contractor Change Request in accordance with the General Conditions for the additional cost. The Contractor Change Request shall outline in specific detail the effects of the security modifications on the Contractor's performance of the Contract, and shall provide a detailed cost breakdown for each item for which the Contractor is requesting reimbursement.

The Contractor shall return to the City, at contract completion or termination, or upon demand by the City, all access keys issued to it by the City to security critical areas of the Airport. If the Contractor fails to return any such key or keys at contract completion or termination or upon demand by the City, the Contractor shall be liable to the City for all the City's costs, including the City's labor costs for employees, incurred in re-coring doors and any other work which is required to prevent compromise of the Airport security system. In order to collect such costs hereunder, the City may withhold funds in such amount from any amounts due and payable to the Contractor under this Contract.

#### **SC-10 CONSTRUCTION ACCESS**

The work site(s) is(are) located at Terminal, AOB and Concourses A, B & C. The Contractor shall have access to the work site via Gates 1, 5, and via 78th Avenue.

The City will not provide parking spaces for the Contractor's employees or subcontractor employees at the Airport. Arrangements for transportation and parking for all of its and its subcontractors employees will be the responsibility of the Contractor. The Total Contract Bid Amount or Contract Amount shall include any and all costs associated with the Contractor's and subcontractors' employee parking. Information about parking facilities and charges is available from the Airport Parking Office. Refundable deposits are required for all parking passes.

Unless specifically required by the Contract Documents, the Contractor shall install no fences or other physical obstructions on or around any project work area without the approval of the City.

#### **SC-11 VEHICLE PERMITTING**

Vehicle access on the Airport Operation Area ("AOA") is controlled by and requires permission from the Airport Access Services Office. It is not anticipated that the Contractor will need to operate vehicles on the AOA to perform the Work. Only direct construction support vehicles and/or equipment will be allowed in the contractor's



work areas or sites.

#### **SC-12 VENDORS AND SUPPLIERS**

The Contractor shall provide the Project Manager's office with a list of its equipment/material vendors and suppliers. Vendors or suppliers shall access the construction work areas via the Contractor's access route, described in SC-10 above. All delivery vehicles are subject to search.

#### **SC-13 SITE COMMUNICATIONS**

Any site communications at DIA must be approved by DIA Operations.

#### **SC-14 USE, POSSESSION OR SALE OF ALCOHOL OR DRUGS**

The Contractor and its officers, agents, and employees shall cooperate and comply with the provisions of Executive Order No. 94 and Attachment A thereto concerning the use, possession, or sale of alcohol or drugs. Violation of these provisions or refusal to cooperate with implementation of the policy can result in the City's barring the Contractor from City facilities or participating in City operations.

#### **SC-15 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, Contractor agrees to pay to the City its costs and a reasonable attorney's fee. Because the City Attorney Staff does not bill the City for legal services on an hourly basis, Contractor agrees a reasonable fee shall be computed at the rate of one hundred dollars per hour of City Attorney time.

#### **SC-16 INSURANCE TO BE PROVIDED BY THE CONTRACTOR**

In accordance with the provisions of Title 16 of the General Conditions, the minimum insurance requirements for this contract are set forth in the Sample Insurance Certificate attached to these Special Conditions. The Contractor specifically agrees to comply with each condition, requirement or specification set forth in the attachment for each required coverage during all periods when the required coverage's are in effect.

Contractor and sub-contractors shall procure and maintain until all of their obligations have been discharged, including any warranty periods under this Contract are satisfied, insurance against claims for injury to persons or damage to property which may arise from or in connection with the performance of the work hereunder by the Contractor, his agents, representatives, employees or sub-contractors.

The insurance requirements herein are minimum requirements for this Contract and in no way limit the indemnity covenants contained in this Contract.



The City and County of Denver in no way warrants that the minimum limits contained herein are sufficient to protect the Contractor from liabilities that might arise out of the performance of the work under this Contract by the Contractor, his agents, representatives, employees or sub- contractors. The Contractor shall assess its own risks as it deems appropriate and/or prudent, maintain higher limits and/or broader coverages. The Contractor is not relieved of any liability or other obligations assumed or pursuant to the Contract by reason of its failure to obtain or maintain insurance in sufficient amounts, duration or types.

Contractor shall furnish the City and County of Denver with certificates of insurance (ACORD form or equivalent approved by CCD) as required by this Contract. The certificates for each insurance policy are to be signed by a person authorized by the insurer to bind coverage on its behalf.

All certificates and any required endorsements are to be received and approved by the City before work commences. Each insurance policy required by this Contract must be in effect at or prior to commencement of work under this Contract and remain in effect for the duration of the project. Failure to maintain the insurance policies as required by this Contract or to provide evidence of renewal is a material breach of the Contract. All insurance coverages for sub-contractors shall be subject to the minimum requirements identified in the Exhibit. All sub-contractors certificates and endorsements shall be received and approved by the Contractor before work commences. The City reserves the right to request copies of these certificates at any time.

All certificates required by this Contract shall be sent directly to Denver International Airport, Business & Technologies, Airport Office Building, Room 8810, 8500 Pena Boulevard, Denver, Colorado 80249. The City project/Contract number and project description shall be noted on the certificate of insurance. The City reserves the right to require complete, certified copies of all insurance policies required by this Contract at any time.

The parties hereto understand and agree that the City and County of Denver, its officers, officials and employees, are relying on, and do not waive or intend to waive by any provisions of this Contract, the monetary limitations or any other rights, immunities and protections provided by the Colorado Governmental Immunity Act, §§ 24-10-101 - 120, C.R.S., or otherwise available to the City and County of Denver, its officers, officials and employees.

#### **SC-17 SUBCONTRACTOR RELEASES**

The release form referred to in General Condition 907 is attached to these Special Conditions. It is entitled "Denver International Airport Partial Release."

#### **SC-18 REVISIONS TO G.C. 210**

General Contract Condition 210 is amended to read as follows:

#### **"210 DIVISION OF SMALL BUSINESS OPPORTUNITY**

"The Director of the Division of Small Business Opportunity (DSBO), or persons under the Director's administrative control, will review the employment practices of the Contractor and all levels of Subcontractors and Suppliers, and the utilization by the Contractor of Minority/Women Business Enterprises (MBE/WBE) and/or Disadvantaged Business Enterprises (DBE), in connection with work performed under the Contract. The reviews will be made to determine whether or not all applicable rules, regulations, ordinances, and laws governing equal employment opportunity, affirmative action programs and MBE/WBE and DBE requirements are complied with. The DSBO is a division of the Mayor's Office of Economic Development. The City's MBE/WBE program requirements are found at Sections 28-31 to 28-36 and Sections 28-52 to 28-90 of the Denver Revised Municipal Code."

**SC-19 ADDITIONAL AFFIRMATIVE ACTION REQUIREMENTS, FEDERAL PROVISIONS**

This contract is subject and subordinate to the terms, reservations, restrictions, and conditions of any existing or future agreements between the City and the United States, the execution of which has been or may be required as a condition precedent to the transfer of federal rights or property to the City for airport purposes, and the expenditure of federal funds for airport purposes. The "Federal Requirements" section attached hereto is made a part of this Contract.

**SC-20 APPLICATIONS FOR PROGRESS PAYMENTS; G.C. 902.3**

General Condition 902.3 is amended to read as follows:

"3. The Contractor shall prepare an estimate of Work completed on application for progress payment forms supplied by the Project Manager. These forms shall be completed in the computerized format or such format as required by of the Technical Specifications. The Contractor shall submit with the application for progress payment a monthly progress report and a schedule showing actual progress to date compared with scheduled progress and the releases required by G.C. 902. The Project Manager after the receipt of each application of progress payment review the application and either recommend to the Deputy Manager such amounts as the Project Manager reasonably determines are due or notify the Contractor in writing of the reasons withholding his approval as provided in G.C. 904. The estimate, when recommended by the Project Manager and signed by the Deputy Manager, establishes the total amount due the Contractor. From this estimate are deducted sums already paid and sums to be withheld. This estimate is then attached to a standard City payment voucher. The estimate of Work completed and the payment voucher, are then sent to the Auditor of the City where a pre-audit examination (including Contractor's and subcontractor's payrolls) is conducted, and upon approval by the Auditor, a warrant is issued."

**SC-21 ESTIMATED QUANTITIES OF UNIT PRICED ITEMS**

The "total estimated quantity" of each unit price item as stated on the bid schedules shall be the estimated quantity which is used to determine the percentage of change in such item for purposes of G.C. 1104.7

**SC-22 REVISIONS TO G.C. 1901**

General Condition 1901, "Notice of Substantial Completion," is revised to read as follows:

"When the Contractor considers that the Work is substantially complete as defined in G.C. 119, the Contractor shall notify the Project Manager in writing that the Work is ready for inspection and shall include with its Notice of Substantial Completion of the Work a list of minor items to be completed or corrected that would not affect beneficial occupancy."

**SC-23 REVISIONS TO G.C. 1102**

G.C. 1102.2 is amended by replacing the phrase "Change Request" in all its occurrences in such G.C. with the phrase "Change Notice."

G.C. 1102.3 is amended by replacing the phrase "Field Order/Change Directive" in all its occurrences in such G.C. with the phrase "Change Directive."

**SC-24 LISTING OF ACCEPTABLE MANUFACTURERS**

The Technical Specifications list "Acceptable Manufacturers" for certain products. Such listing identifies manufacturers of certain products which have been determined by a preliminary review to be able to meet the basic product and/or system technical requirements. The listing is not intended to provide a blanket endorsement or acceptance of the manufacturer's specified products or product line. All products from listed manufacturers must meet the detailed requirements of the Technical Specifications. Products that do not meet all detailed Technical Specifications are not acceptable and will be rejected, regardless of whether the manufacturer was listed as "acceptable." The Contractor is responsible for determining the acceptability of all products under the Technical Specifications prior to submission of products for approval.

**SC-25 SUBCONTRACTOR ACCEPTANCE, G.C. 502.1**

General Condition 502.1 is amended to read as follows:

"1. Except as provided in the City's Minority and Women Business Enterprise and Disadvantaged Business Enterprise (MBE/WBE/DBE) contracting requirements, the city recognizes that prior to bidding, the bidder may not have been able to negotiate for all portions of the Work which the bidder proposes to subcontract. The City will, therefore, permit the successful bidder to propose additional Subcontractor(s) at any time during the Contract period, provided, however, that any limitation on subcontracting has not been exceeded, and that all such MBE/WBE/DBE requirements are adhered to. If the proposed Subcontractor(s) are acceptable and the City, by letter to the Contractor, approves of the Subcontractor(s), the Contractor may enter into agreements with these parties. If any proposed Subcontractor(s) are not acceptable to the City, the Contractor must submit for City approval the names of substitute Subcontractors."

**SC-26 ADDITIONAL WITHHOLDING OF PROGRESS PAYMENTS, G.C. 909.1(F)**

General Condition 909.1(F) is amended to read as follows:

“F. Failure to comply with affirmative action, equal employment opportunity, Minority/Women Business Enterprise, or Disadvantaged Business Enterprise requirements set forth in the Contract.”

**SC-27 REPORTING WAGES PAID, G.C. 1004.2**

General Condition 1004.2 is amended to read as follows:

“2. Two (2) sets of these payroll records are required. The original shall be transmitted to the Auditor of the City and County of Denver and a copy shall be sent to the Division of Small Business Opportunity.”

**SC-28 DISPUTES, G.C. 1301.1 and 1301.2**

General Conditions 1301.1 and 1301.2 are amended to read as follows:

“1. All disputes of any nature whatsoever regarding the Contract, including without limitation Contractor claims for additional compensation or extensions of Contract Time, and disputes involving claimed breach of or default under the Contract, shall be resolved by an administrative hearing. Such administrative hearing shall be conducted pursuant to the procedures set out in D.R.M.C §56-106 for Public Works Department Contracts, and pursuant to the procedures set out in D.R.M.C §5-17 for Department of Aviation Contracts. With respect to appropriate issues arising under the City's Ordinances governing Minority/Women Business Enterprise (MBE/WBE) contracting, or any disadvantaged business enterprise (DBE) contracting program mandated by the federal government, the proceeding shall be conducted pursuant to D.R.M.C §28-33.

“2. If either party raises a question concerning whether any issue or claim raised in such administrative proceeding is within the scope of the Contract's dispute resolution provisions, including this GC 1301, such question shall be decided by the Hearing Officer assigned to hear the matter, if any, or by the Manager of Public Works, Manager of Aviation, or Director of the Division of Small Business Opportunity, as the case may be, if such official intends to personally conduct the administrative hearing.”

**SC-29 TERMINATION OF CONTRACT FOR CAUSE, G.C. 2201.1(J)**

General Condition 2201.1(J) is amended to read as follows:

“J. If the Contractor fails to comply with affirmative action or Minority/Women Business Enterprise or Disadvantaged Business Enterprise (MBE/WBE/DBE) requirements;”

**SC-30 ACCESSIBLE PARKING SPACES, ACCESS AISLES AND ROUTES OF TRAVEL**

If any Work is performed in or adjacent to parking facilities at the Airport, the Contractor is responsible for compliance with this SC-30. "Accessible" parking spaces and access aisles as used in this SC-30 mean parking spaces and access aisles which are accessible for, and reserved for use by, persons with disabilities. These parking spaces and access aisles are designed and built to standards established by federal regulations implementing the Americans with Disabilities Act of 1990 ("ADA"), and are marked by signage. "Accessible routes of travel" as used herein means routes through parking facilities which comply with ADA accessibility standards, including degree of slope and absence of obstructions.

Accessible routes of travel and accessible parking spaces and access aisles must be kept free of obstructions and construction debris at all times. No accessible parking spaces or access aisles or accessible routes of travel shall be relocated, blocked or rendered unusable unless the contractor has obtained specific advance approval in writing for such actions from the airport's ADA Compliance Officer.

When prosecution of the Work requires that accessible spaces be temporarily blocked, those accessible spaces and their access aisles shall be temporarily relocated to another location as close as possible to an accessible building entrance. Temporary signage that identifies these parking spaces and access aisles as reserved for the handicapped shall be installed, and the accessible route shall be clearly marked as required.

Before blocking or relocating accessible parking spaces or accessible routes of travel, the contractor must obtain written approval from the DIA ADA Compliance Officer, by submitting a completed request form, which will be provided to the Contractor by the Project Manager at the preconstruction meeting if it is not included as a standard form in Section 01999 of the Technical Specifications. The request shall include the location of alternative spaces and/or routes, and specifications of the temporary signage to be used. Work shall not proceed without this approval.

If a vehicle is parked in any accessible space which is either temporary or approved to be relocated, the contractor will not remove signage or take any other action which would allow the access aisle for such parking space to be blocked. Such actions must be postponed until the parking space is no longer occupied.

**SC-31 NO EMPLOYMENT OF ILLEGAL ALIENS TO PERFORM WORK UNDER THE AGREEMENT:**

A. The Agreement is subject to Den. Rev. Mun. Code 20-90 and the Consultant is liable for any violations as provided in the ordinance.

B. The Consultant 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 either 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 Consultant 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 subcontractor that fails to certify to the Consultant 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.

(5) If it obtains actual knowledge that a subcontractor performing work under the Agreement knowingly employs or contracts with an illegal alien, it will notify such subcontractor and the City within three days. The Consultant will also then terminate such subcontractor if within three days after such notice the subcontractor does not stop employing or contracting with the illegal alien, unless during such three day period the subcontractor provides information to establish that the 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 Den. Rev. Mun. Code 20-90.3.

**SC-32 RETAINAGE, G.C. 908**

General Condition 908 is amended to read as follows:

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 CRS §38-26-107 from each approved application for payment.



## INSURANCE CERTIFICATE

**CITY AND COUNTY OF DENVER  
CERTIFICATE OF INSURANCE FOR DEPARTMENT OF AVIATION**

Original COI

Advice of Renewal

Change

Party to Whom this Certificate is Issued:

Name and Address of Insured:

CITY AND COUNTY OF DENVER  
Manager of Aviation  
Denver International Airport  
8500 Peña Boulevard, Room 8810  
Denver CO 80249

**CONTRACT NAME & NUMBER TO WHICH THIS INSURANCE APPLIES: 201102945 – Hydronic System Optimization**

**I. MANDATORY COVERAGE**

**Colorado Workers' Compensation and Employer Liability Coverage**

**Coverage:** COLORADO Workers' Compensation

**Minimum Limits of Liability (In Thousands)**

WC Limits: \$100, \$500, \$100

And Employer's Liability Limits:

**Any Policy issued under this section must contain, include or provide for the following:**

1. All States Coverage or Colorado listed as a covered state for the Workers' Compensation
2. Waiver of Subrogation and Rights of Recovery against the City and County of Denver (the "City"), its officers, officials and employees.

**Commercial General Liability Coverage**

**Coverage:** Commercial General Liability (coverage at least as broad as that provided by ISO form CG0001 or equivalent)

**Minimum Limits of Liability (In Thousands):**

Each Occurrence:	\$1,000
General Aggregate Limit:	\$2,000
Products-Completed Operations Aggregate Limit:	\$2,000
Personal & Advertising Injury:	\$1,000
Fire Damage Legal - Any one fire	\$1,000

**Any Policy issued under this section must contain, include or provide for the following:**

1. City, its officers, officials and employees as additional insureds, per ISO form CG2010 and CG 2037 or equivalents
2. Coverage for defense costs of additional insureds outside the limits of insurance, per CG0001.
3. Liability assumed under an Insured Contract (Contractual Liability).
4. The full limits of coverage must be dedicated to apply to this project/location, per ISO form CG2503 or equivalent.
5. Waiver of Subrogation and Rights of Recovery, per ISO form CG2404 or equivalent.
6. Separation of Insureds Provision required
7. General Aggregate Limit Applies Per: Policy \_\_\_ Project \_\_\_ Location \_\_\_\_, if applicable

**Business Automobile Liability Coverage**

**Coverage:** Business Automobile Liability (coverage at least as broad as ISO form CA0001)

**Minimum Limits of Liability (In Thousands):** Combined Single Limit \$1,000

**Any Policy issued under this section must contain, include or provide for the following:**

1. Symbol 1, coverage for any auto. If no autos are owned, Symbols 8 & 9, (Hired and Non-owned) auto liability.
2. If this contract involves the transport of hazardous cargo such as fuel, solvents or other hazardous materials may occur, then Broadened Pollution Endorsement, per ISO form CA 9948 or equivalent and MCS 90 are required.

## II. ADDITIONAL COVERAGE

### Umbrella Liability

**Coverage:**

<b>Umbrella Liability, Non Restricted Area</b>		
<b>Minimum Limits of Liability (In Thousands)</b>	Each Occurrence and aggregate	\$1,000

**Any Policy issued under this section must contain, include or provide for the following:**

1. City, its officers, officials and employees as additional insureds.
2. Coverage in excess of, and at least as broad as, the primary policies in sections WC-1, CGL-1, and BAL-1.
3. **If operations include unescorted airside access at DIA, then a \$9 million Umbrella Limit is required.**

## III. ADDITIONAL CONDITIONS

It is understood and agreed, for the benefit of the City, that the following additional conditions shall apply to all coverage specified herein

- All coverage provided herein shall be primary and any insurance maintained by the City shall be considered excess.
- With the exception of professional liability and auto liability, a Waiver of Subrogation and Rights of Recovery against the City, its officers, officials and employees is required for each coverage period.
- The City shall have the right to verify or confirm, at any time, all coverage, information or representations contained herein, and the insured and its undersigned agent shall promptly and fully cooperate in any such audit the City may elect to undertake.
- Advice of renewal is required.
- All insurance companies issuing policies hereunder must carry at least an A -VI rating from A.M. Best Company or obtain a written waiver of this requirement from the City's Risk Administrator.
- Compliance with coverage requirement by equivalent herein must be approved in writing by the City's Risk Administrator prior to contract execution.
- No changes, modifications or interlineations on this Certificate of Insurance shall be allowed without the review and approval of the Risk Administrator prior to contract execution.

### **NOTICE OF CANCELLATION**

It is understood and agreed that should any Policy issued hereunder be canceled or non-renewed before the expiration date thereof, or sustain a material change in coverage adverse to the City, the issuing company or its authorized Agent shall give notice to the Department of Aviation in accordance with policy provisions.

**DENVER INTERNATIONAL AIRPORT  
PARTIAL RELEASE**

**DEPARTMENT OF AVIATION**

**FINAL/PARTIAL RELEASE AND CERTIFICATE OF PAYMENT  
(SUBCONTRACTOR/SUPPLIER)**

201102945, Hydronic System Optimization	Date: _____, 200__ .
(NAME OF CONTRACTOR)	Subcontract #: _____ .
	Subcontract Value: \$ _____ .
(NAME OF SUBCONTRACTOR/SUPPLIER)	Last Progress Payment: \$ _____ .
	Date: _____ .
Check Applicable Box: <input type="checkbox"/> DBE <input type="checkbox"/> MBE/WBE	Total Paid to Date: \$ _____ .
	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 \_\_\_\_\_, 200\_\_, 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 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 _____, 200 .	By:
Notary Public/Commissioner of Oaths My Commission Expires	Title:

**CITY AND COUNTY OF DENVER  
RULES AND REGULATIONS AND BID CONDITIONS  
OF THE  
MANAGER OF PUBLIC WORKS**

**PERTAINING TO EQUAL EMPLOYMENT OPPORTUNITY  
IN THE CITY AND COUNTY OF DENVER**

APPROVED FOR LEGALITY

APPROVED AND ADOPTED:

*/s/*

*/s/*

\_\_\_\_\_  
Attorney for the City and County of Denver

\_\_\_\_\_  
Manager of Public Works

Adopted and Published Pursuant to Article III, Division 2 of Chapter 28  
of the  
*Revised Municipal Code*  
of the  
City and County of Denver

These Rules and Regulations cancel  
and supercede any and all previously  
issued Rules and Regulations on the Subject.

Revised November 1, 1990



**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, material 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" means 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 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 Contract Compliance.
- 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. "Bidding Specifications" as used in Article III, Division 2 of Chapter 28 of the Revised Municipal Code shall include BID CONDITIONS, INVITATION T 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. "Office of Contract Compliance" 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 Denver 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 Denver 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 Contract Compliance 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 Contract Compliance shall perform the duties assigned to such official by Article III, Division 2 Chapter 28 of the Denver Revised Municipal Code and by the Manager. The Director of Contract Compliance 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 Contract Compliance; 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 Contract Compliance 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 Contract Compliance 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 Contract Compliance 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.

#### **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 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 in 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  
DESIGN AND CONSTRUCTION MANAGEMENT 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, Division 2 of Chapter 28 of the Denver Revised Municipal Code, and the rules, regulations, and relevant orders of the Manager of Public Works and the Director of the Division of Small Business Opportunity.
5. The Contractor will furnish all information and reports required by Article m, Division 2 of Chapter 28 of the Denver Revised Municipal Code, and by rules, regulations and orders of the Manager and Director or pursuant thereto, and will permit access to the Contractors 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 m, Division 2 of Chapter 28 of the Denver Revised Municipal Code, or by rules, regulations, or order of the Manager of Public Works.

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 of Chapter 28 of the Denver Revised Municipal Code, so that such provisions will take such action with respect to any subcontractor or supplies. 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 of Public Works and the Director of Contract Compliance in obtaining compliance of subcontractors and suppliers with the equal opportunity clause and the rules, regulations and relevant orders of the Manager of Public Works, and will furnish the Manager of Public Works and the Director of Contract Compliance 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 Denver 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 of Public Works and Director of Contract Compliance. In addition, the Contractor agrees that failure or refusal to comply with these undertakings the Manager of Public Works 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.



**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.

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. 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 minority men and women.

2. SPECIFIC AFFIRMATIVE ACTION STEPS:

If 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. NONDISCRIMINATION:

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.

#### A. 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 m, Division 2 of Chapter 28 of the Denver 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 Division of Small Business Opportunity finds that a contractor failed to comply with the requirements of Article III, Division 2 of Chapter 28 of the Denver 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 Denver 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.

**B. 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 Division 2 of Chapter 28 of the Denver 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 m, Division 2 of Chapter 28 of the Denver Revised Municipal Code, such Contractors cannot be considered to be in compliance with Article m, Division 2 of Chapter 28 of the Denver Revised Municipal Code, or its implementing rules and regulations.

**C. 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 subcontractors 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 contractor contract modification subject to Article III, Division 2 of Chapter 28 of the Denver 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 of Chapter 28 of the Denver 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 M, Division 2 of Chapter 28 of the Denver 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 provisions of these Bid Conditions as shall be required by the Division of Small Business Opportunity.
5. Requests for exemptions from these Bid Conditions must be made in writing, with justification, to the Manager of Public Works, City and County Building, Room 379, Denver, Colorado 80202, and shall be forwarded through and with the endorsement of the Director of the Division of Small Business Opportunity.



**EXHIBIT A**  
**STANDARD FEDERAL ASSURANCES**  
**ATTACHMENT 1**

NOTE: As used below the term "contractor" shall mean and include the "Party of the Second Part," and the term "sponsor" shall mean the "City".

During the term of this contract, the contractor, for itself, its assignees and successors in interest (hereinafter referred to as the "contractor") agrees as follows:

1. Compliance with Regulations. The contractor shall comply with the Regulations relative to nondiscrimination in federally assisted programs of the Department of Transportation (hereinafter "DOT") Title 49, Code of Federal Regulations, Part 21, as they may be amended from time to time (hereinafter referred to as the Regulations), which are herein incorporated by reference and made a part of this contract.

2. Nondiscrimination. The contractor, with regard to the work performed by it during the contract, shall not discriminate on the grounds of race, color, sex, creed or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor shall not participate either directly or indirectly in the discrimination prohibited by section 21.5 of the Regulations, including employment practices when the contract covers a program set forth in Appendix B of the Regulations.

3. Solicitations for Subcontractors, Including Procurements of Materials and Equipment. In all solicitations either by competitive bidding or negotiations made by the contractor for work to be performed under a subcontract, including procurements or materials or leases of equipment, each potential subcontractor or supplier shall be notified by the contractor of the contractor's obligations under this contract and the Regulations relative to nondiscrimination on the grounds of race, color, or national origin.

4. Information and Reports. The contractor shall provide all information and reports required by the Regulations or directives issued pursuant thereto and shall permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the sponsor or the Federal Aviation Administration (FAA) to be pertinent to ascertain compliance with such Regulations, orders, and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish this information, the contractor shall so certify to the sponsor of the FAA, as appropriate, and shall set forth what efforts it has made to obtain the information.

5. Sanctions for Noncompliance. In the event of the contractor's noncompliance with the nondiscrimination provisions of this contract, the sponsor shall impose such contract sanctions as it or the FAA may determine to be appropriate, including, but not limited to:

- a. Withholding of payments to the contractor under the contract until the contractor complies, and/or
- b. Cancellation, termination, or suspension of the contract, in whole or in part.

6. Incorporation of Provisions. The contractor shall include the provisions of

paragraphs 1 through 5 in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Regulations or directives issued pursuant thereto. The contractor shall take such action with respect to any subcontract or procurement as the sponsor or the FAA may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or supplier as a result of such direction, the contractor may request the sponsor to enter into such litigation to protect the interests of the sponsor and, in addition, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

## EXHIBIT B

### NONDISCRIMINATION IN AIRPORT EMPLOYMENT OPPORTUNITIES

The Party of the Second Part assures that it will comply with pertinent statutes, Executive Orders and such rules as are promulgated to assure that no person shall, on the grounds of race, creed, color, national origin, sex, age, or handicap be excluded from participating in any activity conducted with or benefiting from Federal assistance. This Provision obligates the Party of the Second Part or its transferee for the period during which Federal assistance is extended to the airport program, except where Federal assistance is to provide, or is in the form of personal property or real property or an interest therein or structures or improvements thereon. In these cases, this Provision obligates the Party of the Second Part or any transferee for the longer of the following periods: (a) the period during which the property is used by the sponsor or any transferee for a purpose for which Federal assistance is extended, or for another purpose involving the provision of similar services or benefits; or (b) the period during which the airport sponsor or any transferee retains ownership or possession of the property. In the case of contractors, this Provision binds the contractors from the bid solicitation period through the completion of the contract.

**It is unlawful for airport operators and their lessees, tenants, concessionaires and contractors to discriminate against any person because of race, color, national origin, sex, creed, or handicap in public services and employment opportunities.**

## EXHIBIT C

### **Certification for Contracts, Grants, Loans and Cooperative Agreements**

The Contractor certifies by execution of this Agreement to the best of its knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the Contractor to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any federal contract, grant loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the Contractor shall complete and submit Standard Form-LLL, "Disclosure of Lobby Activities," in accordance with its instructions.

(3) The Contractor shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this transaction is a prerequisite for making or entering to this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Contract Encumbrance Number:

# PROJECT MANUAL



DENVER  
INTERNATIONAL  
AIRPORT

## HYDRONIC SYSTEM OPTIMIZATION

CONTRACT NUMBER: 201102945

VOLUME 1

ISSUE FOR  
CONSTRUCTION

CITY AND COUNTY OF DENVER  
DEPARTMENT OF AVIATION

KIM DAY  
MANAGER OF AVIATION

**HYDRONIC SYSTEMS OPTIMIZATION**

**INDEX AND CERTIFICATION PAGE**

<b>Division No.</b>	<b>Division Title</b>	<b>No. of Pages</b>
1	GENERAL REQUIREMENTS	170
5	METALS	10
15	MECHANICAL	144
16	ELECTRICAL	28

**CERTIFICATION(S)**



**HYDRONIC SYSTEM OPTIMIZATION**

**TECHNICAL SPECIFICATIONS**

**DIVISION 01 - GENERAL REQUIREMENTS**

01010 - Summary of Work  
01014 - Work Sequence and Constraints  
01015 – Security Requirements – Non SSI  
01016 – Vehicle and Equipment Permitting  
01020 – Utilities Interface  
01025 – Measurement for Payment  
01050 – Layout of Work and Surveys  
01051 – Project Coordination  
01060 – Regulatory Requirements  
01070 – Abbreviations and Symbols  
01091 – Reference Standards  
01095 – Definitions and Conventions  
01110 – Construction Safety  
01111 – Construction Safety - Airside  
01200 – Project Meetings  
01300 – Submittals  
01310 – Schedule (LP)  
01340 – Shop and Working Drawings, Product Data and Samples  
01370 – Schedule of Values  
01400 – Contractor Quality Control  
01401 – Independent Testing Agency  
01402 – DIA Quality Assurance  
01403 – Contractor Quality Control Program  
01410 – Cutting and Patching  
01411 – Selective Demolition  
01500 – Temporary Facilities  
01505 – Mobilization  
01566 – Environmental Controls  
01580 – Temporary Signs  
01620 – Storage and Protection  
01630 – Substitutions  
01650 – System Startup, Testing and Training  
01700 – Contract Closeout  
01710 – Cleaning  
01720 – Contract Record Documents  
01730 – Operation and Maintenance Data  
01740 – Warranties and Bonds  
01999 – Standard Forms

**DIVISION 02 - SITE CONSTRUCTION (NOT USED)**

**DIVISION 03 – CONCRETE (NOT USED)**

**DIVISION 04 – MASONRY (NOT USED)**

**DIVISION 05 – METALS**

05999 - Welding

**DIVISION 06 - WOOD AND PLASTICS (NOT USED)**

**DIVISION 07 - THERMAL AND MOISTURE PROTECTION (NOT USED)**

**DIVISION 08 - DOORS AND WINDOWS (NOT USED)**

**DIVISION 09 – FINISHES (NOT USED)**

**DIVISION 10 – SPECIALTIES (NOT USED)**

**DIVISION 11 – EQUIPMENT (NOT USED)**

**DIVISION 12 – FURNISHINGS (NOT USED)**

**DIVISION 13 - SPECIAL CONSTRUCTION (NOT USED)**

**DIVISION 14 – CONVEYING SYSTEMS (NOT USED)**

**DIVISION 15 – MECHANICAL**

15010 – Basic Mechanical Requirements  
15050 – Basic Mechanical Materials and Methods  
15072 – Mechanical Removals and Demolition  
15135 – Gauges and Meters  
15140 – Supports and Anchors  
15190 – Mechanical Identification  
15260 – Piping Insulation  
15510 – Hydronic Piping  
15515 – Hydronic Specialties  
15952 – Controls and Instrumentation  
15953 – Building Automation System (Krueter)  
15954 – Building Automation System (Honeywell)  
15955 – Building Automation System (Honeywell EBI)  
15980 – Instrumentation and Control Elements  
15985 – Sequence of Operation  
15990 – Testing Adjusting and Balancing

**DIVISION 16 – ELECTRICAL**

16010 – Basic Electrical Requirements  
16015 – Electrical Demolition  
16110 – Raceways and Fittings  
16120 – Wires and Cables  
16142 – Electrical Connections for Equipment

## 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, testing and incidentals for the construction of the Work indicated in the contract documents including lump sum items and unit price items.
- B. The Work in this Contract may impact operations of Denver International Airport. The Contractor shall bid, plan and execute the Work so as to minimize disruption of operations and inconvenience to the airport operations, airport tenants and public.
1. The contractor shall anticipate that the heating systems shall not be allowed to be taken out of service during the heating season of September 15 through May 15. Similarly, the contractor shall anticipate that the cooling systems shall not be allowed to be taken out of service during the cooling season of May 15 through September 15.
  2. For all other months, the contractor shall obtain permission from the DIA Project Manager prior to taking any system out of service. The DIA Project Manager at any time may require that the contractor put a system back into limited operation depending on weather conditions.
  3. All system outages are to be coordinated with and approved by the DIA Project Manager two weeks in advance of the contractor performing work on a particular system.
  4. Within the restrictions outlined above, the contractor will be allowed to install new control valves in the piping that serves Air Handling Units (AHUs) that are fed from a common pump while the pump is being removed. However, the work on a pump and associated units shall not commence until all necessary pipe, fittings, valves and accessories are on the site.
  5. The contractor is responsible for providing temporary cooling to spaces identified as being served by computer room units in contract documents while the units are out of service for the addition of new control valves and pump removals.
- C. The Work specified in this contract generally consists of but is not limited to the following items:
1. Before any construction can commence on a system (heating or cooling) and during a time that the associated system is operation, a test shall be run on each AHU and fan coil that is to receive a new control valve. The test will provide the current performance of the unit. Minimum data to be obtained shall include coil inlet and outlet air and water temperatures with corresponding outdoor air temperature.
  2. Removal of Building Secondary Pumps located in Concourses A, B and C, the North

Terminal, the Airport Operations Building and the Terminal. Units shall be replaced with a spool piece to provide for continuation of flow to the Air Handling Units.

3. Removal and replacement of chilled water and heating water Air Handling Unit Control Valves located in Concourses A, B and C, the North Terminal, the Airport Operations Building and the Terminal
4. Modifying the control system to allow for electronic control of the new control valves in lieu of the existing pneumatic system.

## 1.02 WORK BY OTHERS

- A. The Contractor is hereby notified that there may be other construction activities now and in the future within the project areas and adjacent to the worksites throughout the duration of this contract. The Contractor is responsible for keeping apprised of other projects and worksites and how they may affect the work.
- B. The Contractor shall maintain contact with the City and with other contractors to schedule work to minimize the effect of such construction activities on other site activities. The Contractor shall also maintain, at the direction of the Project Manager, contact with tenants to ensure minimal disruption to tenant operations.

## 1.03 FUTURE WORK

- A. A. The Contractor is hereby notified that there may be other future construction activities within the project and adjacent to the worksites that are scheduled after completion of this contract. It is the Contractor's responsibility to keep apprised of such projects and how they may affect the Work.

## 1.04 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 Work Request bid, 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.

## **PART 2 - PRODUCTS (NOT USED)**

## **PART 3 - EXECUTION**

### **3.01 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.

### **3.02 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.

### **3.03 CONTRACTOR USE OF WORKSITE**

- A. Confine worksite operations to areas permitted by law, ordinances, permits and the contract.
- B. 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 equipment on worksite.

- C. 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.
- D. Protect products, equipment and materials stored on worksite.
- E. Relocate stored products, equipment and materials which interfere with operations of City, government bodies, public and private utilities, and other contractors.

#### **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 including any and all necessary relocations requested by the City. The cost of the work described in this section shall be included in the applicable multiplier or bid items contract price.

**END OF SECTION 01010**



## SECTION 01014

### WORK SEQUENCE AND CONSTRAINTS

#### PART 1 - GENERAL

##### 1.01 OTHER WORK

- A. Other concurrent construction contracts with which the Contractor must interface are described elsewhere in the Contract Documents. Refer to Technical Specifications Section 01310 and the Special Conditions for specific work constraints and milestones.

##### 1.02 WORK SEQUENCE

- A. The work sequence shall be in compliance with Phasing, Sequencing and Milestones as indicated in the Contract Documents and in accordance with the approved Construction Schedule developed by the Contractor. The schedule shall be in compliance with requirements indicated in the Special Conditions and Technical Specifications Section 01014 Work Sequence and Constraints. The Construction Schedule is described in Technical Specifications Section 01310 Schedule.

##### 1.03 WORK CONSTRAINTS

###### A. Site Constraints

1. Access to the project shall be generally as indicated in the Contract Documents. Access shall be organized and planned by the Contractor to ensure no disruption of airline or DIA operations.
2. Access to work sites will be strictly monitored and must comply with DIA Airport Operations and FAA Regulations. The Contractor shall provide monitoring and escorts as required by DIA Operations in the area of the work.
3. The Contractor's staging area will be as indicated in the Construction Documents.
4. Contractor employee parking will not be allowed within the existing revenue control system. To access the Terminal building, Contractor employees may use the DIA Landside Employee Parking Lot located on 78th Avenue at a cost of \$30.00 per month per employee. A free DIA shuttle to the Terminal is available from this Lot. Material for work in the Terminal may be brought in through the Terminal Loading Dock accessed via Gate 1. Employee and material access to the Concourses will be via Gate 5.
5. The Contractor shall use the haul routes specified in the plans.
6. If required, the Contractor shall provide a bus and driver to transport the Contractor's employees between the designated employee parking area and the work sites. No separate payment will be made for this bus and driver. The cost shall be included in the bid item "Mobilization". The bus driver shall be provided at all times when Contractor employees are working on the project.

###### B. System Interruptions

1. The Contractor shall submit on approved forms through the Project Manager to DIA Maintenance Control any written requests for system interruptions such as fire alarm,

HVAC, electrical, water systems or other systems. System interruptions shall not be considered if the interruptions interfere with airport operations or tenant operations. Interruptions or system shut down shall be limited to between the hours of 11:00 p.m. and 5:30 a.m. Baggage system shutdown shall be limited to between the hours of 10:00 p.m. and 4:00 a.m. and in accordance with Technical Specifications Section 01014, paragraph 1.03.F. Roadway shutdown times are to be coordinated with Airport Operations and the DIA Project Manager prior to submitting a request for approval to shutdown a roadway.

2. The request forms shall be submitted only during the normal work week (Monday through Friday) between 8:00 a.m. and 4:00 p.m.
3. Upon approval of a system shutdown, the Contractor representatives and the individuals performing the work shall remain at the worksite and shall remain in contact with Maintenance Control until such time as the system is restored to working condition. The requesting party shall assume liability for the system until the system is restored to proper working order.
4. Fire Systems, HVAC, and Plumbing: Submit requests two working days prior to the time of requested interruption.
5. Electrical System Interruptions: Submit requests five working days prior to the time of requested interruption.

C. Airfield Operations at Denver International Airport

1. Full airport and aircraft operations are underway adjacent to this project. Contractors are required to obtain a Contractor Participant Manual from the Security Manager and must follow the guidelines in the manual. Copies of the Contractor section of the manual are available for review at the Denver International Airport Access Services Office.
  - a. If any Work contains requirements for Work activities or access through or in the restricted area, reference Technical Specifications Section 01015 and 01016 for requirements.
  - b. If not in a restricted area, the Contractor personnel still must be badged; reference Technical Specifications Section 01015.

D. CONDUCT OF PERSONS USING THE DENVER MUNICIPAL AIRPORT SYSTEM

1. Contractor activities shall comply with Airport Operations and Regulation 130 TRAFFIC and 20 CONDUCT OF PERSONS USING THE DENVER MUNICIPAL AIRPORT SYSTEM shall be followed. These regulations are available from Airport Operations at Denver International Airport.

E. OPERATIONAL SAFETY ON AIRPORTS DURING CONSTRUCTION

1. All work shall be accomplished in accordance with FAA Advisory Circular AC150/5370-2C, "Operational Safety on Airports During Construction", FAR Part 139 and FAR Part 107 except as herein modified.

F. BAGGAGE SYSTEM SHUTDOWN AND LOCKOUT: Prior to and during work in any area that requires access adjacent to, under, or above baggage systems, the Contractor shall coordinate with baggage system representatives of United Airlines and DIA:

1. Work in these areas shall be limited to between the hours of 10:00 p.m. and 4:00 a.m. The Contractor shall schedule and plan activities within these areas during the

shutdown to ensure removal of personnel and equipment within the time frame as indicated in this Technical Specifications Section. The Contractor shall not have access to the work areas requiring shutdown and lockout during a limited number of selected days. The Contractor shall coordinate with the Project Manager and United Airlines representatives to develop detail scheduling on a day-to-day basis.

2. Scheduling for Shutdown and Lockout: The Contractor shall maintain an on-going one week look-ahead schedule of shutdown/lockout requests including areas identified on plan diagrams. This look-ahead schedule shall be provided daily to the Project Manager and United Airlines representative.
3. Sequence of Shutdown and Lockout
  - a. 10:00 p.m. Shutdown and Lockout. Prior to 10:00 p.m., the Contractor's Superintendent and the Contractor's Safety Representative shall meet with United Airlines baggage system representatives and DIA representatives to review the areas or zones to be inactivated to allow the Contractor to proceed with work.
    - 1) Baggage Mechanical Systems Lockout. United Airlines representatives in conjunction with the Contractor representatives shall install barriers provided by United Airlines on baggage system tracks to isolate the zone of the Contractor's work. The barriers are to ensure no baggage system cart intrusion into the area. Protection of equipment and other barriers are to be provided by the Contractor.
    - 2) Baggage Electrical Systems Lockout. A representative from United Airlines, in conjunction with Contractor representatives, shall place locks on power cabinets supporting baggage equipment for the identified contractor work zone. Each party shall provide a lock.
    - 3) The Contractor may begin work in baggage system zones after the Contractor's Safety Representative has confirmed lockdown and lockout have been completed. The Contractor shall begin work by first providing covers and protection of baggage system and building systems to preclude damage during the Contractor activities. DIA and/or United Airlines representatives prior to the Contractor beginning work shall review all protection systems for acceptance.
  - b. System Activation: The system shall be activated at 4:00 a.m. Before 4:00 a.m. the Contractor shall begin clearance and removal of equipment, materials, barriers, and personnel in areas and envelopes of the baggage system. The Contractor shall take all steps to ensure that all baggage systems envelopes are clear of personnel, protective coverings, and equipment prior to 4:00 a.m. The Contractor's safety representative shall contact the United Airlines representative and shall inspect areas of work to ensure removal by the Contractor of all personnel, materials and equipment between 3:30 a.m. and 4:00 a.m. At 4:00 a.m. the baggage system will be activated. After this time until the next shift (10:00 p.m.), Contractor personnel or equipment shall not be mobilized in the area of the baggage system (generally in the envelope above 8'0" in the basements).

G. Welding Equipment, Procedures and Constraints

1. Natural gas-powered portable welders or "Powcon Inverter" welders are the only acceptable welding equipment to be used inside of building basement or tunnel areas. Acceptability of equipment other than the equipment noted above shall be at the sole discretion of the Project Manager. If the Contractor proposes other types of inverter welding equipment, testing of equipment for harmonics by the Contractor must be completed prior to the request by the Contractor for use of the equipment.

2. Welding activities inside buildings require submittal of a System Interruption Request (See paragraph 1.03.B of this Specifications Section). Prior to welding in any area, the Contractor shall locate smoke detectors and shall request interruption of the fire alarm system. Subsequent to the interruption of the fire alarm system and prior to welding activities, the Contractor shall cover and protect smoke detectors until work is complete. Prior to expiration of each interruption of the system, the Contractor shall uncover the smoke detectors.
3. Electrical Service: The Contractor shall be responsible for verifying with the DIA Project Manager or representatives locations acceptable for accessing electrical power for welders and other electrical equipment feeders. The Contractor shall be responsible for all work and equipment required to install temporary or permanent electrical modifications for construction power and lighting.
  - a. Temporary Hook-up: Pigtails wired into electrical panels - temporary only: Permanent installation shall require conduit, labeling, and all requirements of Division 16 Technical Specifications. Comply with the following:
    - 1) Provide 20 amp, 3 pole plugs.
    - 2) Wire shall be (4) #10 copper
    - 3) 480V, 3 phase, 3 pole, 4 wire twist lock ground line
    - 4) NEMA L16-20 or ANSI C73.87
  - b. The Contractor may not begin operation of the equipment prior to request for inspection by DIA representatives and acceptance of the installation.
4. Welding Practices: All standard safe welding practices must be followed, including but not limited to the following:
  - 1) Flash protection for surrounding areas
  - 2) Contractor fire extinguisher in area
  - 3) One person in each welding area solely designated as fire watch for each welder
  - 4) Protect all equipment, cable trays and contents, etc. in area
  - 5) Use fire blankets and other appropriate materials to confine sparks and molten metal from the welding, cutting, and/or grinding activities.
  - 6) All welders shall have been qualified through welding tests in accordance with applicable welding code, such as but not limited to AWS, ASME, API, within one year prior to welding taking place. Evidence of qualification shall be through Welding Performance Qualification Records (WPQR).
  - 7) All welder qualifications test shall be or shall have been administered and witnessed by an Independent Testing Agency (ITA), AWS Certified Welding Inspector (CWI).
  - 8) If re-certification of welders is required, delay costs and retesting costs shall be borne by the Contractor.
5. Grounding: Review with DIA representative's area of work prior to beginning work to ensure ground procedures do not induce undesirable charges in steel building system or other systems. This review should take place subsequent to the pre-work meeting. Do not ground to adjacent building systems, baggage system, hangers, or devices that support mechanical or electrical equipment.

#### H. Cleaning Equipment and Spoils

1. Discharge of water, liquids, or chemicals into the building waste, drain systems or storm drainage systems is prohibited. The Contractor shall comply with all Federal, State, and Local requirements for disposal of chemicals. The Contractor shall maintain and service in work areas containers for discharge of water from cleaning of any

construction equipment or removal of water from excavations.

- I. Vehicle Permitting for Tunnel and Basement Use
  - 1. Electric carts require permitting. The Contractor shall provide at least one electric cart for Contractor use during the work in the tunnel and basements of the buildings. Only CNG powered trucks are allowed in the tunnel and basements of the buildings. CNG/gasoline trucks may be used and shall not be parked overnight or for long terms within the tunnel or basements. All vehicles require permitting. Permits may be acquired at the DIA Airport Security Office for a fee of \$5.00 each (non refundable) with a \$100.00 deposit (refundable at project completion).
- J. Radio and Cell Phone Use
  - 1. The Contractor shall have in place prior to initiation of work in the tunnel or basements communications equipment either by use of cell phone and or radio. Cell phone use is limited to “line of sight” communication. Radio equipment shall be submitted to DIA for approval of use at least 14 days prior to intended use. Radio equipment frequencies shall be submitted. Frequencies shall be subject to DIA approval.
- K. Keys
  - 1. The Contractor shall be required to contact DIA Maintenance Control to procure keys for access to all rooms having locks in order to gain access. Keys may be checked out at the beginning of each work shift by the Contractor and shall be returned to DIA Maintenance Control at the end of each work shift.

#### 1.04 COORDINATION

- A. The Contractor will designate a contact person for coordination with the Project Manager and airline tenants. The contact person shall have the authority to make decisions for the Contractor firm and shall have binding signatory power for changes in work. The contact person shall be on site at all times during work activity.
- B. No additional costs shall be considered for coordination activities throughout this project. The Contractor shall include in his bid costs for coordination of all activities.

#### 1.05 LATE COMPLETION

- A. The Contractor will notify the City as soon as possible, but in no case not less than four weeks in advance, of the inability to meet any of the constraints or milestones. Notification shall be consistent with the requirements of Article 5, General Conditions.

### PART 2 - PRODUCTS (NOT USED)

### PART 3 - EXECUTION

#### 3.01 DUST/PROTECTION BARRIERS

- A. Prior to any demolition the Contractor shall construct area containment doors and dust barriers at five feet outside the limits of demolition of the wall and as directed by the DIA Project Manager. Dust barrier at wall demolition shall be constructed of metal studs with ½”

painted gyp board from floor to ceiling. At a minimum, any space containing electrical or telecommunications equipment will require dust barriers for the entire space during demolition and construction. Contractor shall install all required modifications to exit/egress signage until temporary barriers are removed. Contractor shall coordinate location of partition with Fire Sprinkler Contractor to ensure adequate sprinkler coverage during construction. Temporary barriers shall be removed only after completion of the work scope within the areas including final punch list activities. Areas between ceilings and structure above shall be contained to prevent migration of any dust into adjacent areas.

- B. HVAC system containment. The Contractor shall submit to DIA Maintenance HVAC and Fire Alarm shut down requests prior to modifications to the area of work for dust containment. The HVAC system shall be interrupted, re-routed, or blocked off to prevent dust from entering return or supply ducts.
- C. Debris and Protection Barriers: The Contractor shall construct code-approved and DIA-approved dust and debris barriers on both sides of walls and doors that are to be modified. Barriers shall be constructed to allow emergency ingress and egress to and from equipment and spaces. Barriers shall be constructed to allow continual uninterrupted function of building equipment and spaces.
  - 1. Return all removed door hardware to DIA. Label each hardware set correlating the door number of the original hardware set. Coordinate with the DIA Project Manager representatives for storage and return of hardware.

### **3.02 EQUIPMENT**

- A. Equipment: CNG-powered equipment is allowed within the buildings. No other fossil fuel equipment may be used within the buildings unless the equipment is directly vented to the building exterior.
- B. Electric: Electric powered equipment is acceptable in the Work area.

### **PART 4 -**

### **PART 5 - MEASUREMENT**

#### **5.01 METHOD OF MEASUREMENT**

- A. No separate measurement shall be made for work under this Section.

### **PART 6 - PAYMENT**

#### **6.01 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 applicable unit price item, work order or lump sum bid item.

**END OF SECTION 01014**

## SECTION 01015

### SECURITY REQUIREMENTS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. Badges and Permits: DIA requires personnel badging and vehicle permitting administered by the Denver International Airport Security Office. The Contractor shall be required to obtain the proper access authorizations for badges and permits, and the Contractor shall immediately report the presence of unauthorized (unbadged) persons or unauthorized (no permit) vehicles on site to the DIA Project Manager.
- B. Fences: If required, the Contractor shall establish and maintain a secure (fenced) perimeter at its primary operations area to include its field offices, staging and storage areas, and maintenance facilities. The responsibility for security within its operations area shall rest solely with the Contractor. Entrance gates to operations areas shall be equipped with a combination of locks to include a lock provided by the City for its use in accessing emergency equipment, should that need arise. The location, size and other physical characteristics of the Contractor's operations area must be approved by the City prior to its installation.
  - 1. Unless specifically required by the Contract Documents and with the exception of the fenced operations area described above, the Contractor shall install no fences or other physical obstructions on or around the project work area without the written approval of the City.
- C. Trash Dumpsters: To provide maximum security will all construction projects in public areas, all trash dumpsters must have the ability to be covered and locked when not in use.

##### 1.02 VENDORS AND SUPPLIERS

- A. The Contractor shall escort ON A FULL TIME BASIS all unbadged vendors and suppliers requiring access to the restricted areas. Only those vendors and suppliers providing materials and/or supplies shall be allowed on site.

##### 1.03 CONTRACTOR PARTICIPANT MANUAL

- A. Contractors are required to obtain a Contractor Participant Manual from the Airport Security Office and must follow the guidelines in the manual. The Airport Security Plan will be issued after receipt of a \$250.00 refundable deposit. Copies of the Contractor section of the manual are available for review at the Denver International Airport Maintenance and Engineering Office. The Contractor shall comply with DIA policies and TSA regulations.
  - 1. Airport Operations Regulations Part 130 MOVEMENT OF VEHICLES IN RESTRICTED AREAS and Part 20 SECURITY shall be followed. These regulations are available from Airport Operations at Denver International Airport.
  - 2. All work shall be accomplished in accordance with FAA Advisory Circular AC150/5370-2E, "Operational Safety on Airports During Construction", 49 CFR Part 1542 and 14 CFR Part 139 except as modified herein.
  - 3. The following paragraphs supplement, modify, change, delete from or add to FAA



AC150/5370-2E. Where any paragraph, subparagraph or clause of the Advisory Circular is modified or deleted by these supplements, the unaltered provisions of that paragraph, subparagraph or clause shall remain in effect.

4. The Transportation Security Administration requires that all operating airports be secured from the general public and has the authority to issue citations for violations of these requirements. It is the responsibility of the Airport to ensure all fences and gates are secure. If a Contractor's operations necessitate the frequent use of a particular gate, the Contractor shall place a guard at the gate who shall have been trained and certified by Airport Operations to facilitate access to its work. The Contractor assumes full responsibility for maintaining security once this is done. Any fines levied against the Airport as a result of the failure by the Contractor to provide adequate security shall be passed on to the Contractor. A more detailed explanation of security requirements may be found in the Contractor Participant Manual.
5. Contractors will be required at all times to have a supervisor or foreman at each work location in both restricted and non-restricted areas.

B. Access to Restricted Area via Vehicles

1. The Contractor shall obtain access to the restricted area via vehicle only when the vehicle displays a Vehicle Permit issued by Airport Security (refer to Technical Specifications Section 01016) and the driver has an Airport ID badge with a driver authorization.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION**

**3.01 SUBMITTAL FOR BADGES**

- A. Airport identification badges and driver authorization permits shall not be issued prior to Notice to Proceed. The Contractor may at his own risk submit the required information to DIA Maintenance and Engineering Division and to DIA Airport Security prior to Notice to Proceed in order to expedite the badging and permitting process.
- B. By submitting information for personnel badges, the Contractor certifies that the personnel have no disqualifying felony convictions, as defined by Federal Regulations, the employees have valid Colorado driver licenses, and the employees have not previously been required to surrender their badges due to any violations.
- C. Airport ID Badges are obtained as follows:
  1. The Contractor shall designate an Authorizing Agent who is a full time employee of the Contractor and who shall be authorized to sign for the Contractor on all Airport Security applications and forms.
  2. The Contractor shall meet with the DIA Project Manager to review the procedures and required access points at DIA. The Contractor and the Project Manager shall visit the site to verify the access points. Access points shall be listed and submitted by the Contractor to the Project Manager for review and comment prior to Contractor's application for badging.
  3. The Contractor's Authorizing Agent shall schedule a Participant Meeting with the DIA Airport Security Office to review DIA security procedures. A second meeting will be

scheduled for the Authorizing Agent to learn how to successfully complete the required forms for employee badges and vehicle permits.

4. A Criminal History Record Check and Security Threat Assessment (STA) are required for each employee requesting unescorted access to the restricted areas. The employee will complete the Airport Security Badging and Fingerprinting Form (two-sided form) and schedule an appointment with the Airport Security Office to have the form reviewed and to be fingerprinted. The Federal Bureau of Investigation will conduct the Criminal History Records Check and will return the results to the Airport Security Office. (Usually within 3 to 30 business days) The cost of the Criminal History Records Check is \$40.00.
5. When notified by Airport Security that the Criminal History Records Check is completed and cleared, the Contractor shall call to schedule an appointment for employees to come to the Airport Security Office to receive security and driver training. The appointment will take approximately one hour for security training and approximately two hours for security and driver training.
6. All employees will see an interactive security film and must pass a test when they come in for their Airport ID badge appointment. All employees driving on the airfield must also view an interactive driving film and take a second test in addition to receiving airfield driver familiarization training by the Contractor's driver trainer before being allowed to drive on the airfield. Driver familiarization training records must be completed and maintained by the company's authorizing agent.
7. A State Background Check, Identity Verification and Security Threat Assessment (STA) are required for each employee requesting access to the restricted areas. The employee will complete the Airport Security Badging Application along with a residency disclosure and submit the forms to the Airport Security Office to have the background and identity verification conducted. Airport Security will return the results to the Authorizing Agent
8. **ALL EMPLOYEES ARE REQUIRED TO HAVE EITHER A YELLOW CONTRACTOR BADGE OR GREEN CONTRACTOR ESCORT BADGE.** The Contractor is advised that there is a \$200.00 deposit due for each Airport ID issued for unescorted access (Yellow Contractor badge) in addition to the \$10.00 badge fee. The deposit is refundable but not transferable. The fee for each Airport ID issued for escorted access (Green Contractor Escort badge) is also \$10.00 but there is no deposit required. Rebadging fee for both types of badges is \$10.00.
9. The Airport ID badges must be returned to the Airport Security Office prior to final payment. All Airport ID badges are issued with the expiration date of the project on the badge. Contractors shall notify the Project Manager as soon as possible but in no case less than four weeks in advance of any requirement to extend the duration of badge validations.
10. Total fees for startup:
  - \$250 Airport Security Plan Deposit
  - \$ 40 Criminal History Records Check (per employee) for Unescorted access.
  - \$ 10.00 Colorado State Background & ID Check (per employee) for Escorted access, \$20 per additional state.
  - \$ 10.00 Badge (per employee)
  - \$200.0 Refundable badge deposit (per employee) for unescorted access badge.
  - 0

### 3.02 DUMPSTERS

- A. Security Requirements: The following procedures must be followed to provide maximum security with all construction projects in public areas:
1. Roll-off dumpsters must have the ability to be covered (hard side) and locked when not in use.
  2. When unlocked and in use, the Contractor shall provide an employee, or a subcontractor's employee, to stand by the dumpster to prevent unauthorized placement of prohibited items.
  3. If the Contractor is not able to have a roll-off dumpster with the ability to be locked, the dumpster shall be removed from the public area when the construction site is inactive.

#### **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 applicable unit price item, work order or lump sum bid item.

**END OF SECTION 01015**

## SECTION 01016

### VEHICLE AND EQUIPMENT PERMITTING

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. The Contractor shall comply with the Airport Security Plan. Vehicle permits are required for all vehicles operating in the restricted area. Two types of permits are required. The DIA vehicle permit is required for vehicles operating in the restricted area but limited to above grade, outdoor activity. Vehicles or machinery operating within buildings shall be required to acquire a DIA emissions permit as well as a DIA vehicle permit.
- B. Contractors performing work in or through restricted areas are required to obtain a Contractor Participant Manual from the Security Manager and must follow the guidelines in the manual. Copies of the Contractor section of the manual are available for review at the Denver International Airport Operations Office. Contractors shall comply with the DIA Rules and Regulations.
1. Airport Operations Regulations **130 TRAFFIC** and **20 CONDUCT OF PERSONS USING THE DENVER MUNICIPAL AIRPORT SYSTEM** shall be followed. These regulations are available from Airport Operations at Denver International Airport.
  2. All work shall be accomplished in accordance with FAA Advisory Circular AC150/5370-2C, "Operational Safety on Airports During Construction", 49 CFR Part 1542 and 14 CFR Part 139, except as herein modified.
  3. The following paragraphs supplement, modify, change, delete from or add to FAA AC150/5370-2C. Where any paragraph, subparagraph or clause of the AC is modified or deleted by these supplements, the unaltered provisions of that paragraph, subparagraph or clause shall remain in effect.
  4. Special care shall be exercised by the Contractor when operating within clear zones, under approach and departure zones of runways and in the apron area. The clearance zones shall be considered as extending to a distance of 750 feet laterally from the centerline of runways and to a distance of 193 feet laterally from the centerline of taxiways. Where these zones overlap, the greater distance shall apply. Vertical clearance in the approach and departure zones shall be considered as starting at grade 200 feet beyond the ends of runways and rising at the rate of 50 feet horizontal to one foot vertical.
  5. When Work under this contract will take place in the areas listed above, the Contractor must have a radio for communications with Airport Operations. The radio will be assigned after receipt of a \$2,000 deposit. The radio must be with personnel performing work in the airfield operations areas.
  6. Access to the runways, taxiways and aprons shall be gained by the Contractor after establishing radio communications with Airport Operations. No personnel or equipment will be allowed on the runways until radio contact has been made with Airport Operations and permission given.
  7. Access to airport operations areas will be limited in order to allow the maximum efficient movement of aircraft. As part of this limitation the Contractor may be required to only use these areas late at night when there is less aircraft traffic.

8. Once admitted into the restricted area, the Contractor shall proceed directly to the Work location by way of a route assigned by Airport Security. At no time shall a Contractor or any of its personnel enter onto a taxiway, runway or ramp without proper clearance from the Airport Operations Manager or Assistant Airport Operations Manager. Contractors or individuals violating these requirements for driving in the restricted area may be subject to fines, suspension or permanent revocation of the Airport ID badge and driver authorization.
  9. The Transportation Security Administration requires that all operating airports be secured from the general public and has the authority to issue citations for violations of these requirements. It is the responsibility of the Airport to ensure all fences and gates are secure. If a Contractor's operations necessitate the frequent use of a particular gate, the Contractor shall place a guard at the gate, who shall be trained and certified by the Airport Operations, to facilitate access to its work. The Contractor assumes full responsibility for maintaining security once this is done. Any fines levied against the Airport as a result of the failure by the Contractor to provide adequate security shall be passed on to the Contractor. A more detailed explanation of security requirements is in the Contractor Participant Manual which is available from Airport Operations.
  10. Cranes and Construction Equipment: The Contractor shall provide the necessary drawings and specifications to indicate all information needed by the FAA and the City including but not limited to location of construction activities and height of objects including cranes, construction equipment and vehicles. Drawings shall be scaleable site plans indicating northing and eastings of proposed equipment locations, air space northing and eastings of activity and elevations of equipment based on DIA datum. Specifications shall include standard sheets on equipment specifications and any non-standard modifications to the equipment.
  11. The above information shall be submitted to the Project Manager for approval five days prior to mobilization. Changes to information submitted shall be re-submitted for approval at least five days prior to mobilization of any change.
  12. If required by DIA, standard DIA-approved warning lights and flagging will be required on any temporary equipment or structures.
  13. Lighting of the work area is subject to approval by DIA Operations and DIA Planning and Development. The Contractor shall include in item (10) above information on any site lighting proposed by the Contractor. The locations, heights and types of luminaries shall be submitted. The Contractor shall conduct his activities, especially lighting, so as not to interfere with Airport and FAA operations.
- C. General safety regulations when in aircraft operations areas may include the following:
1. At all times, the Contractor shall coordinate its work with the requirements of the Airport site and operations. All work, movement of men, materials, supplies and equipment in areas used by aircraft shall be subject to regulations and restrictions established by the City. The Contractor shall take special precautions and be fully responsible for the prevention of damage to materials and equipment in the areas affected by the jet blast of taxiing aircraft. No work shall proceed until necessary protective devices are placed as required to protect the public, airport operations, property and personnel from the hazards of the Work. The Contractor shall proceed with his work, including temporary work and storage of tools, machinery and materials, to cause no interference with or hazards to the operation of the Airport.
  2. Landings, takeoffs and taxiing shall take precedence over all Contractor's operations. In the event that the Contractor is notified that an emergency landing or a takeoff is

imminent, the Contractor shall stop all operations immediately, regardless of the sequence of events in progress and shall immediately evacuate his personnel and equipment from the runway and taxiway areas as directed.

3. The Contractor shall remove its personnel and equipment to the distance specified below for the prevailing conditions:
  - a. For emergencies the Contractor shall move all personnel and equipment as directed by Airport Operations or the Project Manager.
  - b. At the end of a work day in areas where aircraft are operating, all equipment shall be moved to a location that is not less than 750 lineal feet measured from the near edge of the runway, taxiway or ramp area or to the location designated by the City.
4. If the Contractor is asked to leave part of its worksite to allow aircraft operation, the Contractor shall clean the area to allow safe aircraft movement. Cleaning may include sweeping the area to prevent damage to aircraft.

D. Vehicle Permitting

1. Vehicle permits are limited to those vehicles and or equipment required for completion of the work. Employee vehicles will not be issued permits. Employee parking is addressed in Technical Specification Section 01014 or as indicated in the Contract Documents. No Contractor employee parking will be acceptable in the Restricted Area.
2. The Contractor shall obtain access to the restricted area only when the vehicle displays a Contractor permit and the driver has an Airport ID badge with a driver authorization. Vehicle permits may be obtained as follows:
  - a. Contractor vehicle permits cost \$105.00 dollars, of which \$100.00 dollars is a deposit refunded at completion of work and after the permit is returned to Airport Security. Vehicle permits must be surrendered before final payment will be made for work accomplished. A Vehicle Permit Application must be filled out and approved by the Project Manager prior to the issuance of the permit. The Contractor's Security Coordinator must file a sponsorship form with DIA Access Services and accompany any subcontractor requesting a vehicle permit. The approved vehicle application must be presented at Airport Security to obtain the vehicle permit.
  - b. All vehicles that are not permitted by Airport Operations to drive in the restricted area are required to be escorted. All vehicles that are escorted must have a minimum of \$1,000,000.00 combined single limit coverage with a 30 day notice of cancellation to Airport Operations. All unescorted vehicles must have \$10,000,000.00 combined single limit coverage with a 30-day notice of cancellation to Airport Operations prior to any permits being issued.
  - c. Contractor permits are issued with the expiration date of the project on the permit. A \$5 fee will be charged for a new permit that requires an extension of time.
  - d. The Contractor must have a four-inch letter company logo on each side of the vehicle, or the Contractor shall obtain an orange and white checkered flag. The cost of the flag is \$30.00, and may be obtained at Access Services. All vehicles operating in the restricted area must display the logo or the flag at all times. Contractors may use old flags in good condition.
  - e. The Contractor shall obtain a driver authorization for all operators of vehicles in the restricted area. Reference Technical Specifications Section 01015.
  - f. Contractors will be required to have a supervisor or foreman at each work location at all times.

E. Equipment Permitting

1. Fossil fuel powered equipment to be used in the interior of buildings and/or in basement/tunnel areas shall require inspection by DIA Maintenance and the Denver Fire Department. **Only CNG fossil fuel powered equipment may be used; gasoline powered, propane powered, or diesel powered equipment will not be acceptable unless identified and operated per Specifications Section 01014.**

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION**

**3.01 PERMITS**

- A. Vehicle permits shall not be issued prior to Notice to Proceed. The Contractor may, at his own risk, submit required information prior to Notice to Proceed to the following:
1. Vehicle permit: DIA Engineering Group or DIA Airport Security
  2. Equipment and vehicle emissions permit: DIA Engineering or DIA Maintenance Group.

**3.02 SCHEDULE**

- A. The Contractor shall allow in his schedule five days for DIA review of submittals for permits. Testing of equipment and review by the Denver Fire Department shall be scheduled by the Contractor. By submitting information for permits, the Contractor certifies that equipment and vehicles comply with all city, state and federal regulations including but not limited to emissions, licensing and safety 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. 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 applicable unit price item, work order or lump sum bid item. All permits shall be returned to the City prior to the Contractor submittal for Final Settlement, Termination, and/or upon written request from the Project Manager.

**END OF SECTION 01016**



**SECTION 01020**

**UTILITIES INTERFACE**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. Various utilities are located within the limits of work in the project area. The owners of these utilities hereinafter noted may require that the Contractor is to work around their existing facilities until such alterations, relocation or abandonment have been completed. All known existing utilities are shown; however, the Contractor shall verify and satisfy himself that there are no other existing utilities that may not be shown.
- B. The owners of known utilities within the project area and corresponding representatives are:
- |                                 |                   |              |
|---------------------------------|-------------------|--------------|
| Qwest Telephone                 | Margaret Zeiler   | 303-451-2682 |
| DIA Telephone                   | James Winston     | 303-342-2200 |
| Xcel Energy Natural Gas         | Dan Turner        | 303-375-3509 |
| Xcel Energy Electrical Services | Dan Turner        | 303-375-3509 |
| DIA Storm Water                 | Donald Smith      | 303-342-2200 |
| DIA Sanitary Sewer              | Donald Smith      | 303-342-2200 |
| Denver Water Department         | John Bambei       | 303-628-6669 |
| North American Resources        | Larry Lott        | 303-655-4412 |
| Fuel System (ASII)              | Gil Patron        | 303-342-3552 |
| Premise Wiring System           | Alberto Benavente | 303-342-2200 |
| FAA Duct Bank                   | Jim Martinez      | 303-342-1828 |
| Oil/Gas Wells                   | Ed Neibauer       | 303-659-9110 |
| DIA Electrical Department       | Pat Kelly/Tai Lai | 303-342-2800 |
| Fire Alarm System               | Pat Kelly/Tai Lai | 303-342-2800 |
| Paging System                   | Pat Kelly/Tai Lai | 303-342-2800 |
- C. The location and establishment of each construction vehicle crossing shall be at sites mutually agreed upon in writing by the Contractor and the owner of the utility.
- D. At the locations where the Contractor needs to establish a construction vehicle crossing over any of the operating pipelines, the furnishing and placing of a crossing shall be by the Contractor. The crossing shall allow the normal operation of the pipeline at all times. Each crossing shall be adequately marked and signed for safe passage of vehicles over the crossing. Construction vehicles shall not be allowed to cross over operating pipelines at any place other than an established crossing. The maximum size of any vehicle crossing operating pipelines at any location in the project area shall be limited to no larger than a Caterpillar D6 bulldozer unless noted otherwise.
- E. Coordinates for known utilities located within the project area may be available at the Denver International Airport Office. These utilities locations are based upon information provided by the utility companies or previous construction contractors that were the basis for determining utility coordinates. The City does not warrant their accuracy.
- F. The Contractor shall control his operations in order to avoid creating any obstacles for the utility owner's access for maintaining or operating their equipment.

## 1.02 REGULATORY REQUIREMENTS

- A. The Contractor shall obtain and pay for all utility company permits, fees, and licenses necessary for the execution of this work. The Contractor shall give all notices and shall comply with all laws, ordinances, rules and regulations of all authorities having jurisdiction.

## 1.03 QUALITY CONTROL

- A. When the Contractor performs any operations that will impact a utility owner, the Contractor will give timely notice to the utility owner and the DIA Project Manager so that the Contractor's operations may be observed by the utility owner's representative at the discretion of the utility owner's representative and the Project Manager's representative.

## 1.04 WORK INCLUDED

- A. The work of this section includes furnishing all materials, equipment and labor necessary to provide utility crossings as required and as specified herein and subject to approval by the associated utility owner.
- B. North American Resources requires a minimum of 12 feet of total cover over their pipelines at each crossing. This required cover is to extend a minimum distance of five feet perpendicular on both sides of the pipeline, then slope away from the pipeline at a slope determined by the Contractor as sufficient for his vehicles. The top 12 inches of the cover overall shall be Colorado Department of Highways Class 6 road base.
- C. FAA Underground Duct lines: The FAA has duct lines passing under the site. The Contractor shall contact the FAA prior to beginning earthwork operations to ascertain any special requirements or conditions required to maintain this service during construction activities.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Suitable cover material shall be in accordance with Colorado Department of Highways Standard Specifications. Wet, soft or frozen material, asphalt chunks, or other deleterious substances shall not be used for cover.
- B. Aggregate for road base material shall consist of clean, sound and durable particles of crushed stone, crushed gravel or crushed slag, shall be free from coatings of clay, silt and organic matter, and shall contain no clay balls. Material shall conform to the State of Colorado Standard Specifications for Road and Bridge Construction Class 6 aggregate base.
- C. The materials for the load distribution system on top of the cover shall conform to the specification of the American Institute of Steel Construction, the American Institute of Timber Construction, or the American Concrete Institute, as applicable, depending upon the system agreed upon between the Contractor and utility owner.
- D. Materials for the sleeving of the pipelines shall be purchased by the utility owner at the Contractor's expense.

## PART 3 - EXECUTION

### **3.01 NOTIFICATION OF UTILITIES FOR LOCATING AND POTHOLING**

- A. The Contractor shall verify the location of all utilities prior to any operations including physically uncovering the utility to verify location as required by the utility owner or the DIA Project Manager and shall be solely responsible for protection of the utilities during construction. Only manual labor shall be used within five feet of the suspected location of a utility to uncover it. The Contractor shall obtain written permission from each utility owner before constructing crossings or crossing pipelines in service, and provide the Project Manager with a copy of the permission 48 hours prior to commencement of crossing work.
- B. A minimum of three days notice by the Contractor shall be given to the utilities for locating and potholing their lines as needed.
- C. The Contractor shall notify the Utility Notification Center of Colorado (303) 534-6700 as a minimum for location of utilities.
- D. In the event that the Contractor needs to conduct Contractor's operations which will affect an operating utility, the Contractor shall be required to sign a "hold-harmless" agreement with the owner of the utility prior to the Contractor conducting any operations affecting the utility.

### **3.02 TRENCHING AND SLEEVING**

- A. All trenching, excavation, sleeving and shoring needed to cross over or under a utility shall be performed in the manner required by the party owning the utility and in such a manner as to ensure no dislocation of the existing utility. The method used to cross under the utility shall ensure it is fully supported at all times. The Contractor shall accurately locate and record the position of a utility being crossed as soon as it is uncovered and again prior to covering it and report to the Project Manager any change in location greater than 0.5 inch. The crossing shall be protected so that water or construction equipment will not dislocate or undermine unsupported sections of the utilities.

### **3.03 COVER AND COMPACTION**

- A. Backfilling of trenches or adding additional cover shall be conducted at all times in a manner that will prevent damage to the pipe. If the excavated material is not suitable for backfill and cover, as determined by the DIA Project Manager, unsuitable material shall be hauled away and disposed of properly. The owner of the utility will observe at all times the installation of the backfill and cover. Backfill and cover shall be the placement of suitable materials in horizontal, uniform layers and brought up uniformly on the sides and over the pipelines.
- B. The thickness of each layer of backfill shall not exceed eight inches before being compacted to 95 percent relative compaction per ASTM D-698 or to the density required by the utility owner and tested for density by the Contractor.

### **3.04 ROADBASE COMPACTION**

- A. If the required compacted depth of the road base exceeds eight inches, it shall be constructed in two or more layers of approximately equal thickness. The maximum compacted thickness of any layer shall not exceed eight inches before being compacted to 95 percent relative compaction per ASTM D-698 or to the density required by the utility owner.

### **3.05 REMOVAL**

- A. All temporary crossings shall be removed after completion of the work.

**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 applicable multiplier work request bid item.

**END OF SECTION 01020**

## SECTION 01025

### MEASUREMENT FOR PAYMENT

#### PART 1 - GENERAL

##### 1.01 SCOPE

- A. This Section covers the requirements for measurement of quantities for payment as they apply to this contract.
- B. Measurement methods specified in the individual sections of these specifications shall govern if they differ from methods specified in this Section.
- C. The Contractor will compute all final quantities subject to review and acceptance by the Project Manager. Where necessary, such computations will be based upon surveys performed by the Contractor as specified in Technical Specifications Section 01050.

##### 1.02 MEASUREMENT OF QUANTITIES

- A. Measurement Standards
  - 1. All work to be paid for at a contract price per unit of measurement will be measured by the Contractor in accordance with United States Standard Measures.
  - 2. Measurements are subject to check and review by the Project Manager: if errors are found the Contractor shall correct them. If, in the opinion of the Project Manager, the errors are significant or frequent enough, the Project Manager may make the measurements with his own forces at the Contractor's expense. No payment will be made on that portion of an item containing measurement or calculation errors until the errors are corrected to the satisfaction of the Project Manager.
- B. Measurement by Weight
  - 1. Items to be paid for by weight shall be measured by scale or by handbook weights for the type and quantity of material actually furnished and used. One ton shall consist of 2,000 pounds. Handbook weights will only be allowed if there is one-half of one percent or less difference between the handbook weight and the allowable deviation per manufacturer's specification of a material's finish weight.
  - 2. Material to be measured and paid for by weight shall be weighed on accurate, approved scales, furnished by and at the expense of the Contractor. Platform scales of sufficient size and capacity shall be used to permit the entire vehicle or combination of vehicles to rest on the scale platform while being weighed. Combination vehicles may be weighed as separate units provided they are disconnected while being weighed. All scales shall be inspected and certified as often as the Project Manager may deem necessary to ascertain accuracy. Costs incurred as a result of regulating, adjusting, testing, inspecting and certifying scales shall be borne by the Contractor.
    - a. Scales for weighing materials which are required to be proportioned or measured and paid for by weight shall be furnished, erected and maintained by the Contractor or be certified, permanently installed commercial scales.
    - b. Scales shall be accurate to within one-half of one percent of the correct weight throughout the range of use. The Contractor shall have the scales checked under

- the observation of the Project Manager before beginning work and at such other times as requested. The intervals shall be uniform in spacing throughout the graduated or marked length of the beam or dial and shall not exceed one-tenth of one percent of the nominal rated capacity of the scale, but not less than one pound. The use of spring balances will not be permitted.
- c. Beams, dials, platforms and other scale equipment shall be so arranged that the operator and the City's inspector can safely and conveniently view them.
  - d. Scale installations shall have suitable weights or devices available for testing the weighing equipment.
  - e. Scales must be tested for accuracy and serviced before use at a new site. Platform scales shall be installed and maintained with the platform level.
  - f. Scales "overweighing" (indicating more than correct weight) will not be permitted to operate and all materials received subsequent to the last previous correct weighing-accuracy test will be reduced by the percentage of error in excess of one-half of one percent.
  - g. In the event inspection reveals the scales have been "underweighing" (indicating less than correct weight), they shall be adjusted and no additional payment to the Contractor will be allowed for materials previously weighed and recorded.
3. The Project Manager may be present to witness the weighing and to check and compile the daily record of such scale weights; however, in any case, the Project Manager will require that the Contractor furnish weigh slips and daily summary weigh sheets. In such cases, a duplicate weigh slip or load slip for each vehicle weighed shall be furnished to the Project Manager at the point of delivery of the material.
- a. As a minimum, the weigh slips shall contain the following information:
    - 1) Contractor's name and contract number
    - 2) Supplier's name and location of material source
    - 3) Type of material
    - 4) Haul unit's unique identification number
    - 5) Empty weight (this should be checked three times per day)
    - 6) Full weight
    - 7) Weight of material hauled
    - 8) Scale operator's signature stating the weights are correct to within one percent of standard weights.
  - b. The loads shall be weighed prior to water being added.
4. If the material is shipped by rail, the certified car weights will be accepted provided that only actual weight of material will be paid for and not minimum car weight used for assessing freight tariff. Car weights will not be acceptable for material to be passed through mixing plants or material off loaded from rail cars and hauled to the jobsite by trucks from rail cars located off the worksite.
5. Trucks used to haul material being paid for by weight shall be weighed empty daily and at such additional times as the Project Manager may require. Each truck shall bear a plainly legible identification mark. The Project Manager may require the weight of the material verified by weighing empty and loaded trucks on such other scales as the he may designate.
6. When requested by the Contractor and approved by the Project Manager in writing, material specified to be measured by the cubic yard may be weighed and such weights will be converted to cubic yards for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the Project Manager and shall be agreed to by the Contractor before such method of measurement of pay quantities is used.

7. The Contractor shall comply with all legal load restrictions in the hauling of equipment or materials on public roads beyond the limits of the project. A special permit will not relieve the Contractor of liability for damage resulting from the moving of equipment or material.
- a. The operation of equipment or hauling loads that cause damage to structures, the roadway or any other construction will not be permitted. Hauling of materials over the base course or surface course under construction shall be limited by the Contractor to methods and equipment that will prevent damage to the pavement structure before the expiration of the curing periods. The Contractor shall be responsible for the repair of all damage and related expenses resulting from hauling equipment and construction operations.
  - b. If a vehicle's gross weight exceeds the legal limit, and the material transported by the vehicle is delivered to the project, the material and the scale ticket (certificate of correct weight) will not be accepted, except a 500 pounds tolerance will be allowed for overweight loads.
  - c. If a scale ticket from an overweight vehicle is inadvertently accepted and the material incorporated into the project, the Project Manager will adjust the price for the overweight load as follows:
    - 1) The pay item quantity represented by the amount of material in excess of the legal weight plus 500 pounds tolerance will not be paid for.
    - 2) A price reduction will be assessed for the overweight portion of the load based on the following schedule:

Overweight (pounds)	Price Reduction (dollars)
0 - 500	0
501 - 3,000	20
3,001 - 4,000	40
4,001 - 5,000	82
5,001 - 6,000	130
6,001 - 7,000	226
7,001 - 8,000	376
8,001 - 9,000	582
9,001 - 10,000	842
Over 10,000	870 plus \$164 for each 1,000 lbs., or fraction thereof, or 10,000 lbs.

8. Bituminous materials will be measured by the gallon or ton. Unless noted otherwise volume will be measured at 60 degrees Fahrenheit or will be corrected to the volume at 60 degrees Fahrenheit using ASTM D 1250 for asphalt or ASTM D 633 for tars. Net certified scale weights or weights based on certified volumes in the case of rail shipments will be used as a basis of measurement, subject to correction when bituminous material has been lost from the car or the distributor, wasted, or otherwise not incorporated in the work. When bituminous materials are shipped by truck or transport, net certified weights or volume subject to correction for loss or foaming will be used for computing quantities.

C. Measurement by Volumes

1. Measurement by in-place volume will be by the cubic dimension listed or indicated in the Schedule of Prices and Quantities. Volume measurements will be neat line as shown on contract documents, or if actual field measurements show that the volume is less than neat line, the actual volume will be used. Method of volume measurement



shall be by average end area method, with end areas taken at no greater than 100 feet apart or every major change in the cross section area, which ever occurs first, unless noted otherwise. The Contractor may request alternate methods subject to the approval of the Project Manager.

2. Material indicated to be measured by volume in the hauling vehicle shall be hauled in approved vehicles and measured therein at the point of delivery. Vehicles for this purpose may be of any size or type acceptable to the Project Manager provided that the body is of such shape that the actual contents may be readily and accurately determined and is water tight so that the volume can be measured by filling with water. All vehicles shall be loaded to at least their water level capacity, and all loads shall be leveled when the vehicles arrive at the point of delivery.

D. Measurement of Areas

1. Measurement of areas will be by the square dimension listed or indicated in the Schedule of Prices and Quantities and or Unit Price Items. Area measurements will be neat line as shown on contract documents or, if actual field measurements show that the area is less than neat line, the actual area will be used. All longitudinal measurements shall be horizontal unless noted otherwise. Method of square measurement will be as determined by the Project Manager.

E. Measurement of Linear Items

1. Linear measurement will be by the linear dimension listed or indicated in the Schedule of Prices and Quantities and/or Unit Price Items. Linear measurements will be neat line as shown on contract documents, or if actual field measurements show that the linear measurement is less than neat line, the actual linear measurement will be used. Method of linear measurement will be as determined by the Project Manager. Generally, items, components or work to be measured will be measured at the centerline of the item in place.

### 1.03 FIELD MEASUREMENT FOR PAYMENT

- A. The Contractor will compute all quantities of Work performed by the Contractor, including quantities of materials and equipment delivered to the site, for final payment purposes. Computed quantities are subject to check and review by the Project Manager. If errors are found, the Contractor shall correct them. If, in the opinion of the Project Manager, the errors are significant or frequent enough, the Project Manager may make the calculations with his own forces at the Contractor's expense. No payment will be made on that portion of an item containing calculation errors until the errors are corrected to the satisfaction of the Project Manager.
  1. The Contractor will show the actual measurements that are used to compute the quantities along with the formulas used. As requested by the Project Manager, the Contractor shall supply the Project Manager with computations and sketches indicating where measurements were taken and their relationship to the finished product.
- B. The Contractor will supply the Project Manager with an electronic copy and instruction manual of any computer programs used to calculate quantities. Any computer program used shall be executable on an IBM compatible computer with a 286, 386, 486 or Pentium processor. The Contractor shall also provide an electronic copy of the data files used to determine quantities.
- C. The Contractor shall take all measurements for payment purpose in the presence of the

Project Manager in accordance with the provisions for measurement specified herein and in Technical Specifications Section 01050.

#### **1.04 REJECTED MATERIALS**

- A. Quantities of material wasted or disposed of in a manner not called for under the contract, rejected loads of material including material rejected after it has been placed by reasons of the failure of the Contractor to conform to the provisions of the contract, material not unloaded from the transporting vehicles, material placed outside the lines indicated on the contract drawings or established by the Project Manager, or material remaining on hand after completion of the Work will not be paid for and such quantities shall not be included in the final total quantities. No compensation will be permitted for loading, hauling and disposing of rejected material.

#### **1.05 PAYMENT CONSIDERATIONS**

- A. Payment will be full compensation for furnishing all labor, materials, tools, equipment, transportation, services and incidentals as specified in the General Conditions, technical specifications, and contract drawings, and for performing all work necessary for completing the item or work classification including all incidental work.
- B. Full compensation for all expenses involved in conforming to the requirements for measuring materials shall be considered as included in the unit or lump sum prices paid for the materials being measured and no additional compensation will be permitted.

#### **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 applicable unit price item, work order or lump sum bid item.

**END OF SECTION 01025**



## 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. Before commencing any layout of work and surveys the Contractor shall give the Project Manager 48 hours written advance notice so that the Project Manager may witness such work.
- C. 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.

##### 1.03 REFERENCE POINTS, COORDINATE POINTS AND SECTION CORNER MONUMENTS

- A. Protect and preserve reference points, Denver International Airport (DIA) grid control points, benchmarks and section corner monuments. Coordinates shown on the drawings are based upon the DIA coordinate system unless noted otherwise.
- B. Report damaged or destroyed reference points, DIA grid coordinate points and benchmarks to the Project Manager.
  - 1. The Project Manager will reestablish damaged, moved, altered or destroyed reference benchmarks and coordinate points.
  - 2. If section corner monuments are damaged or destroyed during construction activities, such points shall be re-established pursuant to "Laws of the State of Colorado Regulating the Practice of Land Surveying" by a Professional Land Surveyor registered in the State of Colorado.
  - 3. If reference points, coordinate points or bench marks are damaged, moved, altered or destroyed by the Contractor, the City's cost of reestablishing such points shall be borne by the Contractor.
  - 4. The City will not be responsible for any increased costs or delays to the Contractor relating to reference points, DIA grid control points, or bench marks which are damaged, moved, altered or destroyed by the Contractor or its subcontractors, suppliers, agents or employees or other Contractors working on the site.
- C. Report alleged errors in reference points, DIA grid control points, or benchmarks promptly to the Project Manager.

1. Discontinue use of reference points, DIA grid control points, or benchmarks alleged to be in error until the accuracy of points can be verified or as directed.
  2. Claims for extra compensation for alteration or reconstruction allegedly due to errors in reference points, DIA grid control points, or benchmarks will not be allowed unless original reference points, DIA grid points and benchmarks still exist or substantiating evidence proving error is furnished by the Contractor, and unless the Contractor has reported such errors to the Project Manager as specified herein.
- D. The following are limitations and additional information on reference points, DIA grid control points and benchmarks.
1. The use of control monuments for construction surveying other than those shown on the contract drawings or furnished by or approved by the Project Manager is prohibited. Use of other monuments is at the Contractor's sole risk.
  2. Elevations are based upon mean sea level datum from NOAA-NGS, benchmark "R392", elevation 5271.518 feet.
  3. The DIA bench mark and coordinate point data as listed on the contract drawings or listed in the specifications are the only approved coordinate points and benchmarks for construction surveying.
  4. The basis of bearing of the grid system is NGS control points "Adams" and "King" per the North American Datum of 1927.

## **PART 2 - PRODUCTS (NOT USED)**

## **PART 3 - EXECUTION**

### **3.01 CONSTRUCTION LINES AND GRADES**

- A. The reference DIA coordinate points and benchmarks to be provided by the City are those shown on the drawings. Other control points and benchmarks may be provided to the Contractor at the discretion of the Project Manager.
1. The Contractor shall carefully preserve such points and shall be held responsible therefore. If it becomes necessary for the Contractor to remove or disturb a reference or DIA grid coordinate point or benchmark he shall notify the Project Manager before removing or disturbing said point. If, in the opinion of the Project Manager, stakes, monuments, marks or points are carelessly or willfully disturbed by the Contractor, the cost of replacing such stakes, monuments, marks or points shall be charged against the Contractor and shall be deducted from final payment for the Work.
- B. 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.
- C. The Project Manager shall have the right to check surveys and layouts made by the Contractor prior to approving any of the Work. The Contractor shall give advance notice of not less than 48 hours to the Project Manager to enable such checking prior to placing any

Work. The Contractor shall furnish assistance as may be required for checking purposes when so requested by the Project Manager.

- D. 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.
- E. 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.
- F. 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.
- G. Field Notes
  - 1. The Contractor shall record surveys in field notebooks. Copies of the original pages of such records shall be furnished to the Project Manager at intervals required by the Project Manager. Each field notebook shall be furnished to the Project Manager when filled or completed. Field notes shall be kept in the form and style shown in the book "Surveying Theory and Practice" by Davis, Foote, Anderson and Mikhail. At the option of the Project Manager, electronic data collectors may be used and copies of downloaded data on disk may be furnished. The data shall be in MS DOS ASCII format and may be used to supplement field books.
  - 2. Whichever method of note taking the Contractor starts with, he must use the same method throughout the contract duration. If the Project Manager finds errors in the field notes he will return them to the Contractor for correction and resubmission. This review does not relieve the Contractor from the responsibility of maintaining accurate survey data.
- H. The Project Manager may at any time use line and grade points and markers established by the Contractor. The Contractor's surveys are a part of the Work and may be checked by the Project Manager or his representatives at any time. The Contractor shall be responsible for any lines, grades or measurements that do not comply with specified or proper tolerances or which are otherwise defective and for any resultant defects in the Work. The Contractor will be required to conduct re surveys or check surveys to correct errors indicated by review of the field notebooks.

### **3.02 SURVEYS FOR MEASUREMENT FOR PAYMENT**

- A. When the specifications or the Project Manager require items in the Schedule of Prices and Quantities to be measured by surveying methods, the Contractor shall perform the surveys. All such surveys, including control surveys run for establishing the measurement reference lines, shall be performed in the presence of the Project Manager or his representative who will witness the surveying operation and who will sign the field notes or keep duplicate field notes, at the Project Manager's option. The Contractor will reduce the field notes and calculate final quantities for payment purposes. The note reductions and calculations will be given to the Project Manager upon request.

### **3.03 SURVEYING ACCURACY AND TOLERANCES IN SETTING SURVEY, LAYOUT AND**

### QUANTITY CALCULATION STAKES

- A. Control traverse field surveys and computations shall be performed to an accuracy and precision of at least 1:40,000.
- B. 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.

### 3.04 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 by and under the direction of a Colorado licensed surveyor while the work is exposed and the measurements submitted to the Project Manager. Unless noted otherwise the measurements shall show the final location within +/- 3 inches of their actual horizontal and vertical location based upon DIA grid coordinates\*. 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. Survey notes must be supplied to the Project Manager prior to covering up the work or the work shall be considered defective.

- 1. \* DIA Vertical Datum (i.e., N6VD 29)

## 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 applicable work request bid item.

**END OF SECTION 01050**



**SECTION 01051**  
**PROJECT COORDINATION**

**PART 1 - GENERAL**

- A. Work specified in this Section includes coordination efforts which must be provided by the Contractor to ensure that work by others in the contract designated work area and adjacent areas does not negatively impact the Work and overall project.
- B. The construction schedule as specified in Technical Specifications Section 01310 shall reflect all interfaces and coordination efforts as specified in General Condition 701, Special Condition SC-6, Technical Specification Sections 01010, 01014, 01051, and 01650, and other related contracts and procurement documents.
- C. The Contractor will establish regular working relations with all contractors, tenants and the Airport Maintenance Department working in the same area and areas adjacent to the construction site. The Contractor will attend construction progress meetings as described in Technical Specification Section 01200 and will coordinate work as described therein.
- D. The Contractor will assign a member of his staff to act as a coordinator, who will work to coordinate the Contractor's work with other parties doing work at the Denver International Airport site.

**1.02 WORK INCLUDED**

**1.03 CONTRACTOR'S RESPONSIBILITIES**

**1.04 COORDINATION WITH OTHER PROJECTS**

**1.05 METHOD OF MEASUREMENT**

**1.06 METHOD OF PAYMENT**

- A. Minimum cooperation requirements with other contractors include the following:
  - 1. Regular meeting (weekly or more often)
  - 2. Construction schedule coordination
  - 3. Staging area and access planning (to include employee shuttle routes)
  - 4. Deliveries
  - 5. Traffic control.
- B. When and where required, the Contractor shall develop appropriate coordination drawings for use by interfacing adjacent parties using the Denver International Airport site.
- C. The following is a list that includes, but is not limited to all of the contractors that will be working in the area of the project limits: DIA project manager needs to complete list below.
  - 1. (insert name of contractor)
  - 2. (insert name of contractor)

3. (insert name of contractor)

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**PART 4 - MEASUREMENT**

- A. No separate measurement shall be made for work under this Section.

**PART 5 - 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 applicable unit price item, work order or lump sum bid item.

**END OF SECTION 01051**

## 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. The Department of Aviation
  - 2. Colorado Department of Transportation
  - 3. Department of Public Works (including The Division of Wastewater Management)
  - 4. The standards which govern design and construction projects at Denver International Airport.
- 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 RELATED SECTIONS

- A. 01566 – Environmental Controls: for environmental and related permitting requirements.

##### 1.03 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. Appendix N of the amendments addresses Airport Buildings and Structures.

##### 1.04 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

##### 1.05 DENVER FIRE DEPARTMENT

- A. For review and approval of plans for compliance with the Denver Fire Department's requirements as they apply to the Denver International Airport:
  - 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 Uniform Fire Code 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 applicable unit price item, work order or lump sum bid item.

**END OF SECTION 01060**



## SECTION 01070

### ABBREVIATIONS AND SYMBOLS

#### PART 1 - GENERAL

##### 1.01 REFERENCE LIST

- A. Documents published by the following agencies may be referenced within these Contract Documents to define the quality of materials, equipment, workmanship and other features of work. Unless otherwise stated, the reference documents shall be of the latest edition as of the date of the Advertisement for Bids.
- B. Wherever used in the Contract Documents, the following abbreviations will have the meanings listed:

AALA	American Association of Laboratory Accreditation
AAN	American Association of Nurserymen
AAO	Affirmative Action Officer
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AFI	Air Filter Institute
AGTS	Automated Ground Transportation System
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute, Inc.
APA	American Plywood Association
APEN	Air Pollution Emission Notes
APWA	American Public Works Association
ARI	Air Conditioning and Refrigeration Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers



ASME	American Society of Mechanical Engineers
ASNT	American Society for Non-Destructive Testing
ASPE	American Society of Plumbing Engineers
ASSE	American Society of Sanitary Engineering
ASTM	American Society for Testing and Materials
AWPA	American Wood Preserver's Association
AWS	American Welding Society
AWWA	American Water Works Association
BID	Building Inspection Division, Department of Public Works
CAR	Corrective Action Report
CCD	City and County of Denver
CCR	Contractor Change Request
CCRL	Cement Concrete Reference Laboratory
CD	Change Directive
CDOH	Colorado Department of Highways or Colorado Department of Health
CDOT	Colorado Department of Transportation
CMEC	Concrete Materials Engineering Council
CN	Change Notice
CO	Change Order
COE	Corps of Engineers
CPM	Critical Path Method
CR	Change Request
CRSI	Concrete Reinforcing Steel Institute
CSI	Construction Specifications Institute
DFD	Denver Fire Department
DIA	Denver International Airport
DOT	United States Department of Transportation

DOR	Designer of Record
DWB	Denver Water Board
EEO	Equal Employment Officer or Equal Employment Opportunity
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FHWA	Federal Highway Administration
FM	Factory Mutual Association
FS	Federal Specifications (U.S. General Services Administration)
GCC	General Contract Conditions
IAPMO	International Association of Plumbing and Mechanical Officials
IBR	Institute of Boiler and Radiator Manufacturer's
ICBO	International Conference of Building Officials
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
ISA	Instrument Society of America
ITA	Independent Testing Agency
MIL	Military Specifications (Naval Publications and Forms Center)
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry
NAAB	National Association of Air Balance
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards (now called National Institute of Standards and Technology)
NCR	Nonconformance Report
NEC	National Electric Code (NFPA 70)

NECA	National Electric Contractors Association
NEMA	National Electrical Manufacturer's Association
NESC	National Electrical Safety Code
NFC	National Fire Code (as published by NFPA)
NFPA	National Fire Protection Association
NICET	National Institute for the Certification of Engineering Technologies
NIST	National Institute of Standards and Technology
NGS	National Geological Survey
NLMA	National Lumber Manufacturers Association
NOAA	National Oceanic and Atmospheric Administration
NRMCA	National Ready Mix Concrete Association
NTP	Notice to Proceed
NVLAP	National Voluntary Laboratory Accreditation Program
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PDM	Precedent Diagram Method
PS	Product Standard of NIST (U.S. Department of Commerce)
PM	Project Manager (DIA)
QA	Quality Assurance
QC	Quality Control
RAR	Remedial Action Request
RFI	Request for Information
SC	Special Contract Condition
SDI	Steel Door Institute
SMACNA	Sheet Metal and Air Conditioning Contractor's National Association
SSPWC	Standard Specifications for Public Works Construction

TCP	Traffic Control Plan
TSA	Transportation Security Administration
UBC	Uniform Building Code (published by ICBO)
UL	Underwriters Laboratories, Inc.
UMC	Uniform Mechanical Code (published by ICBO)
UPC	Uniform Plumbing Code (published by ICBO)
USC	United States Code
WBS	Work Breakdown Structure

**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 applicable unit price item, work order or lump sum bid item.

**END OF SECTION 01070**



## SECTION 01095

### DEFINITIONS AND CONVENTIONS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. This Section contains a list of definitions of words or phrases and grammatical or contextual conventions commonly used in these contract documents.

##### 1.02 REFERENCES

- A. Related Documents: General Conditions, Special Conditions, and applicable provisions of Technical Specifications Division 1 apply to this Section.

##### 1.03 DEFINITIONS

- A. Alphabetical Listing of Definitions
1. **As indicated:** Shown on the drawings by graphic indication, notes or schedules, or written in the specifications or elsewhere in the contract documents.
  2. **As directed, as approved, as requested:** Unless otherwise indicated, these terms imply "by the Project Manager" and require that an instruction be obtained by the Contractor from the Project Manager.
  3. **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.
  4. **Ensure:** To make certain in a way that eliminates the possibility of error.
  5. **Exposed:** Not installed underground or "concealed" as defined above.
  6. **Furnish or Provide:** To supply, install and connect complete and ready for safe and regular operation of particular work unless specifically otherwise noted.
  7. **Indicated, Shown, or Noted:** As depicted on drawings or specifications.
  8. **Install:** To erect, mount and connect complete with related accessories.
  9. **Or equal, or approved equal:** Refers to products which, in the opinion of the Project Manager, are similar in all respects to products specified by proprietary brand name. (Refer to Section 01630 for procedures for submittal of proposed substitutions.)
  10. **Rework:** To repair existing items or work required to be removed and replaced in order to accomplish the Work in accordance with the contract documents.
  11. **Related Work:** Includes, but not necessarily limited to, mentioned work associated with, or affected by, the work specified.
  12. **Reviewed, Satisfactory, Accepted, or Directed:** Assumes by or to the Project Manager.
  13. **Similar, or Equal:** Same in materials, weight, size, design, construction, capacity, performance and efficiency of specified product.
  14. **Supply:** To purchase, procure, acquire and deliver complete with related accessories.

15. **Unless Otherwise Indicated and Unless Otherwise Noted:** General note to perform work as indicated or shown on drawings or in specifications unless specifically directed otherwise elsewhere in the contract documents; may be abbreviated "U.O.N.", "U.O.I.", or "U.N.O."

#### 1.04 CONVENTIONS

##### A. Specifications Format

1. In order to standardize the location of information in the Contract Documents, the specifications generally are organized in one or more of the following formats:
  - a. The 16-Division "MASTERFORMAT" published by the Construction Specifications Institute.
  - b. The Standard Specifications for Road and Bridge Construction published by CDOT.
  - c. The alpha-numeric system as published by the FAA.

##### B. Organization of Drawings and Specifications

1. Organization of the specifications into divisions and sections, and arrangement or numbering of drawings is intended solely for the convenience of the Contractor in his responsibilities to divide the Work among subcontractors or to establish the extent of work to be performed by any trade.
2. Neither the Owner nor the Project Manager assume any liability arising out of jurisdictional issues or claims advanced by trade organizations or other interested parties based on the arrangement or organization of drawings or specifications.

##### C. Gender and Number

1. For convenience and uniformity, parties to the Contract, including the Owner, Contractor, and Project Manager, and their subcontractors, suppliers, installers, consultants or other interested parties are referred to throughout the contract documents as if masculine in gender and singular in number. Such reference is not intended to limit the meaning of the contract documents to the masculine gender or singular number.

##### D. Singular vs. Plural

1. Materials, products, equipment or other items of work referred to in the singular shall be construed as plural where applicable by the intent of the contract documents and shall not limit quantities to be provided by the Contractor.

##### E. Imperative Mood

1. Specifications and notes on the drawings or elsewhere in the contract documents are generally written in the imperative mood as instructions to the Contractor, whether the Contractor is specifically addressed or not.

##### F. References to Subcontractors or Trades

1. References to subcontractors, trades or other entities which are not parties to the contract shall be construed as meaning the Contractor whose responsibility it shall be to divide the Work among subcontractors or trades. Such references are used as a matter of convention, and are not intended to preclude or direct the Contractor's responsibility to divide the Work.



**G. Abbreviations**

1. A list of abbreviations used in the contract documents is included in Technical Specifications Section 01070; an abridged list of abbreviations used on the drawings is included with the drawings.
2. Abbreviations are believed to be those in general use in the construction industry. Contact the Project Manager for clarification of abbreviations for which the meaning is not clear.

**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.

**END OF SECTION 01095**



## 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.

##### 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 and approved under the general contract prior to commencing any work. If a Task Order is issued where the work is not covered by the approved safety plan then a revision to the plan specific for the work in the task order shall be resubmitted for approval. NOTE: NO PROGRESS PAYMENT SHALL BE APPROVED UNTIL THE SAFETY PLAN HAS BEEN ACCEPTED BY THE PROJECT MANAGER.

##### 1.04 PROJECT MANAGER'S REVIEW

- A. The Contractor shall provide six 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 in his 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 air quality will be monitored and personnel removed or protected from air that is hazardous for humans.
  - t. 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 at Denver International Airport, 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.
- B. If the Contractor experiences lost time or an injury rate greater than 75 percent of the national average for all construction, the Contractor shall audit its safety procedures and submit a plan to reduce its rates.
- C. If at any time the lost time or injury rates experienced by the Contractor are 150 percent or more of the national average for construction, the Contractor shall immediately hire an independent safety professional who shall audit the Contractor's procedures and operations and make a report of changes that the Contractor should implement to reduce the rate including changing personnel.
  - 1. Six copies of this report shall be submitted to the DIA Project Manager.
  - 2. The Contractor shall immediately begin implementing the recommendations.
  - 3. A weekly report shall be submitted by the Contractor on the status of the implementation of the recommendations.
  - 4. Failure to comply with these requirements is a basis to withhold a portion of progress payments.

## **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 applicable unit price item, work order or lump sum bid item.

**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 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 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. Equal Employment Opportunity (EEO), 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 equipment, 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. Include a written plan for dealing with and preventing FOD (Foreign Object Damage).
  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. The Contractor's procedures to coordinate its work with the work of other contractors and its procedures for sharing access to the worksite.
  11. Deliveries and priorities of major equipment.
  12. 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 Project Manager or the Project Manager's representative.
- 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 review all RAR's, CCR's, and NCR's issued and the status of each item.
    - b. The Contractor's Quality Control Representative shall present and discuss the Independent Testing Agency weekly test report and/or testing schedule.
    - c. The Contractor's Quality Control representative shall report on inspections by other agencies and any follow-up activity required.
    - d. 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. Design activities: open discussion
  5. Shop drawings/submittals
    - a. The Contractor shall provide four copies of 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 re-submittal.
    - c. The Contractor shall review any accepted submittals that the Contractor plans to re-submit with changes.
  6. Construction activities: Open discussion to include coordination items with other Contractors and or agencies.
  7. Schedule
    - a. The Contractor shall provide to the Project Manager four copies of 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, anticipated dates of inspection by DIA and other agencies, 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 applicable multiplier or work request bid item.

#### **END OF SECTION 01200**



## 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.

#### 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 two weeks 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 DIA Project Manager 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. All pages shall be completely legible and oriented to correct reading view.
    - 2. Formats are acceptable only with written permission of the project manager or required by individual spec sections:
      - a. Microsoft Office 2007 or newer. All files shall be fully compatible with Microsoft Office 2007.
      - 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 DIA Project Manager.
    - 3. Electronic file names: Each electronic document shall have a unique file name. File name convention shall be as follows: CEXXXXX-AAA-BBBBB-CCCRZ
      - a. XXXXX = DIA contract number

- b. AAA = sequential submittal number starting at 001.
- c. BBBB = specification section containing submittal requirements
- d. CCC = sequential specification submittal number starting at 001.
- e. RZ = sequential revision number. RZ not required on initial submittals.
- f. Example A: "CE52006-005-01370-002", five submittals have been logged overall with two submittals made to specification section 01370.
- g. Example B: "CE52006-009-01370-002R3, 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 City review may be completed not less than 30 days before Work represented by those submittals is scheduled to be performed.
- D. Allow a minimum cycle of 30 days for review of each submittal by the City.
- E. Accompany submittal documents with DIA transmittal form CM-30 (refer to Technical Specification Section 01999) that shall contain the following information:
  - 1. Contractor's name, address and telephone number.
  - 2. Submittal number and date.
  - 3. Contract title and number.
  - 4. Supplier's, manufacturer's or subcontractor's name, address and telephone number.
  - 5. Identification of variations from contract documents.
  - 6. Contractor's stamp and signature certifying his review.
  - 7. Identification of submittal:
    - a. If the submittal is being made on a General Condition or Special Condition, reference the General or Special Condition number.
    - b. If the submittal is being made under a specification section, reference the specification number, paragraph number and subparagraph number.
    - c. If the submittal is being made under a drawing, reference the drawing(s) number and subnumber.

- F. The Contractor shall at the time of submission describe variations from the contract documents in writing, separate from the submittal document. If 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 City, 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 City 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 City, 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 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 applicable unit price item, work order or lump sum bid item.

**END OF SECTION 01300**

## SECTION 01310

### SCHEDULE (LONG-DURATION PROJECT)

#### 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.

##### 1.02 PLANNING

- A. The schedule shall show the 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 for the Work utilizing the Precedence Diagram Method (PDM) in Gantt Chart view. The computerized format shall be compatible with the City's Primavera system (Primavera Contractor, Primavera 3.1 or Primavera P6 or later). The Schedule shall be submitted to the Project Manager electronically in PDF format and on a CD in a dynamic format which will allow review and manipulation of any part of the schedule. The schedule activities shall be resource loaded showing labor man hours, 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 Values 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 overall progress curve shall be submitted for approval within 30 days after Notice to Proceed. The overall progress curve will indicate planned progress monthly from start to finish of the project. The progress curve will be updated monthly with actual progress. 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) at Preconstruction Meeting
  - 2. Construction schedule (with narrative and progress curve)
  - 3. Monthly progress report (with narrative and updated progress curve)
  - 4. Construction schedule change request (as needed)
  - 5. As built construction schedule.

## **PART 2 - PRODUCT**

### **2.01 PLOT AND REPORT FORMAT**

- A. Preliminary and Construction Schedule formats shall contain a title block with a minimum 18-point font showing:
  - 1. Contractor's name
  - 2. Contract number and title
  - 3. Data date
  - 4. Symbol definitions
- B. Schedules shall contain a time line at the top.
- C. The Activity Table (Layout) shall include at a minimum the following columns:
  - 1. Activity ID
  - 2. Activity Name
  - 3. Original Duration
  - 4. Schedule % Complete



5. Start
  6. Finish
  7. Total Float
- D. A report shall accompany all schedules containing a list of all approved changes to the original approved (baseline) schedule.
- E. Reports shall be submitted electronically in PDF format, 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 60 calendar days of the contract. 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 60 days, including planning, mobilization, shop submittals and approval time, 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 60 days. The narrative shall elaborate on the basis of durations, production rates, and major equipment to be used, and shall identify all major assumptions used to develop the schedule.
- D. In lieu of the Preliminary Schedule the Contractor may at his own discretion submit the Construction Schedule at the Preconstruction Meeting. If the Construction Schedule is submitted in lieu of the Preliminary Schedule, the City will respond within 30 days with acceptance or direction to revise and resubmit within 10 days.

#### **3.02 CONSTRUCTION SCHEDULE**

- A. The construction schedule shall be a computerized CPM schedule utilizing the PDM formatted in Gantt Chart View 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 durations shall not 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 manhours estimated to perform the work including work by subcontractors and the value of the work.
  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 milestone 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 CPM schedule utilizing the PDM showing all logic ties and the Gantt Chart view on a CD and an electronic copy in PDF format.
  2. A physical progress curve showing either manpower or other appropriate key contract items derived from the construction schedule approved by the project manager and against which physical progress performance will be measured for schedule and payment purposes. The physical progress curve will indicate planned progress monthly from start to finish of the project.
  3. 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, an updated schedule and a physical progress curve. 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. A Gantt chart schedule shall be provided showing the Contractor's completion status (progress) on each work item along with logic ties and formats described in Technical Specifications Section 01310-3.02.C.1.
  3. The physical progress curve shall be updated to show actual progress.

- C. If 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 counterplan. The revisions suggested by the Project Manager shall be used for updating reports until the Project Manager approves the counterplan.
  - 2. If the Contractor does not submit a counterplan and data within ten days after the date of the Project Manager's suggested logic, the Contractor is deemed to have concurred 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 the 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 applicable unit price item, work order or lump sum bid item.

**END OF SECTION 01310 (LP)**

## 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 General Conditions, to the Project Manager in accordance with the requirements in the technical specifications. The Project Manager 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. The Contractor shall not submit as shop drawings copies or reproductions of drawings issued to the Contractor by DIA.

##### 1.02 SUBMITTALS

- A. Refer to Technical Specifications Section 01300 for submittal procedures.
- B. All submittals shall be delivered to the DIA 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. Microsoft Office 2007 or newer. All files shall be fully compatible with Microsoft Office 2007.
    - c. 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.
    - d. Other files pre-approved by the DIA 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 DIA 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.
  - 3. Electronic files submitted shall correspond with DIA File Control Numbering System available from the DIA Project Manager. All files shall contain the prefix

**CEXXXXX.14.02.submittalnumber.specsection.item.revision.**

- a. SUBMITTALNUMBER attribute shall be obtained from the DIA Project Manager.
- b. SPECSECTION attribute shall be a five digit number corresponding to the specification section requiring submitted data.
- c. ITEM attribute will be a two digit number designating the corresponding submittal item number.
- d. REVISION attribute will be for revised and resubmitted submittals, an “R” followed by a number (IE: R3).

**C. Quantities**

1. One DVD-ROM or CD-ROM containing electronic files of each shop or working drawing.
2. One DVD-ROM or CD-ROM containing electronic files of manufacturer's standard schematic drawings.
3. One DVD-ROM or CD-ROM containing electronic files of manufacturer's calculations and manufacturer's standard data.
4. One DVD-ROM or CD-ROM containing electronic files of manufacturer's printed installation, erection, application and placing instructions.
5. Nine samples of each item specified in the various specification sections, unless otherwise specified.
6. One DVD-ROM or CD-ROM containing electronic files of inspection, test reports and certificates of compliance.
7. Note: If manufacturer's printed information is in color, all copies of submittals must be in color.

**D. Review**

1. Submittal review comments by the City 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'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 Deputy Manager of Aviation as provided in Technical Specifications Section 01630.

**1.04 QUALITY CONTROL**

- A. Shop drawings and 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 equivalent specification defining equal drafting quality for microfilming.

**PART 2 - PRODUCTS**

**2.01 SHOP AND WORKING DRAWINGS**

- A. Prepare shop and working drawings on a reproducible sepia sheet size of 24 x 36 inches to a scale large enough to easily depict and annotate each of the various items.
- B. 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, FAA, AASHTO 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.
- C. 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, FAA, AASHTO 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.

## 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. Reference requirements of General Conditions Article 405.
- B. Verify field measurements, catalog numbers and similar data.



- C. 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.
- D. Before making submittals ensure that products will be available in the quantities and at the times required by the contract.
- E. Submit final, corrected, reproducible sepias 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.

### **3.02 REVIEW BY THE CITY**

- A. One electronic copy of the marked-up shop and working drawing and one electronic copy of the product data will be returned to the Contractor by the Project Manager. Only the transmittal form, appropriately marked, will be returned on sample submittals.
- B. Contractor's responsibility for errors and omissions in submittals for compatibility will not be reduced, waived or otherwise limited by the review and acceptance of submittals by the City.

## **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 applicable multiplier for the division under which the work falls.

**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.

##### 1.02 RELATED DOCUMENTS

- A. General Contract Conditions, Title 9 Compensation
- B. Technical Specifications Section 01300 Submittals
- C. Technical Specifications Section 01340 Shop and Working Drawings, Product Data and Samples
- D. 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 discounts 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. If the permanent material is stored outside the Denver area the Contractor must pay for the City representative's transportation and lodging to see the stored material as needed. Acceptable lodgings must, as a minimum, have a Mobil Travel Guide Rating Criteria® rating of Two-Star or the American Automobile Association Lodging Listing Requirements & Diamond Rating Guidelines® rating of Two Diamonds. The minimum transportation shall be by regularly scheduled commercial air carrier at coach rates. The Project Manager will determine if an overnight stay is required.
- G. All permanent material stored off site, for which payment is being requested must be insured and stored in bonded, insured warehouses.
- H. 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 applicable unit price item, work order or lump sum bid item.

**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 may 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 Contractor.

##### 1.02 SUBMITTALS

- A. Refer to Technical Specification Section 01300 and Technical Specifications Section 01340, for submittal requirements.
- B. Quality Control Plan: Within 10 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 DIA. 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 whose sole responsibility is quality control manager and is highly qualified in all phases of construction as it relates to this project. 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 and to DIA Maintenance Control (303-342-2800). 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 prepared daily on the form included in Technical Specifications Section 01999. The Contractor may add sheets of information to this form as required. 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 shall be computerized or typed and contain an electronic signature. Reporting shall be transmitted to the project manager electronically.
  2. Submit one electronic copy of the Daily Quality Control Report to the Project Manager at the end of each work week. 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.

### 1.03 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 DIA 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.



#### 1.04 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 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.
- D. Quantities will be verified as defined in the Pre-Work Meetings.

#### 1.05 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), the ITA representative, the DIA Project Manager and DIA inspectors. 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 DIA, 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 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.

#### **1.06 SAMPLES**

- A. The Contractor shall maintain at the worksite a copy of all samples submitted and accepted by DIA. 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 DIA 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 DIA 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 DIA 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 applicable multiplier for the division under which the work falls. 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 Deputy Manager or his 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 01401

### INDEPENDENT TESTING AGENCY

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. The Contractor shall employ the services of an Independent Testing Agency (ITA). This Section identifies the requirements for the Contractor to employ an Independent Testing Agency and identifies the required activities of the Independent Testing Agency.
- B. Laboratory and field testing requirements to be conducted by the ITA for materials and construction on this project are included in the appropriate technical specifications. Where the technical specifications reference the CDOT Standard Specifications for Road and Bridge Construction, the references shall also mean CDOT Field Materials Manual for schedule of tests unless otherwise stated. As a minimum the ITA described in this section shall perform all applicable tests listed in the manual including the independent assurance sampling and testing. In the event of such a conflict between the schedule and a specification in these technical provisions, the more comprehensive testing shall govern unless otherwise noted.
- C. Inspections and tests conducted by the ITA shall not in any way relieve the Contractor of his responsibility and obligation to meet all specifications and referenced standards. Employment of the ITA does not relieve the Contractor of providing the required Quality Control program.
- D. When inspections or tests by the ITA prove that the item or material does not meet all applicable specifications and requirements, the cost incurred for the re-testing or re-inspection shall be borne by the Contractor (see paragraph 5.01 of this Technical Specifications Section).
- E. 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.
- F. The Contractor is obligated to correct any item deemed deficient at no additional cost to DIA.

##### 1.02 RELATED DOCUMENTS

- A. ASTM C 1077 - Standard Practices for Laboratory Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
- B. ASTM D 3740 - Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
- C. ASTM E 329 - Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as Used in Construction
- D. ASTM E 543 - Determining the Qualifications of Nondestructive Testing Agencies.
- E. ASTM E 548 - Generic Criteria for Use in Evaluation of Testing and Inspection Agencies.

- F. Standard testing practices for other disciplines.

### 1.03 SUBMITTALS

- A. All submittals shall comply with requirements of Technical Specifications Sections 01300 and 01340 for submittal requirements.

### 1.04 CONTRACTOR SUBMITTAL OF PROPOSED TESTING AGENCIES

- A. The Contractor shall employ the services of an Independent Testing Agency (ITA) that has been accredited by AASHTO or CCRL or an approved equal to perform the test(s) required in the contract. The Contractor shall receive written acceptance from the Project Manager of the Independent Testing Agency prior to any permanent work being installed or tested.
- B. The Contractor shall not submit for acceptance to the Project Manager any testing agency or laboratory utilized in the design or construction document preparation or presently employed by DIA as part of DIA Quality Assurance.
- C. For consideration of acceptance, the Contractor shall submit to the Project Manager the following items received from the ITA:
  - 1. Evidence of license to operate as a commercial testing laboratory.
  - 2. Evidence that AMRL or CCRL has inspected the laboratory of the ITA within the last three years. Copies of the inspection(s) along with documentation showing correction of deficiencies, if any. AMRL or CCRL reference sample program test results shall be submitted from the previous two years.
  - 3. Affidavit of compliance with applicable national certification and/or accreditation program stating that the ITA laboratory actually performing the work is qualified to perform the tests and work in accordance with the technical requirements of the contract specifications.
  - 4. Name, certification, and qualifications of person in charge of the ITA laboratory. This individual shall be a full time employee of the ITA laboratory and have a minimum of five years of experience in construction materials testing.
  - 5. Evidence that the ITA laboratory and field technicians are qualified to perform the work. NICET, ACI, NRMCA, PCA, AWS, ASNT or a degree in a related engineering field with construction field experience can demonstrate qualifications through certification.
  - 6. A list of testing equipment proposed for each test procedure.
  - 7. A copy of the certification and latest calibration data for all ITA laboratory and field equipment to be used for this project verifying their conformance to national standards.
  - 8. A matrix indicating each technical specification section, paragraph, quantity and type of sampling and/or testing required.

### 1.05 SUBMITTAL OF REPORTS

- A. Test results shall be submitted by the Contractor to the DIA Project Manager after completion of inspections/tests by the ITA and prior to incorporation of the item(s) into the Work unless the test or inspection must be done during or after installation.
- B. Field testing/inspection, field density and moisture tests shall be reported in legible draft form immediately at the test site and attached to the Daily Quality Control Report (reference

Technical Specifications Section 01400, paragraph 1.02.D) with typed final test results provided weekly to the Project Manager. If the DIA Inspector is not present for the actual test, the draft results shall be given to the Project Manager at the end of the shift. All other inspections and test results shall be submitted the same week as the inspection or test.

- C. Test reports shall include worksheets showing all calculations used to obtain the test results. Certificates of compliance shall be submitted 30 days prior to the product's incorporation into the work. All test results must be reviewed and signed by a registered licensed engineer in the State of Colorado. The signature represents that the test procedures used are in strict conformance with the applicable testing standard, the calculated data are true and accurate, the tools and equipment used were in calibration, the sample was not contaminated and the persons running the test were qualified.
- D. Reports of inspections and test activities are record documents and shall be maintained in a manner that provides integrity of item identification, acceptability and traceability. Reports shall identify the following:
1. Contractor's name
  2. Contract number and title
  3. Independent Testing Agency name
  4. Name of item(s) inspected/tested including a physical description and, as applicable, model and make
  5. Quantity of items
  6. Inspection/test procedure used. If national standards are used, any deviation from these standards
  7. Date the sample was taken and the date the test was made
  8. Location (by coordinates, building grid or station number) of where tests and/or samplings were performed including environmental condition where applicable. Include plan drawing indicating location of test and work item sampled or tested
  9. Name of inspector/tester
  10. In the event the testing or sampling is a re-test or re-sampling, reference the previous respective testing or sampling report
  11. Specified requirements in the contract that the item must meet. Include reference to technical specification section and paragraphs
  12. Acceptability
  13. Deviations/nonconformance
  14. Corrective action
  15. Evaluation of results
  16. Signature of authorized evaluator.

#### 1.06 WEEKLY REPORTS

- A. In addition, the ITA shall prepare and submit to the Project Manager a weekly summary report each week which summarizes all activities and results for the quality control tests and inspections conducted. The weekly summary report shall, at a minimum, identify all test types, test locations, testers, test results, any calculations used, specifications, whether the

test passed or failed, and the material supplier, installer and Contractor. Requests shall be identified in a fashion that easily correlates to the failing test. Any failed tests that have not been corrected when the report is published shall be highlighted and noted in the cover letter of the report. The ITA shall identify costs of re-testing or additional site visits required due to scheduling changes by the Contractor.

- B. The weekly report shall be submitted per Technical Specifications Sections 01300 and 01340 requirements.

## **PART 2 - PRODUCTS (NOT USED)**

## **PART 3 - EXECUTION**

### **3.01 REMOVAL OF NONCONFORMING MATERIAL**

- A. The Contractor is obligated to correct or remove nonconforming 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.

### **3.02 PERFORMANCE**

- A. If the Project Manager determines that the ITA manager or any of his authorized support personnel are not effectively enforcing or performing the requirements specified in the contract, the Project Manager will, in writing, require the Contractor to remove and replace such personnel at no cost to DIA.

### **3.03 CONTROL OF MEASURING AND TEST EQUIPMENT**

- A. The ITA shall select measuring and test equipment in such a manner as to provide proper type, range, accuracy, calibration and tolerance for determining compliance with specified requirements. Measuring and test devices shall be calibrated, adjusted and maintained at prescribed intervals prior to use based upon equipment stability and other conditions affecting measurement. Provisions shall be made for the proper handling and storage of equipment. Calibration shall be accomplished using certified standards that have a known traceable relationship to the National Institute of Standards and Technology. Every calibrated measuring and test device shall show the current status, date of last calibration and the due date for the next calibration. Calibration records shall be maintained onsite as quality records and shall be made available for inspection upon the Project Manager's request.

## **PART 4 - METHOD OF MEASUREMENT**

### **4.01 METHOD OF MEASUREMENT**

- A. No separate measurement shall be made for work under the 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 applicable unit price item, work order or lump sum bid item. If the City is required to re-inspect work because the previous inspection



showed that the work was defective or not in conformance, the Deputy Manager or his 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 01401**



## SECTION 01402

### DIA QUALITY ASSURANCE

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. This Section identifies DIA Inspection activities to be performed by inspectors employed by DIA and working under the direction of the 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 DIA. Technical specifications may contain requirements more stringent than Building Inspection Division or other code agency requirements.

##### 1.02 RELATED DOCUMENTS

- A. Technical Specifications Section 01400 – “Contractor Quality Control”
- B. General Conditions Title 17, Section 1701 – “Construction Inspection by the City”
- C. General Conditions Title 17, Section 1702 – “Authority of Inspectors”
- D. General Conditions Title 17, Section 1703 – “Observable Defects”
- E. General Conditions Title 17, Section 1704 – “Defects – Uncovering Work”
- F. General Conditions Title 17, Section 1705 – “Latent Defects”
- G. General Conditions Title 17, Section 1706 – “Removal of Defective Materials and Work”.

#### PART 2 - PRODUCTS (NOT USED)

#### PART 3 - EXECUTION

##### 3.01 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 DIA 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 DIA shall have the right to re-test at DIA's expense any materials that have been tested and accepted at the source of supply after it has been delivered to the site.

### **3.02 INSPECTIONS AND TESTS**

- A. It is understood and agreed that DIA shall have the right to take samples and perform testing of samples at different intervals or at intervals concurrent to the Contractor's testing program. The Contractor shall be issued a Nonconformance Report or a Remedial Action Request in the event DIA tests fail.
- B. Materials accepted on the basis of a certificate of compliance may be sampled and inspected/tested by DIA 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.
- C. DIA inspection shall include but not be limited to Initial Inspection, Follow-up Inspection, Completion Inspection, Pre-Final Acceptance Inspection, and Final Acceptance Inspection. The Contractor shall comply with the requirements of these inspections as identified in Technical Specifications Section 01400.

### **3.03 NONCONFORMING WORK AND MATERIALS**

- A. Remedial Action Request (RAR)
1. The Project Manager will request the Contractor to take remedial action when nonconforming work is discovered and/or when test results indicate nonconforming work.
  2. The Project Manager will document remedial action that cannot be taken immediately (the same day) by issuing a Remedial Action Request form to the Contractor. Remedial Action Requests are appropriate when the affected element of work is in-progress and discrepancies can be rectified as the work proceeds. RAR's shall be written when work can be brought back into conformance with the contract documents.
  3. When issued, a Remedial Action Request will preclude payment for elements noted and will remain in effect until corrective actions have been submitted, approved and performed.
  4. Upon satisfactory completion of the remedial action, the Contractor shall transmit the RAR form with the Contractor's statement of action taken (including any applicable test results) to the Project Manager. The Project Manager will perform a follow-up inspection to verify the RAR has been satisfactorily completed. The RAR then will be closed.

B. Nonconformance Report (NCR)

1. The Project Manager will issue a Nonconformance Report to the Contractor whenever there are violations of the terms of the contract that cannot be immediately brought back into conformance, including materials received and/or items of the work found not to be in conformance with contract requirements. When issued, a Nonconformance Report will preclude payment for elements noted and will remain in effect until corrective actions have been submitted, approved and performed.
2. The Nonconformance Report form will describe the nature and extent of nonconforming elements and will include space for the Contractor's corrective action proposal, the designer's review of the Contractor's proposal, reinspection and/or verification of approved corrective rework and a space for the Project Manager's disposition of the nonconformance matter. Copies of the Nonconformance Report, at each step of its processing (i.e., initial issuance to Contractor through final disposition), will be sent to the Project Manager.
3. The Project Manager will make the disposition of nonconforming items/materials.

C. The Contractor is obligated to correct any item deemed deficient.

**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 unit price item, work order or lump sum bid item. If the City is required to re-inspect work because the previous inspection showed that the work was defective or not in conformance, the Deputy Manager or his 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 01402**



**SECTION 01403**ERROR! BOOKMARK NOT DEFINED.

**CONTRACTOR QUALITY CONTROL PROGRAM**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. The Contractor shall establish, provide and maintain an effective Quality Control Program that details the methods and procedures that will be taken to ensure that all materials and completed construction required by this contract conform to contract plans, technical specifications and any other requirements, whether manufactured by the Contractor or procured from subcontractors or vendors. Although guidelines are established and certain minimum requirements are specified herein and elsewhere in the contract technical specifications, the Contractor shall assume full responsibility for accomplishing the stated purpose.

**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 DIA 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 REQUIREMENTS**

- A. The Contractor shall be prepared to discuss and present, at the Preconstruction Conference, his/her understanding of the quality control requirements. The Contractor shall not begin any construction or production of materials to be incorporated into the completed work until the Quality Control Program has been reviewed and approved by the DIA Project Manager. No partial payment will be made for materials subject to specific quality control requirements until the Quality Control Program has been reviewed and approved by the DIA Project Manager.
- B. The quality control requirements contained in this section and elsewhere in the contract technical specifications are in addition to and separate from the acceptance testing requirements. Acceptance testing requirements are also the responsibility of the Contractor.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION**

**3.01 QUALITY CONTROL PROGRAM**

- A. GENERAL DESCRIPTION. The Contractor shall establish a Quality Control Program to perform inspection and testing of all items of work required by the technical specifications, including those performed by subcontractors. This Quality Control Program shall ensure conformance to applicable specifications and plans with respect to materials, workmanship, construction, finish, and functional performance. The Quality Control Program shall be effective for control of all construction work performed under this contract and shall

specifically include surveillance and tests required by the technical specifications in addition to other requirements of this section and any other activities deemed necessary by the Contractor to establish an effective level of quality control.

- B. **QUALITY CONTROL PROGRAM.** The Contractor shall describe the Quality Control Program in a written document which shall be reviewed by the DIA Project Manager prior to the start of any production, construction or off-site fabrication. The written Quality Control Program shall be submitted to the DIA Project Manager for review and approval at least five (5) calendar days before the Preconstruction Conference.
- C. The Quality Control Program shall be organized to address, as a minimum, the following items:
  - 1. Quality control organization
  - 2. Project progress schedule
  - 3. Submittals schedule
  - 4. Inspection requirements
  - 5. Quality control testing plan
  - 6. Documentation of quality control activities
  - 7. Requirements for corrective action when quality control and/or acceptance criteria are not met.
- D. The Contractor is encouraged to add any additional elements to the Quality Control Program that he/she deems necessary to adequately control all production and/or construction processes required by this contract.

### **3.02 QUALITY CONTROL ORGANIZATION**

- A. The Contractor's Quality Control Program shall be implemented by the establishment of a separate quality control organization. An organizational chart shall be developed to show all quality control personnel and how these personnel integrate with other management/production and construction functions and personnel.
  - 1. The organizational chart shall identify all quality control staff by name and function and shall indicate the total staff required to implement all elements of the Quality Control Program, including inspection and testing for each item or work. If necessary, different technicians can be utilized for specific inspection and testing functions for different items of work. All personnel used for implementation of all or part of the Quality Control Program shall be subject to the qualification requirements of paragraph 3.02 A and 3.02 B. The organizational chart shall indicate which personnel are Contractor employees and which are provided by an outside organization.
- B. The quality control organization shall consist of the following minimum personnel:
  - 1. **QUALITY CONTROL MANAGER.** The Quality Control Manager shall be a full-time employee of the Contractor or a consultant engaged by the Contractor. The Quality Control Manager shall have a minimum of 10 years of experience in airport and/or highway construction and shall have had prior quality control experience on a project of comparable size and scope as this contract.
  - 2. Additional qualifications for the Quality Control Manager shall include the following requirements:



- a. Licensed professional engineer with 5 years of airport or highway grading and drainage, field and laboratory testing, and quality control experience acceptable to the DIA Project Manager
  - b. Current resume with P.E. seal affixed thereto
  - c. Four references for work on projects completed within past five (5) years (names, current organization, and telephone number)
  - d. Three years of highway and/or airport paving experience acceptable to the DIA Project Manager with a B.S. degree in Civil Engineering, Civil Engineering Technology or Construction
  - e. Construction Materials Technician certified at Level III by the National Institute for Certification in Engineering Technologies (NICET)
  - f. Highway Materials Technician certified at Level III by NICET
  - g. Highway Construction Technician certified at Level III by NICET
  - h. A NICET Certified Engineering Technician in Civil Engineering Technology with 5 years of highway and/or airport paving experience acceptable to the DIA Project Manager.
  - i. The Quality Control Manager shall have full authority to institute any and all actions necessary for the successful implementation of the Quality Control Program to ensure compliance with the contract plans and technical specifications. The Quality Control Manager shall report directly to a responsible officer of the construction firm. The Quality Control Manager shall be on-site for a minimum of 40 hours per week during all production and shall be released from full-time duties only after written permission from the DIA Project Manager.
3. ELECTRICAL QA/QC MANAGER. In addition to the Quality Control Manager, the Contractor shall provide a dedicated, full-time Electrical Quality Assurance/Quality Control (QA/QC) Manager. The Electrical QA/QC Manager shall have no other responsibilities other than overall electrical QA/QC. The Electrical QA/QC Manager shall be a master electrician with a minimum of 5 years electrical airfield construction experience at a commercial carrier airport. The Electrical QA/QC Manager shall be a Certified Senior Technician—Level IV as recognized by the National Electrical Testing Association (NETA).
4. QUALITY CONTROL TECHNICIANS. A sufficient number of Quality Control Technicians necessary to adequately implement the Quality Control Program shall be provided. These personnel shall be engineers, engineering technicians, or experienced craftsman with the following qualifications:
- a. Engineer-in-training with 2 years of airport/highway grading experience acceptable to the DIA Project Manager
  - b. An individual with 3 years of highway and/or airport grading experience acceptable to the DIA Project Manager, with a Bachelor of Science degree in Civil Engineering, Civil Engineering Technology or Construction
  - c. Construction Materials Technician certified at Level II by the National Institute for Certification in Engineering Technologies (NICET)
  - d. Highway Materials Technician certified at Level II by NICET
  - e. Highway Construction Technician certified at Level II by NICET
  - f. Electrical Construction Technician at Level III certification by NETA.
  - g. The Quality Control Technicians shall report directly to the Quality Control Manager and shall perform the following functions:
    - 1) Inspection of all materials, construction, plant and equipment for conformance to the technical specifications, and as required by paragraph 3.05 below

- 2) Performance of all quality control tests as required by the technical specifications and paragraph 3.06 below.
  - h. Certification at an equivalent level by a state or nationally recognized organization will be acceptable in lieu of NICET certification.
- C. **STAFFING LEVELS.** The Contractor shall provide sufficient qualified quality control personnel to monitor each work activity at all times. Where material is being produced in a plant for incorporation into the work, separate plant and field technicians shall be provided at each plant and field placement location. The scheduling and coordinating of all inspection and testing must match the type and pace of work activity. The Quality Control Program shall state where different technicians will be required for different work elements.

### **3.03 PROJECT PROGRESS SCHEDULE.**

- A. The Contractor shall submit a coordinated construction schedule for all work activities. The schedule shall be prepared as a network diagram in Critical Path Method (CPM), PERT, or other format, or as otherwise specified in the contract. As a minimum, it shall provide information on the sequence of work activities, milestone dates and activity duration.
- B. The Contractor shall maintain the work schedule and provide an update and analysis of the progress schedule on a twice-monthly basis, or as otherwise specified in the contract. Submission of the work schedule shall not relieve the Contractor of overall responsibility for scheduling, sequencing and coordinating all work to comply with the requirements of the contract.

### **3.04 SUBMITTALS SCHEDULE.**

- A. The Contractor shall submit a detailed listing of all submittals (e.g., mix designs, material certifications, etc.) and shop drawings required by the technical specifications. The listing can be developed in a spreadsheet format and shall include:
  1. Specification item number
  2. Item description
  3. Description of submittal
  4. Specification paragraph requiring submittal
  5. Scheduled date of submittal.

### **3.05 INSPECTION REQUIREMENTS**

- 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 Quality Control Manager, Quality Control and Safety representative(s), the Testing Agency (TA) representative, the DIA Project Manager and DIA inspectors. Supervisory, safety and quality control representatives of all applicable subcontractors will also attend. The DIA Project Manager will chair the meeting. The purpose of the meeting is to ensure 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 at the meeting:
- a. Contract requirements and specifications
  - b. Shop drawings, certifications, submittals and as-built drawings that apply
  - 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 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.
2. 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 DIA Project Manager or his/hers designated representative 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.
  - f. 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 DIA Project Manager. The Contractor's Quality Control representative shall chair, prepare and distribute minutes of Quality Control meetings. Meeting minutes shall be distributed within 24 hours of the meeting.
3. 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.
4. 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 DIA 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 DIA 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.
5. PRE-FINAL ACCEPTANCE INSPECTION. Prior to requesting a Pre-final Acceptance Inspection by DIA, 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 DIA Project Manager, no inspection will be held due to the incompleteness of the work.

- a. The DIA Project Manager will schedule the Pre-final Acceptance Inspection and 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.
6. 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 DIA 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 DIA Project Manager.

### 3.06 QUALITY CONTROL TESTING PLAN.

- A. As a part of the overall Quality Control Program, the Contractor shall implement a quality control testing plan as required by the technical specifications. The testing plan shall include the minimum tests and test frequencies required by each technical specification Item as well as any additional quality control tests that the Contractor deems necessary to adequately control production and/or construction processes.
- B. The testing plan can be developed in a spreadsheet fashion and shall, as a minimum, include the following:
  1. Specification item number (e.g., P-401)
  2. Item description (e.g., Plan Mix Bituminous Pavements)
  3. Test type (e.g., gradation, grade, asphalt content)
  4. Test standard (e.g., ASTM or AASHTO test number, as applicable)
  5. Test frequency (e.g., as required by technical specifications or minimum frequency when requirements are not stated)
  6. Responsibility (e.g., plant technician)
  7. Control requirements (e.g., target, permissible deviations).
- C. The testing plan shall contain a statistically based procedure of random sampling for acquiring test samples in accordance with ASTM D 3665. The DIA Project Manager shall be provided the opportunity to witness quality control sampling and testing.
- D. All quality control test results shall be documented by the Contractor as required by paragraph 3.07 below.

### 3.07 DOCUMENTATION.

- A. The Contractor shall maintain current quality control records of all inspections and tests performed. These records shall include factual evidence that the required inspections or tests have been performed, including type and number of inspections or tests involved; results of inspections or tests; nature of defects, deviations, causes for rejection, etc.; proposed remedial action; and corrective actions taken.
- B. These records must cover both conforming and defective or deficient features and must include a statement that all supplies and materials incorporated in the work are in full compliance with the terms of the contract. Legible copies of these records shall be furnished to the DIA Project Manager daily. The records shall cover all work placed subsequent to the previously furnished records and shall be verified and signed by the Contractor's Quality Control Manager.
- C. Specific Contractor quality control records required for the contract shall include, but are not necessarily limited to, the following records:
- D. Daily Inspection Reports. Each Contractor quality control technician shall maintain a daily log of all inspections performed for both Contractor and subcontractor operations on a form acceptable to the DIA Project Manager. These technician's daily reports shall provide factual evidence that continuous quality control inspections have been performed and shall, as a minimum, include the following:
1. Technical specification item number and description
  2. Compliance with approved submittals
  3. Proper storage of materials and equipment
  4. Proper operation of all equipment
  5. Adherence to plans and technical specifications
  6. Review of quality control tests
  7. Safety inspection.
  8. The daily inspection reports shall identify inspections conducted, results of inspections, location and nature of defects found, causes for rejection, and remedial or corrective actions taken or proposed.
  9. The daily inspection reports shall be signed by the responsible quality control technician and the Quality Control Manager. The DIA Project Manager shall be provided a minimum of one copy of each daily inspection report on the workday following the day of record.
- E. Daily Test Reports. The Contractor shall be responsible for establishing a system which will record all quality control test results. Daily test reports shall document the following information:
1. Technical specification item number and description
  2. Test designation
  3. Location
  4. Date of test
  5. Control requirements

6. Quality Control Charts
  7. Test results
  8. Causes for rejection
  9. Recommended remedial actions
  10. Retests.
  11. Test results from each day's work period shall be submitted to the DIA Project Manager prior to the start of the next day's work period. Any failing test shall be reported separately to a DIA Inspector or the DIA Project Manager within two hours after discovery of the failure. The Contractor shall maintain quality control charts. The daily test reports shall be signed by the responsible quality control technician and the Quality Control Manager. A typed weekly summary shall be submitted to the DIA Project Manager. The number of copies to be provided shall be as directed by the DIA Project Manager.
  12. Field testing/inspection, field density and moisture tests shall be reported in legible draft form immediately at the test site and attached to the daily test report with a summary of test results provided weekly to the DIA Project Manager. If the DIA Inspector is not present for the actual test, the draft results shall be given to the DIA Project Manager at the end of the shift.
  13. Test reports shall include worksheets showing all calculations used to obtain the test results. Certificates of compliance shall be submitted 30 days prior to the product's incorporation into the work. All test results must be reviewed and signed by a registered licensed engineer in the State of Colorado. The signature represents that the test procedures used are in strict conformance with the applicable testing standard, the calculated data are true and accurate, the tools and equipment used were in calibration, the sample was not contaminated and the persons running the test were qualified.
- F. Contractor Daily Reports. The Contractor shall report daily construction activities using the Daily Construction Report form as included in Specification Section 01999. These daily reports shall include the following:
1. Daily activities
  2. Quantities of material placed
  3. Weather
  4. Equipment on site with time used
  5. Work delays
  6. Possible delays
  7. Materials delivered.
  8. The daily construction reports shall be signed by the responsible foreman. The DIA Project Manager shall be provided a minimum of one copy of each daily construction report on the work day following the day of record.

### **3.08 CORRECTIVE ACTION REQUIREMENTS**

- A. The Quality Control Program shall indicate the appropriate action to be taken when a process is deemed, or believed, to be out of control (out of tolerance) and detail what action will be

taken to bring the process under control. The requirements for corrective action shall include both general requirements for operation of the Quality Control Program as a whole, and for individual items of work contained in the technical specifications.

- B. The Quality Control Program shall detail how the results of quality control inspections and tests will be used for determining the need for corrective action and shall contain clear sets of rules to gauge when a process is out of control and the type of correction to be taken to regain process control.
- C. When applicable or required by the technical specifications, the Contractor shall establish and utilize statistical quality control charts for individual quality control tests. The requirements for corrective action shall be linked to the control charts.

### **3.09 SURVEILLANCE BY THE DIA PROJECT MANAGER**

- A. All items of material and equipment shall be subject to surveillance by the DIA Project Manager at the point of production, manufacture or shipment to determine if the Contractor, producer, manufacturer or shipper maintains an adequate quality control system in conformance with the requirements detailed herein and the applicable technical specifications and plans. In addition, all items of materials, equipment and work in place shall be subject to surveillance by the DIA Project Manager at the site for the same purpose.
- B. Surveillance by the DIA Project Manager does not relieve the Contractor of performing quality control inspections of either on-site or off-site Contractor's or subcontractor's work.

### **3.10 NONCOMPLIANCE**

- A. The DIA Project Manager will notify the Contractor of any noncompliance with any of the foregoing requirements. The Contractor shall, after receipt of such notice, immediately take corrective action. Any notice, when delivered by the DIA Project Manager or his/her authorized representative to the Contractor or his/her authorized representative at the site of the work, shall be considered sufficient notice.
- B. In cases where quality control activities do not comply with either the Contractor's Quality Control Program or the contract provisions, or where the Contractor fails to properly operate and maintain an effective Quality Control Program, as determined by the DIA Project Manager, the DIA Project Manager may:
  - 1. Order the Contractor to replace ineffective or unqualified quality control personnel or subcontractors
  - 2. Order the Contractor to stop operations until appropriate corrective actions are taken.

## **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 applicable unit price item, work order or

lump sum bid item.

**END OF SECTION 01403**



## SECTION 01410

### CUTTING AND PATCHING

#### PART 1 - GENERAL

##### 1.01 RELATED DOCUMENTS

- A. Reference General Contract Conditions, GC 315.
- B. Reference Technical Specifications, Section 01411.

##### 1.02 DEFINITIONS

- A. Cutting: Removal of existing construction to permit installation of or to perform other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

##### 1.03 SUBMITTALS

- A. Refer to Technical Specifications Sections 01300 and 01340 for submittal procedures.
- B. Cutting and Patching Proposal: Submit a proposal describing procedures at least 30 calendar days before the time cutting and patching will be performed, requesting approval to proceed. Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work. The proposal shall include the following information:
  - 1. Identification of the contract and the Contractor's name.
  - 2. Description of proposed work:
    - a. Scope of cutting, patching, alteration or excavation
    - b. The necessity for cutting or alteration
    - c. Drawing showing location of the requested cutting or alteration, along with radar or x-ray report.
    - d. Trades that will execute the work
    - e. Products proposed to be used
    - f. Extent of refinishing to be done
    - g. Alternatives to cutting and patching
  - 3. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
  - 4. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
  - 5. Proposed Dust Control and Noise Control Measures: Submit a statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.

6. Effect on the work and other surrounding work or on structural or weatherproof integrity of project
7. Written concurrence of each contractor or entity whose work will be affected.
8. Cost proposal, when applicable

#### 1.04 QUALITY CONTROL

- A. Operational Elements: Do not cut and patch the following operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance, decreased operational life or safety unless approved by the Project Manager:
  1. Primary operational systems and equipment
  2. Air or smoke barriers
  3. Fire protection systems
  4. Control systems
  5. Communication systems
  6. Conveying systems
  7. Electrical wiring systems
  8. Operating systems of special construction as described in Division 13 and 16
  9. HVAC systems.
- B. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or those results in increased maintenance, decreased operational life or safety unless approved by the Project Manager:
  1. Water, moisture or vapor barriers
  2. Membranes and flashings
  3. Exterior curtain wall construction
  4. Equipment supports
  5. Piping, ductwork, vessels and equipment
  6. Noise control and vibration control elements and systems
  7. Stud walls.
- C. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in DIA's sole opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactorily manner.
  1. If possible, retain the original installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage the original installer or fabricator, engage another recognized, experienced and specialized firm as approved by the Project Manager:
    - a. Processed concrete finishes
    - b. Stonework and stone masonry

- c. Ornamental metal
  - d. Matched-veneer woodwork
  - e. Preformed metal panels
  - f. Firestopping
  - g. Window wall systems
  - h. Terrazzo
  - i. Wall coverings
  - j. HVAC enclosures, cabinets or covers,.
- D. Cutting and Patching Conference: Before proceeding, meet at the Project site with all parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

## 1.05 WARRANTY

- A. Existing Warranties: Remove, replace, patch and repair materials and surfaces cut or damaged during cutting and patching operations by methods and with materials so as not to void existing warranties.
- 1. If possible, retain the original installer or fabricator to patch the exposed Work listed below that is damaged during selective demolition. If it is impossible to engage the original installer or fabricator, engage another recognized, experienced and specialized firm as approved by the Project Manager:
    - a. Ornamental metal
    - b. Preformed metal panels
    - c. Firestopping
    - d. Terrazzo
    - e. ProCoat paint finishes
    - f. Granite flooring
    - g. Wall coverings
    - h. HVAC enclosures, cabinets or covers.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. General: All patching material shall be of the type specified for the material being patched. Comply with requirements specified in other Sections of these Technical Specifications.
- B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
- 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials as approved by the Project Manager.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are

to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Immediately notify the Project Manager, in writing, of unsuitable, unsafe or unsatisfactory conditions.
3. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.
4. Proceed with patching only after construction operations requiring cutting are complete and inspected by the Project Manager.

### 3.02 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut to ensure structural value or integrity.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Services: Where existing services are required to be removed, relocated or abandoned, bypass such services before cutting to avoid (or minimize) interruption of services to occupied areas.

### 3.03 POLLUTION CONTROLS

- A. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.
  1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions such as ice, flooding and pollution.
  2. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosures. Vacuum carpeted areas.
- B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- C. Cleaning: Clean adjacent structures and improvements of dust, dirt and debris caused by selective demolition operations. Return adjacent areas to the condition existing before selective demolition operations began.

### 3.04 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Execute cutting and demolition by methods that will prevent damage to other work and will provide a proper surface to receive patching.
  1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their

- original condition.
2. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerance and finishes.
  3. Restore work that has been cut or removed; install new products to provide complete work in accordance with requirements of the contract documents.
  4. Fit work airtight and fire safe to pipes, sleeves, ducts, conduit and other penetrations through surfaces as required by the contract documents.
- B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and other similar operations, including excavation, using methods least likely to damage elements retained to adjoining construction. If possible review proposed procedures with original installer and comply with original installer's written recommendations.
1. In general, use ground fault hand or small power tools designed( to short if metal is hit) for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to the size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  3. Concrete: Use a cutting machine such as an abrasive saw or a diamond-core drill.
  4. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Technical Specifications.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
  2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing. For continuous surfaces, refinish entire unit to the nearest break line. For an assembly, refinish entire unit.
  3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs on a painted surface, apply primer and intermediate paint coats over the patch and apply the final coat over the entire unbroken surface containing the patch. Provide additional coats until the patch blends with adjacent surfaces.
  4. Ceilings: Patch, repair or re-hang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
- D. Fire Rated Construction: Where rated elements are cut, reconstruct to approved designs to provide original fire rating.

### 3.05 CORE DRILLING

- A. The Contractor shall execute a minimum of x-rays or ground penetrating radar at each location planned for core drilling prior to submittal to the Project Manager and to utility representatives for approval for core drilling. The request for approval shall be submitted seven days in advance of the planned activity. The request for approval shall indicate on the x-ray or radar information regarding alternate locations or core drilling to avoid structural members and any embedded conduit. Embedded conduit may be metallic or plastic. The x-ray or radar system shall be capable of detecting both types of conduit.
- B. Core drilled “cores” and the core-drilled opening shall be inspected by DIA Project Manager representatives prior to installation of any systems in new openings.
- C. X-ray activities may not be performed during hours of activity or occupancy in the area of the x-ray system. The Contractor shall provide all manpower and barriers required to secure the areas affected by x-ray activities.

**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 applicable multiplier for the division under which the work falls.

**END OF SECTION 01410**

## SECTION 01411

### SELECTIVE DEMOLITION

#### PART 1 - GENERAL

##### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.
- B. Technical Specifications Section 01566 Environmental Controls

##### 1.02 SUMMARY

- A. This Section includes the following:
  - 1. Demolition and removal of selected portions of a building or structure.
  - 2. Repair procedures for selective demolition operations.

##### 1.03 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, wrap and label and deliver them to Owner ready for reuse.
- 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.

##### 1.04 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain DIA's property, demolished materials shall become the Contractor's property and shall be removed from the project site.

##### 1.05 SUBMITTALS

- A. Refer to Technical Specifications Section 01300 and 01340 for submittal procedures.
- B. Qualification Data: For firms and persons specified in Technical Specifications Section 01400 Contractor Quality Control to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- C. Proposed Dust Control and Noise Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.

- D. Submit a Schedule of Selective Demolition Activities that indicates the following:
  - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure that DIA's and other tenants' on-site operations are uninterrupted.
  - 2. Interruption of utility services.
  - 3. Coordination for shutoff, capping, and continuation of utility services.
  - 4. Coordination of DIA's continuing occupancy of portions of existing building and of DIA's partial occupancy of completed Work..

#### 1.06 QUALITY CONTROL

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI A10.6 and NFPA 241.
- C. Predemolition Conference: Conduct conference at the Project site with all parties involved with demolition. 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.

#### 1.07 PROJECT CONDITIONS

- A. Painting: Comply with manufacturer's recommendations for application conditions.
- B. When there are occupied portions of buildings immediately adjacent to selective demolition area, conduct selective demolition so DIA's or tenant's operations will not be disrupted. Provide not less than 72 hours' notice to Project Manager of activities that will affect DIA's or tenant's operations.
- C. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.
- D. DIA assumes no responsibility for condition of areas to be selectively demolished. DIA will maintain conditions existing at time of inspection for bidding purpose as far as practical.
- E. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Project Manager.
- F. Storage or sale of removed items or materials on-site will not be permitted.



- G. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
- H. Maintain fire-protection facilities in service during selective demolition operations.

### 1.08 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.
  - 1. If possible, retain original installer or fabricator to patch the exposed Work listed below that is damaged during selective demolition. If it is impossible to engage the original installer or fabricator, engage another recognized experienced and specialized firm.
    - a. Ornamental metal
    - b. Preformed metal panels
    - c. Firestopping
    - d. Terrazzo
    - e. Wall covering
    - f. ProCoat paint finishes
    - g. HVAC enclosures, cabinets or covers.

## PART 2 - PRODUCTS

### 2.01 REPAIR MATERIALS

- A. Use repair materials identical to existing materials.
  - 1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that, when installed, will match the visual and functional performance of existing materials, as approved by DIA.
  - 2. Use materials whose installed performance equal or surpass that of existing materials.
- B. Comply with material and installation requirements specified in individual specification sections.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- B. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- C. When unanticipated mechanical, electrical or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to Project Manager.
- D. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

### 3.02 UTILITY SERVICES

- A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.
  - 1. Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by the Project Manager and authorities having jurisdiction.

### 3.03 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. Do not close or obstruct roads, streets, walks, walkways, or other adjacent occupied or used facilities without written authorization from the Project Manager and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
  - 2. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
  - 3. Protect existing site improvements, appurtenances and landscaping.
  - 4. Erect a plainly visible fence around drip lines of individual trees or around perimeter drip lines of groups of trees.
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities.
  - 1. Provide protection to ensure safe passage of people around selective demolition area, and to and from occupied portions of buildings.
  - 2. Provide temporary weather protection during intervals between selective demolition operations of existing construction on exterior surfaces and new construction to prevent water leakage and damage to structure and interior areas.
  - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  - 4. Cover and protect furniture, furnishings and equipment that have not been removed.
- C. Temporary Enclosures: Provide temporary enclosures for protection of existing buildings and construction projects, both in progress and completed, from exposure, foul weather and other construction operations. Provide temporary weather tight enclosures for building exteriors.
  - 1. Where heating or cooling is needed and permanent enclosures are not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
- D. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

### 3.04 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  2. Neatly cut openings and holes plumb, square and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings that are to remain.
  3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  4. Dispose of demolished items and materials promptly.
  5. Return elements of construction and surfaces that are to remain to the same condition existing before selective demolition operations begin.
- B. Existing Facilities: Comply with DIA's requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.
- C. Removed and Salvaged Items: Comply with the following:
1. Removed and Salvaged Items include but are not limited to:
    - a. BRDG-TNDR valves and control components
    - b. Pumps and pump motors
    - c. Valves and piping components
  2. Clean all removed and salvaged items.
  3. Pack or crate items after cleaning. Identify contents of containers.
  4. Store items in a secure area until turned over to DIA.
  5. Transport items to DIA's storage area as designated by the Project Manager.
  6. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items: Comply with the following:
1. Clean and repair items to a functional condition adequate for the intended reuse. Paint equipment to match new equipment.
  2. Pack or crate items after cleaning. Identify contents of containers
  3. Protect items from damage during transport and storage.
  4. Reinstall items in locations indicated in message schedule. Comply with installation requirements for new materials and equipment. Provide connections, supports and miscellaneous materials necessary to make the items functional for the use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Project Manager, items may be removed to a suitable protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

### 3.05 PATCHING AND REPAIRS

- A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.
- B. Patching: Comply with Technical Specification Section 01410, Cutting and Patching.
- C. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
  - 1. Completely fill holes and depressions in existing masonry walls that are to remain with an approved masonry patching material applied according to manufacturer's written recommendations.
- D. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.
- E. Floors and Walls: Where walls or partitions that are demolished extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish color, texture and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
  - 1. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements as specified in other sections of these specifications.
  - 2. Where patching occurs on a painted surface, apply primer and intermediate paint coats over the patch and apply a final paint coat over the entire unbroken surface containing the patch. Provide additional coats until the patch blends with adjacent surfaces.
  - 3. Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
- F. Ceilings: Patch, repair or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

### **3.06 DISPOSAL OF DEMOLISHED MATERIALS**

- A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Shall be in accordance with Technical Specifications Section 01566.

## **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 applicable unit price item, work order or

lump sum bid item.

**END OF SECTION 01411**



## 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. A construction office is at the Contractor's option (Project Manager's option).
- B. Construction Offices, Construction Yards and Storage Areas
1. The Contractor's offices, construction yards laydown and storage areas shall be located as shown on the contract drawings and/or as designated by the Project Manager. All construction offices, staging areas and material storage areas are to occur within these areas.
  2. Any activity that is expected to result in disturbance of the ground surface equal to or greater than one acre or part of a larger project that is expected to disturb equal to or greater than one acre, is required to be identified in the Construction Activities Stormwater Management Plan (CASMP) and/or Stormwater Management Plan (SWMP). These areas include, but are not limited to, laydowns, borrow areas, stockpiles, and storage areas regardless of the location.
  3. All areas of ground disturbance are required to be stabilized in accordance with State, local, and airport rules and regulations prior to permit termination and/or closure of the contract .
  4. The Contractor shall restore any area on DIA property that becomes contaminated as a result of its operations in accordance with Airport Rule and Regulation 180. Restoration shall be either to applicable standards under Federal and State law or to such other levels as may be required by the Manager of Aviation, at the Manager's sole discretion.
  5. All temporary facility sites must be inspected prior to contract closeout. The DIA Project Manager or authorized representative shall conduct an inspection of contractor areas used during the life of the project. These areas include but are not limited to, staging areas, laydown areas, borrow areas, and contractor yards and offices. The DIA PM will ensure these areas have been properly stabilized in accordance with DIA Rules and Regulations and restored to the condition in which the City initially provided to the Contractor. A representative from DIA Environmental Services shall be present during the final walk through.
  6. Contractor materials shall be managed in accordance with applicable Environmental Regulations.
  7. Temporary facilities which the Contractor desires to locate in secondary laydown and staging areas adjacent to the Work or within the project limits are subject to approval by the Project Manager. If approved, these areas must also be included in the CASMP and/or SWMP.
  8. Access to and security of the Contractor's construction offices, yard, temporary facilities and storage areas shall be as shown on the Contract Drawings or as specified in the

contract Special Conditions.

9. Contractor Field Office

- a. The Contractor shall acquire all necessary permits for installation and construction work related to the Contractor's field office and fencing.
- b. The Contractor shall provide, as part of his on-site field office, a conference room for weekly meetings. Minimum size to accommodate 15 people with the currently approved schedule posted on a wall. The conference room shall have one available telephone.
- c. Jack the mobile office unit off its wheels and provide support. Enclose the underside of the trailer with weatherproof skirting.
- d. Install tie downs in compliance with code.
- e. Provide access to the field office and easily accessible space for parking six full size passenger automobiles as a minimum. Grade the field office site, access roadway and parking area for drainage, and surface with gravel paving or crushed stone.
- f. Water and sewer lines to the field office, if installed, shall be installed so they will not freeze.

C. 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 required by the governing authorities, and connection charges and temporary easements including installation, maintenance and removal of equipment.

D. Telephone Service

1. The Contractor shall furnish, install and maintain at least two telephones in his main field office. These phones shall be manned at all times by the Contractor's personnel or by an answering machine.
2. The Contractor shall supply one separate facsimile line for facsimile equipment.

E. 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.

F. 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.

G. 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. Temporary facilities equipment and materials (include manufacturer's literature)
  2. Details and layout of temporary installations including fences, roads, parking, buildings, storage areas and drainage plans.
  3. 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.
  4. As-built description of any temporary underground utilities referenced to the Airport grid and benchmark system within five days of completion of the installation.

## 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 TELEPHONE SERVICE**

- A. Provide equipment that is compatible with that of Qwest Communications Company and the telephone exchange to which the Contractor connects.

## **2.03 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.

## **2.04 FIRE PROTECTION**

- A. Fire extinguishers shall be UL rated and shall comply with the Uniform Fire Code.

## **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, storage areas or the work of other contractors.
- C. Provide sanitary bubbler drinking fountains if potable water service is available. Disinfect water piping before using for the potable water service.
- D. Install vacuum breakers, backflow preventers and similar devices in a manner and location which will prevent temporary water from returning to the water mains.
- E. 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 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 DIA Project Manager at least seven days before planned execution for review and acceptance.

### **3.07 SIGNAGE**

- A. Contractor shall not provide any signage for temporary facilities without prior approval from the DIA Project Manager.

### **3.08 TEMPORARY FACILITIES AS-BUILT DRAWINGS**

- A. Provide as-built drawings showing vertical and horizontal location. The location of all regulating and shut off devices along with all branches shall be shown. The as-built drawings shall be based upon the DIA grid coordinate system and benchmark. As-built drawings shall be furnished within 48 hours prior to the Contractor's request for turning on services.

### **3.09 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.
- C. The Contractor shall stabilize all areas of disturbance in accordance with State, local, and airport rules and regulations.
- D. In accordance with Part 1, an inspection of temporary facilities used by the Contractor is required prior to contract close out.

## **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 applicable unit price item, work order or lump sum bid item.

**END OF SECTION 01500**

## SECTION 01505

### MOBILIZATION

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. The Work specified in this Section consists of preparatory work and operations including, but not limited to, those necessary for the movement of personnel, equipment, supplies and incidentals to the worksite; for the establishment of all offices, buildings and other facilities necessary for work on the project; and for all other work and operations which must be performed or costs incurred prior to beginning work on the various contract items on the worksite.

##### 1.02 SUBMITTALS

- A. Refer to Technical Specifications Sections 01300 and 01340 for submittal procedures.
- B. Submit a Mobilization Schedule 15 days prior to first billing for mobilization.

##### 1.03 DELIVERY

- A. Delivery to the worksite of construction tools, equipment, materials and supplies shall be accomplished in conformance with local governing regulations.

#### PART 2 - PRODUCTS

##### 2.01 PRODUCTS

- A. Provide construction tools, equipment, materials and supplies of the type and quantities that will facilitate the timely execution of the Work.

#### PART 3 - EXECUTION

##### 3.01 EXECUTION AND REMOVAL

- A. Provide personnel, products, construction materials, equipment, tools and supplies at the worksite at the time they are scheduled to be installed or utilized.
- B. Upon completion of the Work, remove construction tools, apparatus, equipment, unused materials and supplies, plant, and personnel from the jobsite.

#### PART 4 - MEASUREMENT

##### 4.01 METHOD OF MEASUREMENT

- A. The Contractor shall submit for the Project Manager's approval 15 days prior to the first mobilization billing a detailed breakdown of all items, including subcontractor mobilization items that are proposed to be invoiced under Mobilization as part of the Schedule of Values (reference Technical Specifications Section 01370). This breakdown shall be labeled MOBILIZATION SCHEDULE. This schedule will be reviewed by the Project Manager to inform the Contractor what exact types of costs will be approved and paid under Mobilization.

- B. All requests for payment for mobilization shall include a detailed Mobilization Schedule which shall identify the nature of each expense item, its delivery date, setup and startup date and the actual invoice amounts inclusive of acquisition, taxes, transportation assembly, and installation less all discounts.
- C. The Contractor shall identify a line item in the Mobilization Schedule as "Demobilization" and shall establish the value for this line item, at a minimum, of fifteen percent (15%) of the pay item for mobilization.
- D. The initial approved Mobilization Schedule shall determine the basis for all future mobilization payments.

## **PART 5 - PAYMENT**

### **5.01 MOBILIZATION**

- A. Payment will be made only for substantiated Mobilization costs in accordance with the approved Mobilization Schedule, and only to the limit of the contract lump sum amount for the pay item Mobilization. In no case will the City pay Mobilization in excess of five percent (5%) of the total Contract amount.
- B. Payment for the Contractor's bonds may be included in the Mobilization Schedule to the limits of the actual amount.
- C. Payment amounts for personnel involved in mobilization and listed on the approved Mobilization Schedule shall be limited to the Contractor's certified payroll amounts.
- D. Payment amounts for materials, supplies and transportation involved in mobilization and listed on the approved Mobilization Schedule shall be for the actual amounts paid as shown on invoices marked paid. No payment will be made under mobilization for the cost of permanent materials to be installed for this contract. See Section 01370 for Stored Materials.
- E. No payment under mobilization will be made for rented or leased equipment other than actual transportation cost.
- F. No separate payment will be made as part of the Mobilization Schedule for the maintenance and/or use of personnel, equipment, supplies and incidentals after project setup except for demobilization. These costs are to be incorporated in the remaining items of work in the Schedule of Values by multiplier or work request.
- G. For any mobilization payment amounts requested by the Contractor that are unsubstantiated or exceed the allowable limit of five percent of the total Contract amount, the Project City, may in its sole discretion reallocate any, all, or none of those amounts to other work items in the Schedule of Values for lump sum contracts or to be disbursed on a prorated basis as determined by the Project Manager for unit price contracts. Any unsubstantiated mobilization payment amounts not reallocated by the Project Manager will not be paid

**END OF SECTION 01505**

## SECTION 01566

### ENVIRONMENTAL CONTROLS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. The Work specified in this Section consists of avoiding or mitigating adverse environmental impacts caused by construction activities in the areas of air quality, water quality, hazardous and non-hazardous solid waste, natural resources, and noise pollution. Reference the General Contract Conditions 806 (Protection of Drainageways), 807 (Protection of Environment), 808 (Hazardous and Explosive Materials or Substances), and 809 (Archeological and Historical Discoveries).
1. The Contractor, in conducting any activity on airport property or in conducting work for an airport project not on airport property, shall comply with all applicable airport, local, state, and federal rules, regulations, statutes, laws, and orders (“Environmental Requirements”). In addition, these Environmental Requirements include applicable Environmental Guidelines developed for DIA’s Environmental Management System (EMS), as summarized in the airport’s Rules and Regulations Part 180 (Environmental Management), which can be located on the airport’s website at: <http://www.flydenver.com/diabiz/info/research/rules/index.htm>. Information on DIA’s EMS as well as current versions of DIA’s Environmental Guidelines and Environmental Policy are also located on the airport’s website at: <http://www.flydenver.com/diabiz/community/enviro/index.asp>. These Environmental Requirements address, but are not limited to, requirements regarding the management of hazardous materials, petroleum products, solid waste, or any other substance; the National Environmental Policy Act (NEPA); and water quality and air quality regulations. Each entity, including subcontractors and subconsultants providing products, goods, and/or services on behalf of DIA, must be aware of the DIA Environmental Policy, the significant environmental aspects for DIA, and which of these aspects are relevant to the activities conducted by the entity.
  2. The Contractor shall comply with all Environmental Requirements and accept responsibility for compliance with all environmental quality standards, limitations and permit requirements promulgated there under. The Contractor shall obtain all environmental permits required for implementation of the project. Failure of these specifications to specifically mention any Environmental Requirement does not relieve the Contractor from compliance.
  3. If the City, as owner, is determined by any federal, state or local government agency, department, board or commission, or in any judicial proceeding to have violated any such environmental protection rules, laws or regulations as a result of Contractor’s acts or omissions, the Contractor agrees to indemnify and hold harmless the City from any and all prosecutions, payment of any and all fines or penalties, and the cost of abatement and remediation, except that the Contractor shall not be required under General Contract Condition 807, to indemnify the City from any amounts which are attributable to the negligence of the City.
  4. Work shall not commence on any project until all FAA approvals have been received, applicable permits have been issued and signed by permittee, and all inspection requirements have been satisfied in accordance with State and local permitting requirements.

##### 1.02 SUBMITTALS

- A. Refer to Technical Specifications Sections 01300 (Submittals) and 01340 (Shop and Working Drawings, Product Data and Samples) for procedures.
- B. Within 10 days after Notice to Proceed on a task order, the Contractor shall submit the following if applicable, unless waived by the DIA Project Manager:
1. Submittals pertaining to water quality management:
    - a. Copy of the application completed for the City and County of Denver Construction Activities Stormwater Discharge Permit (CASDP) and the CASDP issued for the project by the Denver Department of Public Works. This submittal consists of three items: the Authorization to Discharge, the Sewer Use & Drainage Permit, and the approved Construction Activities Stormwater Management Plan (CASMP).
      - 1) Revisions or amendments to the CASMP by the Contractor. At the completion of the project, after final stabilization has been achieved and accepted in accordance with CASDP requirements, the Contractor shall submit a copy of the CASDP Inactivation Request.
    - b. Copy of the certification issued by the Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Division (WQCD) under the Colorado Discharge Permit System (CDPS) for discharges associated with construction activities and/or industrial activities. Before obtaining this permit, the Contractor shall submit a **draft** permit application and the final permit application for DIA review and approval PRIOR to submittal to CDPHE. The Contractor need not submit copies of the general permits or the general permit rationales.
      - 1) At the completion of the project, after final stabilization has been achieved and accepted in accordance with the State of Colorado CDPS requirements, the Contractor shall submit a copy of the CDPS Inactivation Notice or Notice of Termination.
    - c. Copy of the certification issued by the State of Colorado CDPS under its General Permit for Construction Dewatering Activities. Before obtaining this permit, the Contractor shall submit a **draft** permit application and the final permit application for DIA review and approval PRIOR to submittal to CDPHE. The Contractor need not submit a copy of the general permit or the general permit rationale.
      - 1) At the completion of the project, the Contractor shall submit a copy of the CDPS Notice of Termination.
    - d. Copies of any certification issued by the State of Colorado under its Industrial Permitting for minimal discharges of process wastewater. Before obtaining a permit, the Contractor shall submit a **draft** permit application and the final permit application for DIA review and approval PRIOR to submittal to CDPHE. The Contractor need not submit a copy of the issued permit or the permit rationale.
      - 1) The Contractor shall submit copies of Discharge Monitoring Reports (DMRs) and at completion of the project, the CDPS Notice of Termination.
    - e. A copy of the well permit from the state Division of Water Resources for every new well that diverts or for the monitoring of groundwater.
    - f. A copy of the Notice of Intent for any borehole structure filed with the state Division of Water Resources.
  2. Submittals pertaining to sewage holding tanks associated with buildings and trailers. For purposes of this Section 01566, the generic term “sewage holding tank” means “individual sewage disposal system (ISDS)”, “privy vault”, “septic tank”, or “septic system”.
    - a. Copy of the permit application for a sewage holding tank.
    - b. Copy of the Sewer Use & Drainage Permit issued by the Denver Department of Public Works.
    - c. Copy of the ISDS permit issued by the Denver Department of Environmental



Health.

3. Submittals pertaining to air quality management:
  - a. Copy of any permit issued by the CDPHE Air Pollution Control Division (APCD). Before obtaining a permit, the Contractor shall submit a **draft** permit application and the final permit application for DIA review and approval PRIOR to submittal to CDPHE.
    1. In cases where the City has already obtained a dust control permit, the Contractor shall submit a copy of the paperwork transferring the permit over to the Contractor's company name and a copy of the transferred permit.
  - b. Dust control plan. For projects where the State of Colorado requires a dust control permit, this submittal is waived. This plan must address appropriate control measures that the Contractor will employ to minimize the release of fugitive dust from the site. In addition, the Contractor must comply with the requirements in Section 3.01 below.
  - c. Copies of the Notices of Relocation.
4. Submittals pertaining to storage tanks and containers:
  - a. Copy of the permit issued by the State of Colorado, Department of Labor and Employment, Division of Oil and Public Safety, for installation of petroleum (or other regulated substances) storage tanks located on airport property and used for the project.
  - b. Copy of permits issued by the Denver Fire Department for storage tank installations, storage tank removals, and hazardous materials use/storage.
  - c. Copy of Spill Prevention, Control, and Countermeasure (SPCC) Plan for petroleum storage tanks and containers with capacity of 55 gallons of oil or greater located on airport property and used for the project.
5. Waste Management Plan. This submittal may be waived if DIA Environmental Services, upon consultation with the DIA Project Manager, deems it unnecessary to require such plan. When required, this plan must include, at a minimum, waste management measures listed in Paragraph 3.05.I. below. Because this plan may be required at any point during the project, the Contractor should anticipate making this submittal in its contract bid or proposal.
6. Copies of any other plans, permits, permit applications, correspondence with regulatory agencies (including violations), waste manifests, results of laboratory analyses, or other environmental documentation required for the project not previously identified.

### 1.03 RELATED DOCUMENTS

- A. Code of Federal Regulations (CFR) Publications (including but not limited to):
  1. 33 CFR 323 - Permits for discharges of dredged or fill materials into waters of the United States
  2. 40 CFR - Protection of Environment
  3. 49 CFR 171-180 Hazardous Material Transportation Regulations
- B. Colorado Revised Statutes (including but not limited to):
  1. Water Quality Control, Title 25, Article 8
  2. Air Quality Control, Title 25, Article 7

3. Hazardous Waste, Title 25, Article 15
  4. Noise Abatement, Title 25, Article 12
  5. Petroleum Storage Tanks, Title 8, Article 20.5
  6. Liquefied Petroleum Gas (LPG) Storage Tanks, Title 8, Article 20
  7. Solid waste regulations
- C. City and County of Denver Executive Orders (including but not limited to)
1. Executive Order No. 115
  2. Executive Order No. 123
- D. Denver Revised Municipal Code, Title II, Sections 48-44 and 48-93
- E. City and County of Denver Construction Sites Program
- F. City and County of Denver Construction Activities Stormwater Management Plans Information Guide
- G. Any other applicable rules, regulations, ordinances, and guidance must be followed as applicable.

## PART 2 - PRODUCTS

### 2.01 PRODUCTS

- A. Products required for the work shall meet all Environmental Requirements.
- B. At a minimum, products for erosion and sediment control must conform to the technical requirements contained in the City and County of Denver's Construction Activities Stormwater Management Plan Information Guide and the current version of the Urban Drainage and Flood Control District's Urban Storm Drainage Criteria Manual, Volume 3: Best Management Practices. These documents are posted at <http://www.denvergov.org/Portals/528/documents/DftGuide452007.pdf> and [http://www.udfcd.org/downloads/down\\_critmanual.htm](http://www.udfcd.org/downloads/down_critmanual.htm) respectively.

## PART 3 - EXECUTION

### 3.01 AIR POLLUTION CONTROLS

- A. The Contractor shall use appropriate control measures to comply with applicable air quality permit requirements. Additionally, the Contractor must be aware of the following procedures and techniques while conducting construction activities on DIA property. NOTE: Application of dust control measures should be discussed in the Dust Control Plan.
1. Apply water as needed to the construction site haul roads, disturbed surface areas and public access roads as needed to suppress dust. The use of chemical stabilizer can be requested by the Contractor. The type of stabilizer to be used and locations of use must be included in the Dust Control Plan, which must be approved by the DIA PM prior to application.
  2. The Contractor shall suspend all earthmoving activities if wind speed exceeds 30 mph. For purposes of this Section 01566, the generic term "earthmoving" means clearing, grubbing, excavation, topsoil removal, backfilling, embankment work,

grading, trenching, drilling, and installation of borings. Contractors are expected to check wind speeds with the airport's ramp tower to demonstrate compliance with this requirement. In addition, the project may be shut down if two of three of the Runway Visual Range (RVR) instruments read visibility of 2,400 feet or less. The instruments are used by FAA Control Tower personnel to ensure safe aircraft operations. Costs for shutdowns due to wind velocities or RVR readings shall not be grounds for delay or extra cost claims.

- B. Burning of materials is strictly prohibited on DIA property.

### 3.02 WATER POLLUTION CONTROLS

- A. The Contractor shall conduct construction activities in accordance with all applicable permit requirements. In addition, the Contractor shall comply with the following procedures and requirements while conducting activities on DIA property.
1. Water encountered during construction cannot be discharged to the stormwater system or placed onto the ground surface without a permit AND prior written approval by the DIA Project Manager. If groundwater or stormwater is anticipated to be encountered and the Contractor desires to discharge it to the stormwater system or onto the ground surface, then the Contractor must obtain an appropriate CDPS discharge permit in advance of the discharge unless this activity is specifically authorized under the CDPS Construction Stormwater Permit.
  2. If water is encountered and the Contractor desires to discharge these waters to the sanitary sewer system, then the Contractor must obtain approval from DIA Environmental Services in advance of the discharge.
  3. The Contractor shall ensure that stormwater that comes in contact with storage areas does not become impacted and discharged to the stormwater sewer system or to an impervious surface. Furthermore, any materials in storage areas shall not be stored directly on the ground (refer to DIA Technical Specification 16642 for Cathodic Protection Requirements).
  4. The Contractor shall not operate any valves, sluice gates or other drainage appurtenances related to any DIA sewer system without the prior approval of both the DIA Project Manager and DIA Environmental Services. Any violation of this directive may result in the payment of a financial penalty by the Contractor if the State of Colorado assesses such a penalty.

### 3.03 EROSION CONTROL AND SEDIMENTATION CONTROL

- A. This work consists of constructing, installing, maintaining and removing, if required, temporary and permanent control measures during the life of the contract (and possibly afterward) until the Contractor achieves final stabilization of the site to prevent or minimize erosion, sedimentation, and pollution of any state waters in accordance with all Environmental Requirements.
- B. The Contractor is responsible for compliance with all requirements in accordance with the CASDP, the City and County of Denver Construction Sites Program, the approved CASMP, and CDPS issued permits.
- C. Temporary facilities, including but not limited to, storage areas, laydowns, borrow areas, and contractor offices and work yards shall be managed in accordance with DIA Technical Specification 01500 for Temporary Facilities.

- D. Clean soil fill may be stockpiled in any area that has been previously approved and signed off by the DIA Section Manager of Construction, Design and Planning, and Environmental Services. Soil stockpiles are considered a potential pollutant source and must be addressed in the CASMP and/or SWMP.
- E. Make immediately available, upon the DIA PM's request, all labor, material and equipment judged appropriate by the Project Manager to maintain suitable erosion and sediment control features. These actions requested by the DIA PM take precedence over all other aspects of project construction that have need of the same labor, material and equipment, except those aspects required to prevent loss of life or severe property damage.

### 3.04 CONSTRUCTION OF CONTROL MEASURES FOR EROSION AND SEDIMENTATION

- A. The Contractor must install control measures in accordance with the most recent version of the Urban Drainage and Flood Control District's *Urban Storm Drainage Criteria Manual, Volume 3: Best Management Practices* and the City and County of Denver's *Construction Activities Stormwater Management Plan information Guide*. These documents are posted at: [http://www.udfcd.org/downloads/down\\_critmanual.htm](http://www.udfcd.org/downloads/down_critmanual.htm) and <http://www.denvergov.org/Portals/528/documents/DftGuide452007.pdf> respectively. Deviations from these two documents are allowed with written consent from the City and County of Denver NPDES Inspector.

### 3.05 SOLID WASTE MANAGEMENT

- A. This paragraph applies to solid waste. Solid waste is defined at 40 CFR 261.2 and includes all putrescible and nonputrescible solid, semisolid and liquid wastes, but does not include hazardous waste which is treated as a separate subset of solid waste. Hazardous waste is defined at 40 CFR 261.3, and 6 CCR 1007-2 as a solid, a liquid, or a contained gaseous material that is no longer used or that no longer serves the purpose for which it was produced and meets the definitions of the regulations. Certain types of non-hazardous solid waste may require special handling; such wastes are sometimes called "special waste."
- B. Hazardous and non-hazardous solid waste may be generated by the actions of the Contractor including, but not limited to, the direct purchase of hazardous materials, demolition, site preparation, grading, excavation, construction, or maintenance of equipment. If questionable material is encountered during construction activities, the Contractor must immediately notify the DIA Communications Center at (303) 342-4200 and the DIA Project Manager. If the Contractor will utilize any chemicals that will result in the generation of a potentially hazardous waste, the Contractor must prepare and submit a Waste Management Plan (Section 3.05.I)
- C. Remove scrap and waste material and dispose of it in accordance with laws, codes, regulations, ordinances, and permits.
- D. The Contractor is responsible for the safe management and disposal of all hazardous and non-hazardous solid waste and shall dispose of such waste in accordance with all environmental requirements. Waste disposal options include reuse on the project (with DIA approval only), sale, use for fuel, donation to other public or private projects, or through disposal in approved public or private disposal sites, either free of charge or for a fee. The method of disposal is restricted according to the classification of the waste. Hazardous and non-hazardous solid waste shall not be abandoned, dumped, buried or in any other way disposed on DIA property.
- E. City and County of Denver Executive Order No. 115 requires all non-hazardous solid waste generated at DIA to be directed to the Denver Arapahoe Disposal Site (DADS) landfill. This

includes all non-hazardous solid waste collected or transported in Denver vehicles, Contractor vehicles, or subcontractor vehicles. Contractors shall establish accounts in advance for the disposal of non-hazardous solid waste generated on the project; the Contractor is responsible for contracting waste hauling services. Therefore, this bid shall include costs for transportation to the DADS landfill only and the City is responsible for disposal fees and any applicable State surcharges. The Contractor is responsible for any special handling charge imposed by the transporter or the DADS landfill operator.

1. In the interest of public relations and to maximize the long-term use of the Site, haul routes adjacent to DADS shall be limited to State Highways 30 or 470 unless these routes are impassable (refer to Exhibit A for preferred haul route). Specifically, Gun Club Road between Interstate Highway 70 ("I-70") and Mississippi Avenue shall be avoided.
- F. Some of the naturally occurring material found by the Contractor, especially tar or oil-impregnated soil, may not be obviously hazardous. Physical and chemical analyses and tests may be required to determine if the material meets the criteria set forth in State of Colorado, CDPHE, Hazardous Materials and Waste Management Division (HMWMD) regulations. The Contractor shall pay for such chemical analyses and will coordinate with local authorities to determine the quantity and origin of samples analyzed for any questionable material. The Contractor will provide the classification of the material to the City.
- G. The routes to be followed when transporting solid or hazardous wastes may be subject to the approval of the local agency having jurisdiction.
- H. The Contractor shall not wash down equipment in such a manner as to flush grease and oils into the project site or onto airport property unless the waste is properly contained, treated, and disposed.
- I. Unless waived, the Contractor shall submit a Waste Management Plan that meets these minimum requirements:
1. Contractor's name and contract number;
  2. A list of all materials, products, and wastes for the project; acknowledgment whether any of those materials and products require special handling or storage for environmental, safety, or fire code reasons; and acknowledgment whether any of the wastes will become regulated wastes upon disposal. The list of materials, products, and wastes shall include, at a minimum, trash and unclassified construction debris, asphalt spoils, concrete spoils, pavement sweepings, soils contaminated by chemicals or petroleum products during the project, lime and cement trimmings, scrap metal, and every chemical product used on the project. Reuse of a product on site for its original intended purpose (e.g., cement trimmings from one part of the project used elsewhere on the airport) does not constitute generation of a waste for disposal.
  3. For each material and product listed, the Contractor shall identify the storage method, and identify measures to store hazardous waste separately from non-hazardous waste.
  4. For each waste listed, the Contractor shall identify the handling/transportation method, the disposal method, and the disposal facility utilized.
  5. If the Contractor anticipates generation of hazardous waste, the Contractor shall provide its USEPA (generator) identification number.
  6. Recycling measures.
  7. Waste minimization measures.

8. Pollution prevention measures.
  9. Training measures for management of hazardous materials and hazardous wastes on site.
- J. The Contractor shall maintain copies of MSDSs for any and all materials used at the airport project, at its on-site project office or other designated location. DIA Environmental Services may, at any time, request copies of MSDSs and/or waste manifests for any waste shipments from the project site. Any such request must be fulfilled within 1 business day.
- K. The Contractor shall require all shipments to the worksite to contain documentation that shows whether the material is hazardous or requires special handling, storage, or disposal; what type of material it is; what hazard(s) it poses; how to treat exposure(s); and the quantity of hazardous material in the shipment. This information must be provided to the DIA PM prior to any hazardous material being allowed on site.
- L. Before leaving the site with any hazardous waste or material requiring special handling, disposal, or storage, the Contractor must provide the DIA PM with a detailed description of the material, its source, quantity, who is hauling it off site, and where it is being taken, along with verification that the destination site can legally receive it.
- M. The Contractor shall recycle all construction materials to the extent practicable.

### 3.06 CONSTRUCTION DEBRIS RECYCLING

- A. The City and County of Denver encourages recycling applicable materials. Scrap metal, wood, and other construction materials may be eligible for recycling. The Contractor is responsible for coordinating all aspects with regard to recycling. The Contractor can contact DIA Purchasing or DIA Environmental Services for information regarding recycling policies and practices.
- B. Dry concrete and asphalt materials are considered solid waste, but may be eligible for recycling. DIA maintains two dry concrete and asphalt recycling yards used for the accumulation and crushing of these materials. The only allowable materials at the recycle yards are dry concrete and asphalt materials derived from construction activities occurring on DIA property. The South Yard is located on 71<sup>st</sup> Ave just east of Jackson Gap Street. The North Yard is located on the south side of 110<sup>th</sup>, west of Queensburg Street. The use of these yards must be approved by the DIA Project Manager.
1. Concrete washout activities are prohibited anywhere on DIA property unless a) the activity is specifically authorized under a CDPS permit and included in the SWMP or b) the washwater is collected and hauled offsite for disposal at an appropriately permitted facility. Concrete washout activities authorized by permit are only allowed at a designated concrete washout area as indicated in the approved CASMP and include the washing of the chute and tools ONLY. Concrete washout spoils are eligible for recycling once the washout has been segregated and allowed to dry and harden in accordance with permitted methods.
  2. Rejected loads and/or other wet concrete or asphalt materials are prohibited to be placed ANY WHERE on DIA property unless the Contractor holds a permit that authorizes the placement of such material on the site. Unless specifically authorized in a CDPS permit issued to the Contractor, these materials must be returned to the facility of origination or other permitted facility for proper disposal.
  3. The Contractor shall not place any concrete containing welded wire fabric or deformed steel reinforcing bars installed in a crisscross fashion in either of the airport's two construction spoils recycling yards. The Contractor shall remove

reinforced concrete from the project site and haul such waste to the DADS landfill.

4. A Recycle Materials Manifest is required to be filled out by the Contractor for each load of concrete or asphalt placed in these areas and given to the responsible Project Manager. It will be the responsibility of the Project Manager to ensure the accuracy and completeness of the manifests. The Project Manger will also be responsible for instituting controls to ensure that only the manifested materials are placed in the approved site. If two or more Project Managers have material going into a site at the same time, they will need to coordinate their efforts to ensure that only approved and manifested materials are allowed on the site.
5. A copy of all manifests must be turned in on a weekly basis to the Assistant Deputy Manager of the Construction Management Section (Michael Steffens). A copy of the Recycled Materials Manifest form is available from the DIA Project Manager.

**NOTE:** Concrete and asphalt waste materials are considered a potential pollutant source and must be addressed in the CASMP and/or SWMP.

### 3.07 STORAGE OF OIL, FUELS, OR HAZARDOUS SUBSTANCES

- A. The Contractor shall prevent oil or other hazardous substances (as defined in federal and state regulations) from entering the ground, drainage or local bodies of water, and shall provide containment, diversionary structures, or equipment to prevent discharged oil from reaching a watercourse and take immediate action to contain and clean up any spill of oily substances, petroleum products, or hazardous substances. The Contractor shall provide one or more of the following preventive systems at each petroleum storage site:
  1. Dikes, berms, or retaining walls capable of containing at least 100% of the volume of the largest single tank and equipped with sufficient freeboard to contain precipitation events. The secondary containment must be “sufficiently impermeable” to prevent a release to the environment.
  2. Culverting, curbing, guttering or other similar structures capable of containing at least 100% of the volume of the largest single tank.
- B. The provision of such preventive systems shall be subject to acceptance by the DIA PM prior to tank installation and shall follow the SPCC regulations (40 CFR Part 112).
- C. Prior to bringing any containers of 55-gallon or above capacity onto DIA property for storage of oil, fuel, or other petroleum substances, the Contractor may be required to prepare an SPCC Plan that conforms to 40 CFR Part 112. The plan must include either a certification from a Professional Engineer or self-certification (if applicable), as well as management approval from the legally responsible Contractor representative.

### 3.08 SPILL RESPONSE AND NOTIFICATION

- A. The Contractor is responsible for all spills that may result from its activities. For ANY suspected or confirmed release or spill of oil, fuel, solid waste, hazardous waste, unknown materials, lavatory waste, or miscellaneous chemicals, etc. that occurs as the result of the Contractor’s activities on DIA property, the Contractor is required to take immediate action to mitigate the release or spill and report it to the DIA Project Manager and to the DIA Communications Center at (303) 342-4200.
- B. The Contractor is responsible for notifying the appropriate regulatory agency(ies) in the event suspected and/or confirmed releases are identified, in accordance with regulatory requirements.

### 3.09 SITE REMEDIATION AND RESTORATION

- A. The Contractor shall be required to perform any necessary site assessment and remediation activities required by applicable regulatory agency(ies).
- B. During routine construction activities, the Contractor is required to manage soils using typical construction techniques. The Contractor must differentiate between soils and wastes (including contaminated soils versus clean soils) and determine those materials that can remain on DIA property and those that must be transported offsite for disposal.
- C. During all construction activities that require the management of soils, the Contractor must notify the Project Manager and DIA Environmental Services (ES) that soils being managed may be impacted by industrial activities conducted at the airport. "Process knowledge" pertaining to previous use and/or impact for the location(s) under construction can be used to determine whether impacted soils are probable. Also, common indices such as soil staining and odor can be used as a determination for the probable condition. If probable contamination conditions are suspected, the Contractor will notify the Project Manager and DIA ES immediately. At that time (which may be before the work is initiated where indicative conditions exist), all work will cease until a sampling and analysis approach is determined and implemented by the proper responder.
- D. If the site conditions warrant based on evidence of spillage or contamination, process knowledge, and/or visual or olfactory observations, the Contractor may be required to conduct sampling and analysis to confirm that no remedial action is required. Prior to conducting any removal activities, the Contractor must provide a Scope of Work to the DIA PM describing the proposed site assessment activities.
- E. The impacted project will modify its operation to include a segregation area where probable impacted soils can be placed, stored, and sampled for characterization. Should the soil materials be determined to exceed the applicable standards, the Project Manager in conjunction with DIA ES, will be responsible for the proper disposal of these materials. Materials that are determined to contain contamination levels below the applicable standards can be considered clean soils and placed back into the excavation or reused elsewhere on DIA property. In accordance with Section 3.06, materials removed that are suitable for recycling will be placed within areas designated on DIA to store these materials.
- F. The Contractor shall restore any area on the Airport which becomes contaminated as a result of its operations. Restoration shall be either to applicable standards under federal and state law or to such other levels as may be required by the Manager of Aviation, at the Manager's sole discretion. Such restoration shall be completed at the earliest possible time, and the Contractor's restoration shall be subject to inspection and approval by the Manager of Aviation or her duly authorized representative (see DIA Rules & Regulations – Part 180).

## PART 4 - MEASUREMENT

### 4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for work under this Section.

## PART 5 - PAYMENT

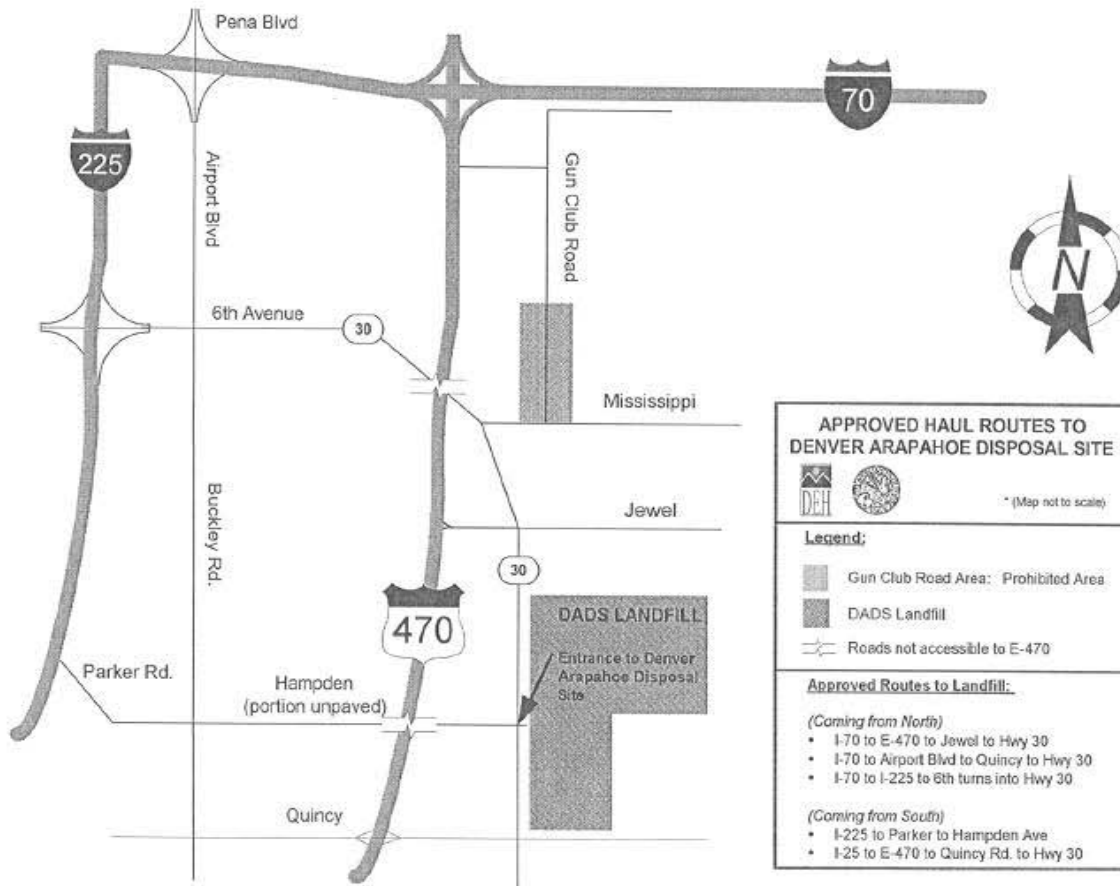
### 5.01 METHOD OF PAYMENT



- 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 applicable unit price item, work order or lump sum bid items. The Contractor shall be responsible for payment of all fees associated with review of environmental permit applications and processing of environmental permits.

**EXHIBIT A**

**MAP OF ROUTE TO DADS LANDFILL**



**END OF SECTION 01566**

## SECTION 01580

### TEMPORARY SIGNS

#### PART 1 - GENERAL

##### 1.01 CONSTRUCTION SIGNAGE VISIBLE TO THE PUBLIC.

##### 1.02 TEMPORARY DIRECTIONAL, INFORMATIONAL OR REGULATORY SIGNAGE.

##### 1.03 QUALITY CONTROL

- A. Construction and other temporary signage visible to the public must be commercial grade quality, professionally fabricated and installed for the location of the sign. The contractor is responsible to maintain this signage until it is no longer needed.

#### PART 2 - PRODUCTS

##### 2.01 GENERAL

- A. Interior signs that are visible and not physically accessible to the public may be made of rigid board, such as "Gator Board" with vinyl messages. All edges must be finished and conceal all attachments.
- B. Interior signs that are visible and physically accessible by the public must be vandal-proof. Acceptable examples of vandal-proof signs are messages applied second surface with concealed tamperproof fasteners.
- C. Exterior signs must be vandal-proof and fabricated of weatherproof materials.

#### PART 3 - EXECUTION

##### 3.01 HARDWARE

- A. Interior Signs: Attach with suitable adhesive and/or tape which may be removed with out damage to finishes.
- B. Exterior Signs: Must be secured to withstand site conditions and varying weather conditions.

##### 3.02 SIGN FINISHES, MATERIALS AND PAINT

- A. Provide temporary signage to reflect permanent sign design and/or as directed by the Signage Design Project Manager. Submit temporary sign finishes, materials and paint, etc., for review and approval prior to any fabrication.

##### 3.03 MAINTENANCE

- A. The Contractor is responsible to maintain temporary signage until it is no longer needed.

##### 3.04 REMOVAL

- A. The contractor is responsible to remove all temporary signs, clean and refurbish affected

areas to their original (or intended) condition.

#### **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 applicable unit price item, work order or lump sum bid item.

**END OF SECTION 01580**

## 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.

##### 1.02 SUBMITTALS

- A. Refer to Technical Specifications Sections 01300 and 01340 for submittal procedures. 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. Material and equipment shall be stored only in those areas that are indicated as storage areas on the contract drawings and on the reviewed and accepted working drawings. 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 applicable unit price item, work order, or lump sum bid item. 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. The Contractor is to use the Request for "Or Equal" Approval form found in the Instructions to Bidders before submitting his bid. The Request for Substitution form, found in Section 01999, is used after the Contractor receives his Notice to Proceed.
- 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.

##### 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 Deputy Manager of Aviation 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 Deputy Manager of Aviation. 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 applicable unit price item, work order or the lump bid item.

**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.

##### 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

signoff 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 minimum of 16 hours of maintenance training to the Airport. Classes shall accommodate up to five people at a time.
- D. The Contractor shall provide a minimum of 8 hours of operator training to the Airport. Classes shall accommodate up to five people at a time with up to two separate courses (one for each shift).
- E. 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.
- F. 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. All disks shall be labeled using the LightScribe technology.
- G. 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 applicable unit price item, work order or the lump bid item. 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. Work has been inspected by the Contractor for compliance with contract documents.
  - 2. Work has been completed in accordance with contract documents.
  - 3. Work is ready for final inspection by the City.
  - 4. All as-built required documents have been submitted and accepted.
  - 5. All damaged or destroyed real, personnel, public or private property has been repaired or replaced.
  - 6. All operation and maintenance manuals have been submitted and accepted and all training has been completed.
  - 7. All personnel badges and vehicle permits have been returned to DIA Airport Security.
- 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 \$75.00 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 applicable unit price item, work order, or lump sum bid item.

**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.

##### 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

- A. Washing Plan. The Contractor shall prepare a plan describing the specific procedures and materials to be utilized for any equipment, vehicle, etc. washing activities. The plan must be submitted to the PM and also approved by the PM and Environmental Services. Outdoor washing at DIA is not allowed unless the materials will be collected or managed in a manner to ensure that they will not enter the municipally-owned separate storm sewer system (MS4). The materials can only be disposed at a location pre-approved by DIA Environmental Services (refer to DIA SWMP). Failure to comply with this requirement would result in the

discharge of non-stormwater. Indoor washing must be conducted in accordance with the Best Management Practices (BMPs) detailed in the DIA SWMP. Refer to Technical Specification 01566. In addition, all indoor washing must be conducted in a manner that ensures that there are no prohibited discharges to the sanitary sewer system.

## **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. DIA Environmental Services must approve the chemicals used prior to discharge to the sanitary sewer system.
- C. Ensure proper disposal of all wastes generated from the use of these materials. Must ensure compliance with all environmental regulations. No wastes can be disposed on DIA property.

## **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, public rights of way, or on the Denver International Airport site.
- 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.
- M. Dispose of all fluids according to the approved Washing Plan.

### **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, whether previously occupied and operational or not.
- I. Dispose of all fluids according to the approved Washing Plan.

## **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 applicable unit price item, work order or lump sum bid item.

**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.

##### 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.
- C. As-built contract drawings shall be submitted with each monthly progress payment application, and a complete set shall be submitted prior to final payment.
1. The Contractor shall provide a single electronic copy of each contract drawing sheet which has been used to produce work during the payment period or work that payment is being requested on, which records the current as-built conditions of work, including the posting of any change orders or change directives not shown on the contract documents at the time of contract signing.
    - a. The Contractor must show as-built work completed through the payment application date including but not limited to utilities, empty conduit, conduit for actual electrical lines, plumbing, HVAC, location of anchor bolts and support points for use by others.
    - b. The Contractor shall be liable for any costs incurred by the City or a third party due to errors or lack of information provided on the as-built drawings.
    - c. All markings on drawings shall be legible to identify the portion of work completed.

##### 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. Affirmative Action Plan and documents.
    - e. 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. Label each document page or article "PROJECT RECORD" in two inch high letters.
- B. Keep record documents current daily.
- C. Legibly mark copies of the contract drawings to record actual construction.
- D. Legibly mark up each Section of the technical specifications and contract drawings to record:
  - 1. Manufacturer, trade name, catalog number and supplier of each product and item actually installed
  - 2. Changes made by change orders, requests for information, substitutions and variations approved by submittals.

### **3.03 DOCUMENT MAINTENANCE**

- A. Provide files and racks for storage of documents to maintain in 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 \$75.00 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 applicable unit price item, work order or lump sum bid item.

**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 one (1) 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 one (1) bound hard copy of the complete Operation and Maintenance Data Manuals in final form 30 days prior to system startup.
- D. Submit one (1) electronic copy and one (1) 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 11 inches, 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 applicable unit price item, work order, or lump sum bid item.

**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.

##### 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 applicable unit price item, work order or lump sum bid item.

**END OF SECTION 01740**



**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 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 forms:
1. Daily Quality Control Report (Form CM-13) (1 Page)
  2. Request for Information (Form CM-17) (1 Page)
  3. Submittal Transmittal Form (Form CM-30) (Page 1 of 2)
  4. Submittal Transmittal Form (Form CM-30) (Page 2 of 2)
  5. Contractor Warranty (Form CM-10) (4 Pages)
  6. Contractor/Subcontractor Warranty (Form CM-11) (4 Pages)
  7. Contractors Certification of Payment (Form CM-19) (this form shall be completed and submitted with each pay application) (1 Page)
  8. Pay Application Form (CM-18) (1 Page)
  9. Certificate of Current Cost or Pricing Data (Form CM-69) (1 Page)
  10. Subcontractor Partial Lien Release Form (Form CM-26) (1 Page)
  11. Subcontractor Final Lien Release Form (Form CM-70) (1 Page)
  12. Request for Substitution (Form CM-09) (5 pages)
  13. System Shutdown Request Forms:
    - a. AGTS and Baggage Systems
    - b. Airfield Systems
    - c. CCTV Security Systems
    - d. Electrical Power and Lighting
    - e. Elevator, Escalator and Autowalk
    - f. Fire Protection Plumbing
    - g. HVAC Systems
    - h. Temperature Control Systems
    - i. Life Safety/ Fire Alarm Systems
    - j. Plumbing
    - k. Roadways

- I. Security
- m. Sterile Public Areas
- n. X-Ray

## **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 applicable unit price item, work order or lump sum bid item.

**END OF SECTION 01999**

## SECTION 05999

### WELDING

#### PART 1 -GENERAL

##### 1.01 SUMMARY

- A. Welding is that work defined in American Welding Society (AWS) "Standard Welding Terms and Definitions - AWS A2.4" and as otherwise shown on drawings.
  - 1. All welding on this project shall comply with requirement of specification, Section 05999 "Welding", and other documents such as but not limited to drawings. If there is a conflict between Project Drawings, codes, and specifications, the more stringent shall apply.
- B. Extent of welding work is shown on drawings, including schedules, notes and details to show size and location of welds. Welding Symbols shall be in accordance with AWS/A2.4-Standard Symbols for Welding, Brazing, and Nondestructive Examination.
- C. Nothing stated in this Section shall be interpreted as diminishing or eliminating requirements stated in other Sections.

##### 1.02 RELATED DOCUMENTS

- A. Drawings, General and Special conditions, general requirements and other applicable Technical Specifications apply to work of this Section.
- B. IEEE-1992. Only welding machines that have been tested and comply with harmonic distortion requirements of IEEE-1992 shall be allowed to operate off of DIA electrical power system.

##### 1.03 RELATED SECTIONS

- A. This section "Section 05999 Welding" will apply to all welding performed under all other sections of this specification.
- B. Division 15 sections.

##### 1.04 REFERENCE STANDARDS

- A. Welding shall 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.
  - 1. AISC - American Institute of Steel Construction
  - 2. AWS - American Welding Society
  - 3. API - American Petroleum Institute
  - 4. AWWA - American Water Works Association
  - 5. ASME - American Society of Mechanical Engineers.

6. ASTM - American Society for Testing and Materials
7. ASNT - American Society for Nondestructive Testing

#### 1.05 SUBMITTALS

- A. Product Data: Submit producers or manufacturer's specifications and installation instructions for all products, including, but not limited to those listed below. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
  1. Welding Electrodes: Submit manufactures specifications, to include recommended parameters and technique, for each electrode to be used on this project.
- B. Submit shop drawings as specified under Section 01300 for all work specified herein, including complete details and schedules for fabrication and assembly of members, procedures and diagrams. Shop drawings shall indicate how each and every component shall be welded. If another company manufactures a component to be welded to another part(s) or piece(s) to form a larger assembly, then the shop drawings shall include that manufacturer's recommended welding procedures for that component. Design construction drawings shall not be re-used as bases for submitted shop drawings. Shop drawings, which use reproductions of design plans or details, will not be reviewed. Drawings shall be submitted in complete units. Do not submit partial sets.
- C. Shop drawings shall clearly indicate profiles, sizes and locations of structural members, connections, attachments, anchorage's, framed openings, size and type of fasteners, and clearances. Indicate welded connections using standard AWS welding symbols, per AWS A2.4. Clearly indicate net weld lengths and sizes, root openings, bevel angles and other information required to satisfactorily complete welding operations.
- D. Contractor shall submit fully dimensioned Isometric drawings (spool drawings) for all welded piping work. Drawings shall indicate all weld types, sizes and materials to be used. The spool drawing size shall match the full size contract documents of either 24x36 or 34x44. Spool drawings shall be submitted in either the latest version of AutoCAD (dwg) or the latest version of Adobe Acrobat (pdf). Adobe Acrobat files shall not contain security. Other file formats will not be accepted.
- E. Calculations required in other Sections shall show all pertinent members and pieces. Calculations shall be submitted prior to, or with, relevant shop drawing submittals. It is contractor's responsibility to insure that field construction uses connection design as submitted and reviewed.
- F. Test Reports: Submit copies of all test reports conducted on shop and field welded connections. Include data on type(s) of tests conducted and test results. Reports must be sequentially numbered and submitted to the DIA Project Manager within 48 hours of completion.
- G. Individual Welder Qualifications: Submit Welding Performance Qualification Records (WPQR) for all welders, shop and field, prior to any welding per Specification Paragraph 05999 1.06 B.
- H. Procedures: Submit Welding Procedure Specifications for all shop and field welding prior to any welding per Specification Paragraph 05999 1.06 B

## 1.06 QUALITY REQUIREMENTS

- A. Codes and Standards: Comply with provisions of following, as applicable
1. AISC American Institute of Steel Construction
    - a. AISC "Code of Standard Practice for Steel Buildings and Bridges", 1986.
    - b. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings", including "Commentary" and Supplements thereto as issued.
  2. American Welding Society (AWS) D1.1 "Structural Welding Code Steel" and all other applicable A.W.S codes (latest editions).
  3. ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".
  4. All welding shall be performed in accordance with the latest addition of applicable AWS, API, ASME code and ASTM Standards.
- B. Qualifications for Welding Work
1. All Welders shall have been qualified through welding tests in accordance with applicable AWS code per Specification paragraph 05999 1.04 A within one year prior to welding taking place. Evidence of qualification shall be through Welding Performance Qualification Records (WPQR).
  2. All welder qualifications test shall be or shall have been administered and witnessed by an Independent Testing Agency (ITA), AWS Certified Welding Inspector, (CWI).
  3. If recertification of welders is required, delay costs and retesting costs shall be borne by the Contractor.
  4. Welding that is to take place at each and every type of joint shall be per approved AWS procedure for that type of joint. Evidence of intended procedure shall be through written Welding Procedure Specifications.
  5. Any welding done without submission to and approval by the DIA Project Manager of Welding Performance Qualification Records of the individual welder(s) doing the welding and Procedure Specifications for the actual welding shall be considered defective and subject to the provisions of Title 17 of the General Conditions.
  6. All WPS and WPQR qualification testing shall be in accordance with this specification and the applicable welding code requirements.
- C. The Contractor shall periodically review each welders work quality and take any steps required to insure high quality work. This is in addition to Quality Control requirements.
- D. Fabricator Qualifications: Minimum of three years experience specializing in fabrication for similar projects.
- E. Design of Members and Connections: Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work.
1. Promptly notify DIA Project Manager whenever design of members and connections for any portion of structure are not clearly indicated.
- F. Welding and materials shall be inspected and tested by an Independent Testing Agency furnished and paid for by the Contractor. The Independent Testing Agency will have

authority to reject weldments and materials. Such rejection may be based on visual inspection where, in the Inspector's opinion, the weldment or material would not pass more detailed investigation. Reference Specification Section 05999 4.01 for inspection and testing requirements. DIA's Quality Assurance Inspector(s), per the provisions of General Conditions Title 17, will also inspect welding and materials. Inspections by either the Independent Testing Agency or DIA's Quality Assurance Inspector may take place in the mill, shop and field.

1. Promptly remove and replace materials or fabricated components that do not comply with requirements as set forth in the Contract Documents.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

- A. Electrodes for Welding: Comply with AWS Code. Use E70 grade minimum unless otherwise approved. Store all electrodes and welding materials inside and protect from moisture, corrosion, and any other damage. Damaged electrodes shall not be used.

### **2.02 FABRICATION**

- A. Shop Fabrication and Assembly: Fabricate and assemble components in shop to greatest extent possible.
  1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
  2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.
- B. Holes for Other Work: Provide holes required for securing other work to components, and for passage of other work through components, as shown on final shop drawings.
  1. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work.
  2. Cut, drill, or punch holes perpendicular to metal surfaces. The DIA Project Manager shall approve any enlarging of holes by flame cutting
- C. Contractor will notify DIA Project Manager or his representative at least 48 hours prior to any commencing fabrication. Notification to include starting date and duration of work.

### **2.03 SHOP CLEANING AND PAINTING**

- A. Components to be painted are as shown on the drawings.
  1. Do not paint surfaces, which are to be welded.
  2. Do not paint over welded joints until after Independent Testing Agency and DIA Quality Assurance Inspector have approved them.

## **PART 3 - EXECUTION**

### **3.01 ERECTION**



- A. Do not enlarge misaligned or undersized holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
- B. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members, which are not under stress, as acceptable to DIA Project Manager. Finish gas-cut sections equal to a sheared appearance when permitted.
- C. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Once Independent Testing Agency and DIA Quality Assurance Inspector have approved welds, apply paint to exposed areas using same material as used for shop painting.
- D. No welding machines are to be operated off of DIA power until such machines have been tested for harmonic distortion per IEEE-1992 and approved by DIA Project Manager.
- E. Contractor will notify DIA Project Manager or his representative at least 48 hours prior to any inspections to be performed by ITA.

## **PART 4 - TESTING AND INSPECTION**

### **4.01 INDEPENDENT TESTING AGENCY (ITA)**

- A. See Division 1 for Independent Testing Agency requirements.
- B. The General Contractor shall provide the ITA for all subcontractors. Subcontractors shall not contract with a separate ITA.
- C. Contractor will engage an Independent Testing Agency to inspect welded connections and to perform tests and prepare test reports. The Contractor's Quality Control Inspector will coordinate the inspections and tests performed by the testing lab inspectors and testing personnel.
  - 1. The Contractor's Independent Testing Agency and DIA Project Manager's staff shall conduct and interpret tests and state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom. All reports shall be delivered to the Project Manager. Results not complying with requirements are to be brought to the Project Manager's attention within 24 hours of discovery. All reports shall be sequentially numbered.
  - 2. Provide access for Independent Testing Agency to places where work is being fabricated or produced so that required inspection and testing can be accomplished.
  - 3. The Independent Testing Agency shall inspect work at the plant before shipment; however, DIA Project Manager reserves right, at any time before final acceptance, to reject material not complying with specified requirements.
    - a. Inspections and tests conducted by the ITA or DIA shall not in any way relieve the Contractor of his responsibility and obligation to meet all specifications and referenced standards. Employment of the ITA does not relieve the Contractor of providing the required Quality Control Program.
  - 4. Welding Inspection Personnel Qualifications: All visual welding inspections shall be performed by AWS Certified Welding Inspectors CWI, qualified in accordance with AWS QC1. Inspectors qualified in accordance with the most current edition of the

- American Society for Nondestructive Testing Recommended Practice No. SNT-TC 1A, shall perform all non-destructive inspections other than visual inspections
5. Independent Testing Agency Inspectors working for the Contractor shall identify with a distinguishing mark all parts and joints they have inspected and accepted. Marks to be visible from at least 50 feet. DIA Project Manager and the Quality Control Inspectors shall mutually agree upon identifying marks.
  6. Independent Testing Agency welding inspector shall be on job site however much time it takes to guaranty that all requirements of Project Specifications and codes are being met and provide written reports showing specific requirements have been met. Shop inspections by ITA welding inspector shall be performed in such a manor as to guaranty that all provisions of Project Specifications and codes are being met and provide written reports showing specific requirements have been met.
- D. The Contractor shall furnish such facilities and provide such assistance as may be required for carrying out the inspection prescribed herein. He shall notify the Independent Testing Agency and the DIA Project Manager at least two weeks in advance of the start of any qualification testing for welding.
- E. The Testing Agency's Inspector will perform his duties in such a way that neither fabrication nor erection is unnecessarily delayed or impeded. The Testing Agency shall notify the DIA Project Manager of any scheduled inspections at least 48 hours prior to such time. The Project Manager shall also be notified as soon as possible prior to any unscheduled inspections. In no case will the inspector recommend or prescribe the method of repair of a defect.
- F. Inspection of welding will be such as to assure that all requirements of Project Specifications AWS D1.1, and other applicable welding codes are being complied with. Reports shall show the following items as being in conformance, but not be limited to just the items shown:
1. Verify that electrodes used for welding conform to the requirements Manufacturer, AWS, and other applicable Welding Codes and Standards.
  2. Verify that the approved Welding Procedure Specifications and the approved welding sequence are followed without deviation.
  3. Verify that only welding operators and welders who have been properly qualified will perform the welding. The inspection agency will witness such qualification testing of welding operations and welders, as may be required. Reference Specification Section 05999 1.06 B for Welder Qualification and Welding Procedure requirements.
  4. Verify that the fit up, joint preparation, size, contour, extent of reinforcement, and length and location of welds conform to specified requirements such as but not limited to applicable welding codes, Welding Procedure Specifications, and drawings.
  5. Review Mill Test Reports of material for compliance with Project Specifications, all applicable Codes, and Drawings.
  6. ITA inspection reports shall list all inspected, nonconforming, repaired, and accepted welds.
- G. DIA Project Manager shall be informed at least 48 hours prior to shop and field welding so random inspections can be performed as stipulated in these specifications and General Conditions, TITLE 17.

- H. All welders shall mark their welds with identifying marks. Contractor shall furnish DIA Project Manager with list of welders and their marks. List shall be updated each time a welder is added or subtracted.

#### 4.02 STRUCTURAL STEEL

- A. The Independent Testing Agency will test shop and field welds per ASTM E 543 and applicable welding code requirements as follows:
1. All welds: 100% visual.
  2. Delamination and non-metallic inclusion tests of base metal:
    - a. Plates and portions of rolled shapes three inches or greater in thickness shall be 100% ultrasonically tested in a zone extending six inches in all directions from any full penetration groove weld which transmits stress through the thickness of the material, or any weld which, because of restraint and/or weld shrinkage will, in the opinion of the inspector, cause significant through-thickness (Z-direction) stress in the material. Such tests shall be made after completion of welding. Acceptance Criteria for such tests shall be in accordance with ASTM A435.
  3. All full penetration or partial penetration groove welds require 100% ultrasonic testing:
  4. All fabricated trusses including all fabricated trusses acting, as girders shall be 100% magnetic particle tested.
  5. Studs on all embed assemblies: 100% of studs tested by hammer method and visual inspection.
  6. Wall and roof deck connections
    - a. 10% Magnetic Particle
  7. All other welded connections: 10% Magnetic Particle.
  8. Additional Testing shall be performed by the Independent Testing Agency as noted in paragraph 4.02, B below.
- B. Additional Field Weld Testing
1. In addition, if defective welds are discovered, the remaining un-inspected welds shall receive such ultrasonic or magnetic particle inspection as may be required by the DIA Project Manager. If more than 10 percent of a welder's welds fail or when a CWI (Certified Welding Inspector) feels that the quality of the qualified welder's work appears to be below the requirements of the applicable AWS Code, he/she shall be removed from the job and retested to demonstrate compliance with AWS D1.1 (Latest Edition) or other applicable AWS codes and all other applicable AWS codes.
  2. Additional testing shall be required if more than 10% of the Magnetic Particle tested welds are rejected. Then an additional 10% will be tested using either Magnetic Particle or Dye Penetrant Testing. This 10% additional testing shall be repeated until rejection rate drops below one in 10.
  3. When ultrasonic indications arising from the weld root can be interpreted as either a weld defect or the backing strip, the backing strip shall be removed at the expense of the contractor, and if no root defect is indicated on this retest, and no significant amount of the base and weld metal have been removed, the joint needs no further repair or welding. If a defect is still indicated, it shall be repaired.
  4. The welding inspector will have the authority to reject weldments. Such rejection may be based on visual inspection where in his opinion the weldment would not pass a

more detailed investigation.

5. Reports by the Independent Testing Agency inspector will contain, as a minimum, an adequate description of each weld tested, the identifying mark of the welder responsible for the weld, a critique of any defects noted by visual inspection or testing, and a statement regarding the acceptability of the weld tested, as judged by current A.W.S. standards. A copy of all tests results, including ultrasonic and x-ray, shall be provided to the DIA Project Manager within 48 hours of the test occurrence. This requirement includes all failed tests. Any test that shows work not in conformance with the contract requirement shall be retaken after the non-conformity is corrected. The retest shall refer to the failed test. Radiographic testing may be substituted for ultrasonic.
- C. Correct deficiencies in structural steel work, which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of corrected work.

#### 4.03 METAL FABRICATIONS

- A. Welding shall be performed in accordance with applicable AWS welding code and these specifications.
- B. 100% visual inspection of all welds.
- C. 10% Magnetic Particle testing of all welds.
  1. Additional testing shall be required if more than 10% of the Magnetic Particle tested welds are rejected. Then an additional 10% will be tested using either Magnetic Particle or Dye Penetrant Testing. This 10% additional testing shall be repeated until rejection rate drops below one in 10.

#### 4.04 CONCRETE REINFORCING BARS

- A. Welding shall be performed in accordance with this specification, AWS D1.4, and other applicable AWS Codes and Standards.
- B. 100 % visual inspection of all welds, Per AWS D1.4 Structural Welding Code Reinforcing Steel, or other AWS Codes as applicable.
- C. 10% Magnetic Particle testing of all welds.
  1. Additional testing shall be required if more than 10% of the Magnetic Particle tested welds are rejected. Then an additional 10% will be tested using either Magnetic Particle or Dye Penetrant Testing. This 10% additional testing shall be repeated until rejection rate drops below one in 10.

#### 4.05 SHEET STEEL

- A. Welding shall be in accordance with AWS D1.3 Structural Welding Code- Sheet Steel.
- B. Inspection
  1. 100 % visual in accordance with acceptance criteria of AWS D1.3.
  2. 10% Magnetic Particle testing of all welds.

3. Additional testing shall be required if more than 10% of the Magnetic Particle tested welds are rejected. Then an additional 10% will be tested using either Magnetic Particle or Dye Penetrant Testing. This 10% additional testing shall be repeated until rejection rate drops below one in 10.

#### **4.06 DIVISION 15 BASIC MECHANICAL MATERIALS AND METHODS**

- A. All welding in Division 15 Mechanical shall comply with the applicable AWS, ASME, AWWA, and API codes, latest editions.
- B. All shop and field welds will be inspected per these specifications and applicable code for work being performed.
- C. All welds shall be 100% visually inspected by ITA supplied by Contractor. Additional testing shall be as required by other parts of 05999, applicable codes, DIA Project Manager and Designer of Record.
  1. Hot and chilled water piping/Hydronic Piping: ASME B31.9
    - a. 100% visual inspection per acceptance criteria of ASME B31.9.
    - b. All other requirements of ASME B31.9 as required for the application.
  2. Piping, ductwork and mechanical equipment supports: AWS D1.1 and other applicable AWS Codes.
    - a. 100 % visual inspection
    - b. Magnetic Particle Test requirements are the same as 4.02 Structural Steel.
  3. Water Lines: Per AWWA, AWS D1.1 latest edition, and Denver Water Board Specifications. If there is a conflict the more stringent shall apply.
    - a. 100% visual inspection per AWS D1.1 visual acceptance criteria.
    - b. AWWA requires that welds be 100% Dye Penetrant Tested in place of Magnetic Particle testing.
- D. Forged fittings, for branch connections and etc. shall be welded in accordance with this specification, ASME B31.1, and manufacturer's recommendations. In the event of a conflict, the more stringent shall apply.
  1. Fittings shall be full penetration welded.
  2. Inside of fitting shall be inspected for full penetration. This shall be done prior to any welding on inside if so required. If weld is required on inside of full penetration joint, it shall be ground or back gouged to sound base metal.

### **PART 5 - MEASUREMENT**

#### **5.01 METHOD OF MEASUREMENT**

- A. No separate measurement shall be made for work under this Section.

### **PART 6 - PAYMENT**

#### **6.01 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 applicable unit price item, work order or lump sum bid item.

**END OF SECTION 05999**

## DIVISION 15 – MECHANICAL

### SECTION 15010

#### BASIC MECHANICAL REQUIREMENTS

#### PART 1 -GENERAL

##### 1.01 RELATED DOCUMENTS

- A. The General Conditions, Supplementary Conditions and Division 1, General Requirements apply to this Section, Section 15050 - Basic Mechanical Materials and Methods and Contractor shall review and adhere to all requirements of these Documents.

##### 1.02 WORK INCLUDED

- A. Basic requirements common to the work in general of Division 15 and other Divisions and Sections of the Specification where referenced.
- B. Provide, unless specified otherwise, all labor, materials and equipment necessary for completely finished and operational mechanical systems described and specified under other Sections of this Division 15.
- C. Provide all minor incidental items such as offsets, fittings, and accessories required as part of the work even though not specified or indicated.
- D. Inspection: Inspect work preceding or interfacing with work of Division 15 and report any known or observed defects that affect the Work to the General Contractor. Do not proceed with the work until defects are corrected.

##### 1.03 REFERENCES

- A. General.
  - 1. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable Codes.
  - 2. The date of the standard is that in effect as the date of the Contract Documents, except when a specific date is specified.
  - 3. When required by individual Specifications Section by means of reference for cleaning or installation requirements, etc.; obtain a copy of the standard. Maintain the copy at job site during work until substantial completion. Copy may be in electronic format.
  - 4. Schedule of Referenced Organizations: The following is a list of the acronyms of organizations referenced in these Specifications:

<u>Acronym</u>	<u>Organization</u>
AABC	Associated Air Balance Council
ABMA	American Bearing Manufacturers Association
ACGIH	American Conference of Governmental Industrial Hygienists
ACI	American Concrete Institute
ASA	American National Standards on Acoustics and Vibrations
ADC	Air Diffusion Council
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing of Materials
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ATA	Air Transport Association of America
AWS	American Welding Society
EPA	Environmental Protective Agency
FM	Factory Mutual Insurance Association
HI	Hydronics Institute
IBC	International Building Code
IFC	International Fire Code
ISA	Instrument Society of America
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry
NACE	National Association of Corrosion Engineers
NAPCA	National Association of Pipe Coating Applicators
NEMA	National Electrical Manufacturers Association
NEBB	National Environmental Balancing Bureau
NFPA	National Fire Protection Association
NIST	National Institute of Science and Technology
SMACNA	Sheet Metal and Air Conditioning Contractor's National Association
SSPC	The Society for Protective Coatings
UL	Underwriters' Laboratories

#### 1.04 DEFINITIONS

- A. Conform to Division 1: These Specifications are of abbreviated, simplified or streamlined type and include incomplete sentences. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of the Contract Documents so indicates.
- B. The following words are re-defined and/or elaborated on for the context of Division 15 work:
1. Furnish: Except as otherwise defined in greater detail, term "furnish" is used to mean supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.
  2. Install: Except as otherwise defined in greater detail, term "install" is used to describe operations at Project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations, as applicable in each instance.
  3. Provide: Except as otherwise defined in greater detail, term "provide" means furnish and install, complete and ready for intended use, as applicable in each instance.



4. General Contractor: The term "General Contractor" used in Division 15 and elsewhere in the Contract Documents means the party with whom the Owner has executed the Owner-Contractor Agreement.

#### 1.05 QUALITY CONTROL

- A. Conform to Division 1. Materials and apparatus required for the work to be new and of first-class quality; to be furnished, delivered, erected, connected and finished in every detail; and to be so selected and arranged so as to fit properly into the building spaces. Where no specific kind or quality of material is given, a first-class standard article shall be furnished.
- B. Unless otherwise specifically indicated, equipment and materials to be installed in accordance with the recommendations of the Manufacturer. This includes the performance of tests as recommended by the Manufacturer.

#### 1.06 REGULATORY REQUIREMENTS

- A. Comply with latest editions of all applicable Codes, Standards, Ordinances and Regulations in effect as of the date of the Contract Documents adopted by CCD, BD, and FD, including but not necessarily limited to the following:
  1. National Electrical Code NFPA-70.
  2. NFPA.
  3. ASHRAE.
  4. SMACNA.
  5. Underwriters Laboratories.
- B. If discrepancies occur between the Contract Documents and any applicable Codes, Guidelines, Ordinances, Acts, or Standards, the most stringent requirements shall apply.
- C. Where hourly fire ratings are indicated or required, provide components and assemblies meeting requirements of the American Insurance Association, Factory Mutual Insurance Association and listed by Underwriters Laboratories, Inc.

#### 1.07 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. Substitutions: Refer to Division 1, General Requirements.
- B. Some materials and equipment are specified by Manufacturer and catalog numbers. The Manufacturer and catalog numbers are used to establish a degree of quality and style for such equipment and material.
- C. When alternate or substitute materials and equipment are used, Contractor shall be responsible for space requirements, configurations, performance, changes in bases, supports, structural members and openings in structure, electrical changes and other apparatus and trades that may be affected by their use.
- D. When providing a product and/or service under the qualification of "acceptable equal," Contractor shall be entirely responsible for additional costs incurred due to modifications to the civil, Architectural, structural, mechanical, and electrical design that may be required to accommodate the "acceptable equal."

- E. Substitute materials and equipment are only allowed to be provided from the Manufacturers listed as approved.

#### **1.08 SHOP DRAWINGS AND PRODUCT DATA**

- A. General: Comply with the General Conditions of the Contract and with Division 1 - General Requirements.

#### **1.09 CONTRACT RECORD DOCUMENTS**

- A. General: Comply with the General Conditions of the Contract and with Division 1 - General Requirements,

#### **1.10 OPERATING AND MAINTENANCE DATA**

- A. Division 15 Contractor shall submit five (5) typed and bound copies of the maintenance manual, 8-1/2" x 11" in size, and one (1) CD-ROM containing a single PDF file of the entire maintenance manual to the DIA Project Manager, General Contractor for their approval. These approved copies shall then be transmitted to the DIA Project Manager.
- B. The manual shall be enclosed in a stiff-back, three-ring binder and shall have:
  - 1. Alphabetical list of all system components including the name, address, and 24-hour phone number of the company responsible for servicing each item during the first year's operation.
  - 2. Operating instructions for complete system, including emergency procedures for fire or failure of major equipment and procedures for normal starting/operating/shutdown and long-term shutdown.
  - 3. Maintenance instructions, including valves, valve tag and other identified equipment lists, proper lubricants and lubricating instructions for each piece of equipment and necessary cleaning/replacing/adjusting schedules.
  - 4. Manufacturer's data on each piece of equipment, including:
    - a. Installation instructions.
    - b. Drawings and specifications (approved shop drawings).
    - c. Parts lists.
    - d. Complete wiring and temperature control diagrams (approved shop drawings).
- C. In addition to the maintenance manual, and keyed to it, the equipment shall be identified and tagged as specified elsewhere. Insert a copy.
  - 1. Identify all starters, disconnect switches, and manually operated controls, except integral equipment switches with permanently applied, legible markers corresponding to operating instructions in the "Maintenance Manual".
  - 2. Tag all manual operating valves with 1-1/2" diameter brass tags attached with chains. Tags are to be sequence numbered with legible metal stamps.
  - 3. Provide a typed tag list or schedule mounted under glass in the room designated by DIA Project Manager stating number, location, and function of each tagged item. Insert a copy of tag list in each "Maintenance Manual".
  - 4. Include the identification list in the PDF version of the Maintenance Manual.

- D. Division 15 Contractor shall be responsible for scheduling instructional meetings for maintenance personnel on the proper operation and maintenance of all mechanical systems, using the maintenance manual as a guide. These meetings must be scheduled through the Project Manager, and General Contractor far enough in advance so that all personnel can be notified.
- E. Division 15 Contractor shall provide proof of performance certification of all Mechanical Equipment and Systems to demonstrate that all Mechanical Equipment and Systems are operating to the intent of the design.

#### 1.11 FINAL OBSERVATION

- A. Comply with the requirements of Division 1 and the following.
- B. Prior to the request for final observation, all Work under the contract shall be completed, all systems shall be in proper working order and placed in operation (System Startup of 48 hours).
- C. All HVAC systems shall be properly balanced with quantities shown on the Drawings, and all water circuits shall be adjusted to provide the proper flows.
- D. All equipment shall be cleaned, including but not limited to, plumbing fixtures. All debris and construction materials shall be removed from the DIA property to a suitable landfill off-airport.
- E. Pumps shall be tested in accordance with Section 15445 and shall be in proper working order and placed in operation.
- F. The temperature control system shall be complete and in proper working order. All instruments shall be properly and accurately field calibrated.
- G. At the request of the Project Manager, a representative of the Contractor who is thoroughly familiar with the Project and operation of the various systems shall be present during the final observation to demonstrate proper operation of the equipment and controls. If requested by the Project Manager, the Contractor shall have representatives from his subcontractors present to assist during final observation.

#### 1.12 PROJECT CONDITIONS

- A. Accessibility.
  - 1. Division 15 Contractor shall be responsible for the sufficiency of the size of shafts and chases and the adequate clearance in double partitions and hung ceilings for proper installation of his work. He shall cooperate with Contractors of other Divisions of the Work whose work is in the same space and shall advise the General Contractor of his requirements. Such spaces and clearances shall, however, be kept to the minimum size required.
  - 2. Division 15 Contractor shall locate all equipment, which must be serviced, operated, or maintained in fully accessible positions. Such equipment shall include (but not be limited to) valves, shock absorbers, traps, cleanouts, motors, controllers, switchgear, and drain points. If required for better accessibility, furnish access doors for this purpose. Minor deviations from Drawings may be allowed to provide for better

- accessibility. Any changes shall be approved by the Project Manager prior to making the change.
3. Division 15 Contractor shall provide the General Contractor with the exact locations of access doors for each concealed valve, shock absorber control, damper, or other device requiring service. Locations of these doors shall be submitted in sufficient time to be installed in the normal course of work.
  4. Provide carpentry, masonry, concrete and metal work required for work of this Division where not specifically called for under other Sections.
- B. Fabrication.
1. Before any ductwork is fabricated and before running and/or fabricating any lines of piping or ductwork, the Contractor shall assure himself that they can be run as contemplated in cooperation with Contractors of other Divisions of the Work and the physical constraints of existing conditions and new Structural and Architectural Work.
- C. Freeze Protection.
1. Do not run lines in outside walls, or locations where freezing may occur. Piping next to outside walls shall be in furred spaces with insulation between the piping and the outside wall. Insulation of piping shall not be considered freeze protection.
- D. Scaffolding, Rigging and Hoisting.
1. Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery into the premises of any equipment and apparatus furnished; remove same from premises when no longer required. Conform to OSHA requirements and standards.

### 1.13 COORDINATION

- A. General: Coordinate and order the progress of mechanical 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.
- B. Coordination with Electrical Work: Section 15050.
- C. Existing System Interruptions: Comply with Division 1.
- D. Cutting and Patching: Section 15050 and Division 1.
- E. Drawings and Specifications: The Mechanical Drawings indicate the general design and arrangement of lines, equipment, systems, etc. Information shown is diagrammatic in character and does not necessarily indicate every required offset, fitting, etc. Do not scale the Drawings for dimensions. Take dimensions, measurements, locations, levels, etc., from the Architectural Drawings and equipment to be furnished.
- F. Discrepancies: Examine Drawings and Specifications for other parts of the work, and if any discrepancies occur between the plans for the work of this Division and the plans for the work of others, report such discrepancies to the Project Manager and obtain written instructions for any changes necessary.
- G. Order of Precedence: The precedence of mechanical construction documents are as Specified in Article 4 of the General Conditions.

#### 1.14 START-UP PROCEDURES

- A. Before start-up, each piece of equipment comprising a part of the system shall be checked for proper lubrication, drive rotation, belt tension, proper control sequence, and any other condition, which may cause damage to equipment or endanger personnel.
- B. Ensure that all control systems are fully operational in automatic mode.
- C. If systems are not to continue in use following the start-up procedures, steps should be taken to ensure against accidental operation or operation by unauthorized personnel.
- D. Factory personnel shall be notified as appropriate to start systems requiring their services.
- E. Notify the DIA Project Manager in writing a minimum of 48 hours prior to start-up of all major mechanical equipment and systems.
- F. Should there be any equipment found which had not been properly started up, it will be the responsibility of this Contractor to arrange for the appropriate personnel to start up the equipment at his expense and at a time as scheduled by the DIA Project Manager.

#### 1.15 SCHEDULE OF TESTING

- A. Provide testing in accordance with the General Conditions of the Contract.
- B. A schedule of testing shall be drawn up by the Division 15 Contractor in such a manner that it will show areas tested, test pressure, length of test, date, time and signature of testing personnel.
- C. Notify the DIA Project Manager, DIA Mechanical Inspector and DIA Mechanical Engineer in writing a minimum of 72 hours prior to testing of any mechanical equipment and systems.
- D. All testing must be performed in the presence Project Manager and or his designated representative; his signature for verification of the test must appear on the schedule.
- E. All testing must be performed in accord with the procedures set forth in Division 15 and other Sections of the Specifications where referenced. At completion of testing, the schedule shall then be submitted in triplicate to the Project Manager.
- F. Make all specified tests on piping, ductwork and related systems as necessary.
- G. Make sure operational and performance tests are made on seasonal equipment.
- H. Complete all tests required by Code Authorities, such as health codes, building codes, and safety codes.
- I. After test runs have been completed and systems have been demonstrated to be satisfactory and ready for permanent operation, all permanent pipeline strainers and filters shall be cleaned, air filters cleaned or replaced, valve and pump packing properly adjusted, belt tensions adjusted, drive guards secured in place, lubrication checked and replenished if required.

#### 1.16 CLEANING AND FINISHING

- A. Provide cleaning in accordance with the General Requirements of the Contract
- B. Cleaning shall include but not be limited to removing grease, dirt, dust, stains, labels, fingerprints and other foreign materials from sight-exposed piping, ductwork, equipment, fixtures and other such items installed under Division 15 of the work. If finishes have been damaged, refinish to original condition and leave everything in proper working order and of intended appearance.
- C. Clean HVAC Piping Systems in accordance with Section 15510 - Hydronic Piping

#### **1.17 WARRANTIES**

- A. Conform to Division 1: Provide a written warranty covering the entire mechanical work to be free from defective materials, equipment and workmanship for a period of two years after date of acceptance. During this period provide labor and materials as required to repair or provide labor and materials required to repair or replace defects. Provide certificates for such items of equipment, which have or are specified to have warranties in excess of one year.

**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 applicable unit price item, work order or lump sum bid item.

**END OF SECTION 15010**

## SECTION 15050

### BASIC MECHANICAL MATERIALS AND METHODS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. This Section includes the following basic mechanical materials and methods to complement other Division 15 Sections.
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Nonshrink grout for equipment installations.
  - 3. Concrete bases.
  - 4. Installation requirements common to equipment specification Sections.
  - 5. Mechanical demolition.
- B. Cutting and patching.
  - 1. Touch up painting and finishing.
- C. Pipe and pipe fitting materials are specified in piping system Sections.

##### 1.02 RELATED SECTIONS

- A. Drawings and general provisions of Contract, including General and the Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 15010 – Basic Mechanical Requirements.
- C. Section 15190 - Mechanical Identification: Labeling and identifying mechanical systems and equipment is specified in Division 15 Section "Mechanical Identification."

##### 1.03 DEFINITIONS

- A. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.
- B. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
- C. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- D. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

#### 1.04 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Shop drawings detailing fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.
- C. Prepare coordination drawings according to Division 1 Section "Submittals" to a 1/4 inch equals 1 foot scale or larger. Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Show where sequence and coordination of installations are important to the efficient flow of the Work. Include the following:
  - 1. Clearances for servicing and maintaining equipment, including space for equipment disassembly required for periodic maintenance.
  - 2. Pump metal support details.
- D. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the Quality Assurance Article.
- E. Floor x-rays and/or ground penetrating radar reports.
- F. "As Built" Plans shall be provided in the same format and manner as described above. Each set shall be equipped with a plan holder equal to "Stacor Plan Clamps" for the appropriate size drawing.
- G. Field Test Reports: Written reports of each pressure tests specified in Division 15 Sections. Include the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Failed test results and corrective action taken to achieve requirements.

#### 1.05 QUALITY CONTROL

- A. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing by the DIA Project Manager and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. No additional costs will be approved for these increases, if larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.
- B. Electronic Equipment Compliance:
  - 1. Contractor warrants that all equipment, devices, items, systems, software, hardware, or firmware provided shall properly, appropriately, and consistently function and accurately process date and time data (including without limitation: calculating, comparing, and sequencing). This warranty supersedes anything in the Specifications or other Contract Documents which might be construed inconsistently. This warranty is applicable whether the equipment, device, item, system, software, hardware, or firmware is specified with or without reference to a manufacturer's name, make, or model number.



- C. Unless specified otherwise, all materials and equipment shall be of domestic (USA) manufacture and shall be of the best quality used for the purpose in commercial practice.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored ductwork, pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.
- C. Protect flanges, fittings, and piping specialties from moisture and dirt.
- D. Deliver ductwork and fittings with plastic sheeting to protect it from elements. Inspect duct liner for exposure to dirt and tears.

#### 1.07 SEQUENCING AND SCHEDULING

- A. Coordinate mechanical equipment installation with other building components.
- B. Coordinate the installation of required supporting devices.
- C. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work.
- D. Coordinate connection of electrical services.
- E. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces.

### PART 2 – PRODUCTS

#### 2.01 PIPE AND PIPE FITTINGS

- A. Refer to individual piping system specification Sections for pipe and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

#### 2.02 JOINING MATERIALS

- A. Refer to individual piping system specification Sections in Division 15 for special joining materials not listed below.
- B. Grooved Mechanical Couplings: Acceptable only for fire protection piping; not acceptable for any other applications.
- C. Pipe Flange Gasket Materials: Suitable for the chemical and thermal conditions of the piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, except where thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125 cast-iron and cast-bronze flanges.

b. Narrow-Face Type: For raised-face, Class 250 cast-iron and steel flanges.

D. Solder Filler Metal: ASTM B 32.

1. Alloy Sn95 or Alloy Sn94: Tin (approximately 95 percent) and silver (approximately 5 percent) – Not industry standard, usually 5% antimony.

### 2.03 SLEEVES

- A. Galvanized-Steel Sheet: 0.0478-inch (18 gage) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

### 2.04 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
  1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  2. Design Mix: 5000-psi, 28-day compressive strength.
  3. Packaging: Premixed and factory-packaged.

## PART 3 - EXECUTION

### 3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. General: Install piping as described below, except where system Sections specify otherwise. Individual piping system specification Sections in Division 15 specify piping installation requirements unique to the piping system.
- B. General Locations and Arrangements: Drawings indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.
- C. Install piping at indicated slope.
- D. Install piping free of sags and bends.
- E. Install piping plumb and at right angles and plumb or parallel to building walls. Diagonal runs are prohibited, except where indicated.
- F. Install piping tight to slabs, beams, joists, columns, walls, and other building elements.
- G. Install fittings for changes in direction and branch connections.
- H. Install couplings according to manufacturer's printed instructions.

- I. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system Sections.
  1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
  2. Remove scale, slag, dirt, rust, and debris from inside and outside of pipe and fittings before assembly.
  3. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:
    - a. 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.
    - b. Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
    - c. Align threads at point of assembly.
    - d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
    - e. Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- J. Piping Connections: Except as otherwise indicated, make piping connections as specified below.
  1. Install unions in piping 2 inches and smaller adjacent to each valve and at final connection to each piece of equipment having a 2-inch or smaller threaded pipe connection.
  2. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### 3.02 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.
- B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Project Manager.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.
- D. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
- E. Install equipment giving right-of-way to piping systems installed at a required slope.

### 3.03 PAINTING AND FINISHING

- A. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### 3.04 CONCRETE PENETRATIONS

- A. Refer Division 1 for core drilling and saw cutting requirements.

- B. All penetrations required through completed concrete construction shall be core drilled or saw cut at minimum size required. All penetrations in concrete require an x-ray or ground penetrating radar to determine if the location is clear of reinforcing steel and embedded systems. Precautions shall be taken when drilling to prevent damage to structural concrete. The Contractor shall provide an interpretation of the x-rays or radar shot and obtain written acceptance from the DIA Project Manager before proceeding with drilling.

### 3.05 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
  2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
  3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in DIVISION 3.

### 3.06 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Refer to DIVISION 5 for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- C. Field Welding: Comply with AWS D1.1 Structural Welding Code - Steel, as referenced in Part1.

### 3.07 DEMOLITION

- A. Refer to DIVISION 1 for general demolition requirements and procedures.
- B. Where pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.
- C. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.
- D. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
1. Piping to Be Removed: Remove portion of piping and associated supports indicated to be removed, provide a shutoff valve with plug or cap in pressurized systems and cap or

- plug remaining piping with same or compatible piping material. No piping shall be abandoned in place. Repair insulation.
2. Ducts to Be Removed: Remove portion of ducts and associated supports indicated to be removed and plug remaining ducts with same or compatible ductwork material. No ductwork shall be abandoned in place. Repair insulation.
  3. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  4. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.
  5. Repair structure floor, ceilings, roof, slabs from removed supports in accordance with Division 9

**3.08 GROUTING**

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

**3.09 ELECTRIC WIRING**

- A. Furnish equipment requiring electrical connections to operate properly and deliver full capacity at electrical service available.
- B. All control wiring to be in accordance with Manufacturer's recommendations; all wiring shall be color coded 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 herein. Contractor should note that the intent of this electric wiring schedule is to have the Division 15 Contractor 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 16 for electrical work of this Division 15, which is not otherwise specified. No extras will be allowed for Contractor's failure to provide for these required items. The Division 15 Contractor shall refer to the Division 16 Specifications and plans for all power and control wiring and shall advise the Project Manager of any discrepancies prior to bidding.

Item	Furnishe	Set	Power	Control
------	----------	-----	-------	---------

	<b>d By</b>	<b>By</b>	<b>Wiring</b>	<b>Wiring</b>
Equipment Motors	15	15	16	15
Fused and Unfused Disconnect Switches, Thermal Overloads and Heaters	16	16	16	---
Control Relays and Transformers (See Note 1)	15	15	16	15
Pushbutton Stations Pilot Lights, Manual Switches, not carrying Load Currents	15	15	16	15
Thermostats, line voltage control components	15	15	---	15
Temperature Control Systems	15	15	16	15

**NOTES:**

- a. \* 15 = Mechanical Contractor Under Division 15 of the Work
- b. \* 16 = Electrical Contractor Under Division 16 of the Work
- c. Control wiring is any voltage required to accomplish sequence specified. Contractor listed is responsible.
- d. Control relays and control transformers shall be furnished under Division 15 except where furnishing such items are specifically required under Division 16 Specifications and/or Drawings.

**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 applicable unit price item, work order or lump sum bid item.

**END OF SECTION 15050**

## SECTION 15072

### MECHANICAL REMOVALS AND DEMOLITION

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Removal of designated building equipment and fixtures.
- B. Removal of designated construction.
- C. Disposal of materials.
- D. Identification of utilities.

##### 1.02 RELATED SECTIONS

- A. Division 1 for Summary of Work, Demolition, and Construction Facilities and Temporary Controls.
- B. Section 15010 - Basic Mechanical Requirements.

##### 1.03 REGULATORY REQUIREMENTS

- A. Do not disable or disrupt building fire or life safety systems without 5 business days prior written notice and written acceptance of DIA Project Manager and DIA Life Safety Team.
- B. Conform to procedures applicable when hazardous or contaminated materials are discovered.

##### 1.04 SCHEDULING

- A. Schedule Work to coordinate with work of other trades.

##### 1.05 PROJECT CONDITIONS

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Cease operations immediately if structure appears to be in danger and notify DIA Project Manager. Do not resume operations until directed.

#### PART 2 - PRODUCTS (NOT USED)

#### PART 3 - EXECUTION

##### 3.01 PREPARATION

- A. Provide, erect, and maintain temporary barriers at locations indicated.
- B. Erect and maintain weatherproof closures for exterior openings.
- C. Protect existing materials and systems, which are not to be demolished.

- D. Notify affected utility companies before starting work and comply with their requirements.
- E. Mark location and termination of utilities.

### **3.02 DEMOLITION**

- A. Disconnect remove, cap, and identify designated utilities within demolition areas.
- B. Demolish in an orderly and careful manner. Remove all unused piping, ductwork or tubing back to source and cap. No piping, ductwork, or tubing is to be abandoned in place.
- C. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.
- D. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.
- E. Remove temporary Work.

## **PART 4 - MEASUREMENT**

### **4.01 METHOD OF MEASUREMENT**

- A. No separate measurement will be made for work under this Section.

## **PART 5 - PAYMENT**

### **5.01 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 Lump Sum Contract price.

**END OF SECTION 15072**



**SECTION 15135**  
**GAUGES AND METERS**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Positive displacement meters.
- B. Flow meters.
- C. Pressure gauges and pressure gauge taps.
- D. Thermometers and thermometer wells.
- E. Static pressure gauges.
- F. Filter gauges.

**1.02 RELATED SECTIONS**

- A. Section 15010 - Basic Mechanical Requirements.
- B. Section 15050 - Basic Mechanical Materials and Methods.
- C. Section 15510 - Hydronic Piping: Installation of Thermometer wells.
- D. Section 15985 - Sequence of Operation.

**1.03 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. Refer to Section 15010 for listing of issuing organizations or agencies.
- B. Applicable Standards:
  - 1. American Society of Mechanical Engineers (ASME)
    - a. ASME - B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
    - b. ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle and Venturi.
  - 2. American Society for Testing of Materials (ASTM)
    - a. ASTM D 2458 - Method of Flow Measurement by The Venturi Motor Tube.
    - b. ASTM E 1 - Specification for ASTM Thermometers.
    - c. ASTM E 77 - Verification and Calibration of Liquid-in-Glass Thermometers.
  - 3. American Water Works Association (AWWA)
    - a. AWWA C700 - Cold Water Meters - Displacement Type.
    - b. AWWA C701 - Cold Water Meters - Turbine Type for Customer Service.
    - c. AWWA C702 - Cold Water Meters - Compound Type.
    - d. AWWA C706 - Direct Reading Remote Registration System for Cold Water Meters.

- e. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.
- 4. Instrument Society of America (ISA)
  - a. ISA RP 3.2 - Flange Mounted Sharp Edged Orifice Plates for Flow Measurement.
- 5. International Fire Code (IFC) with the Denver Amendments
- 6. International Building Code (IBC) with the Denver Amendments.
- 7. Underwriters' Laboratories (UL)
  - a. UL 393 - Indicating Pressure Gauges for Fire and Protection Services.
  - b. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service.

#### 1.04 SUBMITTALS

- A. Submittals For Review
  - 1. Product Data: Provide list, which indicates use, operating range, total range and location for manufactured components.
- B. Submittals At Project Closeout
  - 1. Project Record Documents: Record actual locations of components and instrumentation.
- C. "As Built" Plans shall be provided in the same format and manner as described above. Each set shall be equipped with a plan holder equal to "Stacor Plan Clamps" for the appropriate size drawing.

#### 1.05 ENVIRONMENTAL REQUIREMENTS

- A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

#### 1.06 EXTRA MATERIALS

- A. Provide two bottles of red gauge oil for static pressure gauges.
- B. Provide two dial thermometers.

### PART 2 - PRODUCTS

#### 2.01 FLOW METERS

- A. Manufacturers:
  - 1. Gustin-Bacon.
  - 2. BIF.
  - 3. Hersey Products Inc.
  - 4. Liquid Controls Corp.
  - 5. Substitutions: Under provisions of Section 15010.
- B. Orifice principle by-pass circuit with direct reading gauge, soldered or flanged piping connections for 125 psig working pressure, with shut off valves, and drain and vent connections.

- C. Direct reading with insert pitot tube, threaded coupling, for 150 psig working pressure, maximum 240 degrees F, 5 percent accuracy.
- D. Cast iron, wafer type, orifice insert flow meter for 250 psig working pressure, with read-out valves equipped with integral check valves with gasketed caps.
- E. Calibrated, plug type balance valve with precision machined orifice, readout valves equipped with integral check valves and gasketed caps, calibrated nameplate and indicating pointer.
- F. Cast iron or bronze, globe style, balance valve with handwheel with vernier type ring setting and memory stop, drain connection, readout valves equipped with integral check valves and gasketed caps.
- G. Annular element flow stations with meter set.
  - 1. Measuring Station: Type 316 stainless steel pitot type flow element installed in threaded nipple pipe section, with safety shut-off valves and quick coupling connections, and permanent metal tag indicating design flow rate, reading for design flow rate, metered fluid, line size, station or location number.
    - a. Pressure rating: 275 psig.
    - b. Maximum temperature: 400 degrees F.
    - c. Accuracy: Plus 0.55 percent to minus 2.30 percent.

## **2.02 STEM TYPE THERMOMETERS**

- A. Manufacturers:
  - 1. Terrice.
  - 2. U.S. Gauge.
  - 3. Moeller.
  - 4. Dietz.
  - 5. Substitutions: In conformity with provisions of Section 15010.
- B. Thermometer: ASTM E 1, adjustable angle, red appearing mercury, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.
  - 1. Size: 9 inch scale.
  - 2. Window: Clear glass.
  - 3. Stem: 3/4 inch NPT brass.
  - 4. Accuracy: ASTM E 77 2 percent.
  - 5. Calibration: Both degrees F and degrees C.

## **2.03 THERMOMETER SUPPORTS**

- A. Socket: Brass separable sockets for thermometer stems with extensions where necessary to clear insulation, and with cap and chain.
- B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

## **2.04 TEST PLUGS**

- A. Manufacturer:
  - 1. Peterson Equipment Co.
  - 2. Substitutions: In conformity with provisions of Section 15010.
- B. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F and Nordel core for temperatures up to 350 degrees F.
- C. Test Kit: Carrying case, internally padded and fitted containing one 2-1/2 inch diameter pressure gauges, one gauge adapters with 1/8 inch probes, one 1-1/2 inch dial thermometers.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
- C. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets. Refer to Section 15952. Where thermometers are provided on local panels, pipe mounted thermometers are not required.
- D. Coil and conceal excess capillary on remote element instruments.
- E. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- F. Install thermometers and test plug in locations where there is an unobstructed field of view from a normal operating level. All portions of thermometers shall be easily read from a normal operating level. Locations of test plugs shall be treated as thermometers for installation and field of view verification.
- G. Install thermometers in vertical to 45 degrees off vertical.
- H. Adjust and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- I. Locate test plugs adjacent to thermometers and thermometer sockets.

### **3.02 SCHEDULES**

- A. Install meters and thermometers at a minimum in the locations listed in the schedules below and additional locations shown on the drawings.
- B. Flow Meter Schedule
  - 1. Locations:
    - a. Heating water system
    - b. Chilled water system
- C. Stem Type Thermometer Schedule

1. Locations:
  - a. Headers to central equipment
  - b. Coil banks - inlets and outlets
  - c. After major coils
  
- D. Thermometer Socket Schedule
  1. Locations:
    - a. Control valves 1 inch and larger

#### **PART 4 - MEASUREMENT**

##### **4.01 METHOD OF MEASUREMENT**

- A. No separate measurement will be made for work under this Section.

#### **PART 5 - PAYMENT**

##### **5.01 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 Lump Sum Contract price.

**END OF SECTION 15135**



## SECTION 15140

### SUPPORTS AND ANCHORS

#### PART 1 -GENERAL

##### 1.01 SUMMARY

- A. This Section includes the following hangers and supports for mechanical system piping and equipment:
  - 1. Steel pipe hangers and supports.
  - 2. Thermal-hanger shield inserts.
  - 3. Fastener systems.

##### 1.02 RELATED SECTIONS

- A. Division 1: Painting.
- B. Section 15010 - Basic Mechanical Requirements.
- C. Section 15050 - Basic Mechanical Materials and Methods.
- D. Section 15245 - Vibration Isolation.
- E. Section 15510 - Hydronic Piping.

##### 1.03 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. Refer to Section 15010 for listing of issuing organizations or agencies.
- B. Applicable Standards:
  - 1. ASME International (ASME):
    - a. B31.1 - Power Piping.
    - b. B31.9 - Building Services Piping.
  - 2. Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualification".
  - 3. ASTM International (ASTM):
    - a. A36/A37M - Carbon Structural Steel.
    - b. A780 - Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
    - c. C533 - Calcium Silicate Block and Pipe Thermal Insulation.
    - d. C552 -Cellular Glass Thermal Insulation.
    - e. C1107 - Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
  - 4. The International Association of Plumbing and Mechanical Officials (IAPMO):
    - a. PS42 - Pipe Alignment and Secondary Support Systems.
  - 5. International Fire Code (IFC) with the Denver Amendments
  - 6. International Building Code (IBC) with the Denver Amendments.

7. Manufacturers Standardization Society of The Valve and Fittings Industry Inc. (MSS SP):
  - a. 58 - Pipe Hangers and Supports - Materials, Design and Manufacture.
  - b. 69 - Pipe Hangers and Supports - Selection and Application.
  - c. 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
  - d. 90 - Guidelines on Terminology for Pipe Hangers and Supports.
8. Metal Framing Manufacturers Association (MFMA):
  - a. 3 - Metal Framing Standards Publication.
  - b. 102 - Guidelines for the Use of Metal Framing.
9. National Fire Protection Association (NFPA)
  - a. NFPA 13 - Installation of Sprinkler Systems.
  - b. NFPA 14 - Installation of Standpipe and Hose Systems.
10. The Society for Protective Coatings (SSPC):
  - a. PA1 - Paint Application Specification No. 1: Shop, Field , and Maintenance Painting of Steel.
11. Underwriters' Laboratories (UL)
  - a. UL 203 - Pipe Hanger Equipment for Fire Protection Service.

#### 1.04 SUBMITTALS

- A. Product Data: For the following:
  1. Steel pipe hangers and supports.
  2. Thermal-hanger shield inserts.
- B. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- C. Refer to Section 15010 for coordination requirements.
- D. "As Built" Plans shall be provided in the same format and manner as described above. Each set shall be equipped with a plan holder equal to "Stacor Plan Clamps" for the appropriate size drawings.

### PART 2 -PRODUCTS

#### 2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

#### 2.02 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to PART 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
  1. Bergen-Power Pipe Supports.



2. B-Line Systems, Inc.; a division of Cooper Industries.
  3. Grinnell Corp.
  4. PHS Industries, Inc.
  5. Piping Technology & Products, Inc.
  6. Substitutions: Under provisions of Section 15010.
- C. Galvanized, Metallic Coatings: Pre-galvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

### 2.03 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Manufacturers:
1. Carpenter & Paterson, Inc.
  2. PHS Industries, Inc.
  3. Pipe Shields, Inc.
  4. Substitutions: Under provisions of Section 15010.
- C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C533, Type I calcium silicate or ASTM C552, Type II cellular glass with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C533, Type I calcium silicate or ASTM C552, Type II cellular glass.
- E. For Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

### 2.04 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated or stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Manufacturers:
- a. B-Line Systems, Inc.; a division of Cooper Industries.
  - b. Hilti, Inc.
  - c. ITW Ramset/Red Head.
  - d. Substitutions: Under provisions of Section 15010.

### 2.05 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 6/A36M, steel plates, shapes, and bars; black and galvanized.

- B. Grout: ASTM C1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

### PART 3 -EXECUTION

#### 3.01 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as required and in accordance with spans and hanger rod sizes based on MSS SP-69 recommendations. Hanger rod sizes are based on single-rod hangers using ASTM A36-81A or ASTM A575-81 Gr 1020 steel. If local codes or special design considerations necessitate shorter spans or larger rod sizes, they shall govern. Contractor shall adjust requirements as necessary for conditions such as increase in loading caused by valves, fittings, or other conditions. Support details for all piping with special design considerations are included in the project structural construction drawings.
- B. Space steel piping supports to permit normal pitch of pipe lines with deflection and bending stress maintained at a minimum. Except as otherwise required by applicable codes, do not exceed the following support spacings:

<u>Nominal Pipe Size (inches)</u>	<u>Water Service Spacing (feet)</u>	<u>Gas, or Air Service Spacing (feet)</u>	<u>Hanger Rod Min. Diameter (inches)</u>
1/2 and Smaller	7	8	3/8
3/4 through 1-1/4	7	9	3/8
1-1/2	9	12	3/8
2	10	13	3/8
3	12	15	1/2
4	14	17	5/8
6	17	21	3/4

- C. For new piping larger than 6" diameter, refer to structural drawings for specific support locations and associated support details.
- D. Support cast iron piping at each joint and in accordance with applicable codes and standards.
- E. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- F. Place a hanger within 12 inches of each horizontal elbow.
- G. Use hangers with 1-1/2 inch minimum vertical adjustment.
- H. Support vertical piping at every floor. Support vertical cast iron pipe at each floor and at each hub.
- I. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- J. Support riser piping independently of connected horizontal piping.
- K. At changes in pipe flow direction, install piping sufficiently spaced to allow pipe movement

### 3.02 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450°F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
  - 2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
  - 3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
  - 4. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
  - 5. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  - 6. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
  - 7. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
  - 8. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
  - 9. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
  - 10. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
  - 11. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- G. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  - 2. Steel Clevises (MSS Type 14): For 120 to 450°F piping installations.

3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450°F piping installations.
- H. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  5. C-Clamps (MSS Type 23): For structural shapes.
  6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  9. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  10. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  11. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
- I. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  2. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- J. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

### **3.03 HANGER AND SUPPORT INSTALLATION**

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

- C. Fastener System Installation:
  - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- D. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- E. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- F. Install lateral bracing with pipe hangers and supports to prevent swaying.
- G. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- H. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- I. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- J. Insulated Piping: Comply with the following:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 3. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
  - 4.
  - 5. Insert Material: Length at least as long as protective shield.
  - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### **3.04 ADJUSTING**

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

### **3.05 PAINTING**

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

**PART 4 -MEASUREMENT**

**4.01 METHOD OF MEASUREMENT**

- A. No separate measurement will be made for work under this Section.

**PART 5 - PAYMENT**

**5.01 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 Lump Sum Contract price.

**END OF SECTION 15140**

## SECTION 15190

### MECHANICAL IDENTIFICATION

#### PART 1 -GENERAL

##### 1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Stencils.
- D. Pipe Markers.
- E. Valve Chart and Schedule.

##### 1.02 RELATED SECTIONS

- A. Division 9 - Painting: Identification painting.
- B. Section 15010 - Basic Mechanical Requirements.
- C. Section 15050 - Basic Mechanical Materials and Methods.

##### 1.03 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. Refer to Section 15010 for listing of issuing organizations or agencies.
- B. Applicable Standards:
  - 1. American Society of Mechanical Engineers (ASME)
    - a. ASME A13.1 - Scheme for the Identification of Piping Systems.
  - 2. International Building Code (IBC) with the Denver Amendments
  - 3. International Fire Code (IFC) with the Denver Amendments

##### 1.04 SUBMITTALS

- A. Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- B. Include valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- C. Product Data: Provide manufacturers catalog literature for each product required.
- D. "As Built" Plans shall be provided in the same format and manner as described above. Each set shall be equipped with a plan holder equal to "Stacor Plan Clamps" for the appropriate size drawings.

##### 1.05 PROJECT RECORD DOCUMENTS

- A. Record actual locations of tagged valves.

## **PART 2 - PRODUCTS**

### **2.01 ACCEPTABLE MANUFACTURERS**

- A. Manufacturers:
1. W.H. Brady Co.
  2. Panduit Corp.
  3. Seton Name Plate Corp.
  4. Marking Services, Inc.
  5. Substitutions: Under provisions of Section 15010.

### **2.02 MATERIALS**

- A. Color: Unless specified otherwise, conform with ASME A13.1.
- B. Plastic Nameplates: Laminated three-layer plastic with engraved black letters on light contrasting background color.
- C. Metal Tags: Brass or aluminum, with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- D. Chart: Typewritten letter size list in anodized aluminum frame.
- E. Stencils: With clean cut symbols and letters of 2-1/2 inch size.
- F. Stencil Paint: In accordance with Division 9, semi-gloss enamel.
- G. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and fluid being conveyed.
- H. Underground Plastic Pipe Markers:
1. Bright colored continuously printed plastic ribbon tape of not less than 6 inch wide by 4 mil thick, manufactured for direct burial service.
  2. For non-metallic buried piping provide printed foil type tape as manufactured by Marking Services Inc., enabling locating of runs by use of a metal detector.

### **2.03 CEILING TACKS**

- A. Description: Steel with 3/4 inch diameter color coded head.
- B. Color code as follows:
1. Yellow - HVAC equipment.
  2. Red - Fire dampers/smoke dampers.
  3. Green - Plumbing valves.
  4. Blue - Heating/cooling valves.

## **PART 3 - EXECUTION**



### 3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Division 9 for stencil painting.

### 3.02 INSTALLATION

- A. Plastic Nameplates: Install with corrosive-resistant mechanical fasteners and adhesive.
- B. Metal Tags: Install with corrosive-resistant chain.
- C. Stencil Painting: Apply in accordance with Division 9.
- D. Plastic Pipe Markers: Install in accordance with manufacturer's instructions.
- E. Underground Plastic Pipe Markers: Install 6 to 8 inches below finished grade or paving, directly above buried pipe.

- F. Equipment: Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates or stencil painting. Small devices, such as in-line pumps, may be identified with metal tags. At a minimum, the nameplate shall contain the following information:

- 1. Equipment Tag
- 2. Equipment location
- 3. Service Area
- 4. Flowrate (cfm/gpm)
- 5. Capacity (btuh/kw)
- 6. <Equipment owner>



(nameplate example capacity and Owner not shown)

- G. Equipment and terminal devices above ceiling: provide adhesive backed plastic nameplate on ceiling grid support directly below equipment identifying unit tag and temperature control node number.

- 1. Example:

VAV-01      NODE 067

- H. Controls: Identify control panels and major control components outside panels with plastic nameplates. Key to control schematics.

- I. Valves Identification:

- 1. Identify all valves, including fire protection valves, in main and branch piping located inside the building. Use tags secured with brass 'S' hooks or brass chains.
- 2. Stamp tags with a unique prefix to identify system to which applied, followed by a number (Example: CW-1, CW-2, etc.). In general, prefix shall match system abbreviations used on drawings where applicable.
- 3. Provide a typewritten listing of valves including: valve identification number, location, function, normal position, service, and area served. Mount list as specified and directed. Include additional copy in operation and maintenance manuals.
- 4. Show valve tag designations on the project record document drawings, including schematic flow diagrams where included with construction documents.
- 5. Contractor shall prepare and install where directed, in aluminum frames with clear plastic protective cover, a valve location diagram in the form of a series of flow

diagrams with each automatic or manually actuated control or shut-off valve clearly identified in sequence with its individual valve tag number. Automatic control valves shall be tagged to match designations shown on the temperature control drawings, and the specified valve charts shall be installed adjacent to valve location diagrams.

- J. Piping: Identify piping, concealed or exposed, with plastic pipe markers. Tags may be used on 1/2" or smaller diameter non-insulated piping. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and "T", at each side of penetration of structure or enclosure, and at each obstruction.
- K. Ductwork:
1. Identify ductwork with plastic nameplates or stenciled painting. Identify as to air handling unit number, and area served.
  2. Install duct markers with on air ducts in the following color codes:
    - a. Green: For cold-air of general supply ducts.
    - b. Yellow: For hot-air supply ducts.
    - c. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
    - d. ASME A13.1 Colors and Designs: For hazardous material exhaust.
    - e. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  3. Stenciled Duct Marker Option: Stenciled markers, showing service and direction of flow, may be provided instead of laminated-plastic duct markers, at Installer's option, if lettering larger than 1 inch (25 mm) high is needed for proper identification because of distance from normal location of required identification.
  4. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system and/or each side of a penetration of structure or enclosure and at each obstruction and at air-handling equipment.

### 3.03 VALVE CHART AND SCHEDULE

- A. Provide valve chart and schedule in aluminum frame with clear plastic shield. Install at location as directed.

### 3.04 PIPING IDENTIFICATION SCHEDULE

- A. Pipe identification and color coding for general-use piping systems shall be in accordance with the following schedule:

<u>Classification</u>	<u>Band Color</u>	<u>Stenciled Legend</u>
Chilled Water Supply	Green	Ch. Water Supp.
Chilled Water Return	Green	Ch. Water Ret.
Hot Water Heating Supply	Yellow	H.W. Htg. Supp.
Hot Water Heating Return	Yellow	H.W. Htg. Ret.

- B. Paint exterior piping and duct systems to match wall colors.

## PART 4 -MEASUREMENT

### 4.01 METHOD OF MEASUREMENT

- A. No separate measurement will be made for work under this Section.

**PART 5 - PAYMENT**

**5.01 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 Lump Sum Contract price.

**END OF SECTION 15190**



## SECTION 15260

### PIPING INSULATION

#### PART 1 -GENERAL

##### 1.01 SECTION INCLUDES

- A. This Section includes preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

##### 1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 15010 - Basic Mechanical Requirements.
- B. Section 15140 - Supports and Anchors: Pipe insulation shields and protection saddles
- C. Section 15510 - Hydronic Piping: Placement of hangers and hanger inserts.

##### 1.03 RELATED SECTIONS

- A. Section 15010 - Basic Mechanical Requirements.
- B. Section 15050 - Basic Mechanical Materials and Methods.
- C. Section 15190 - Mechanical Identification.

##### 1.04 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. Refer to Section 15010 for listing of issuing organizations or agencies.
- B. Applicable Standards:
  - 1. American Society for Testing and Materials (ASTM):
    - a. A666 – Austenitic Stainless Steel, Strip, Plate, and Flat Bar.
    - b. B209/B209M – Aluminum and Aluminum-Alloy Sheet and Plate.
    - c. C195 – Mineral Fiber Thermal Insulating Cement.
    - d. C196 – Expanded or Exfoliated Vermiculite Thermal Insulating Cement.
    - e. C449/C449M – Mineral Fiber Hydraulic-Setting Thermal Insulating and Finish Cement.
    - f. C533 – Calcium Silicate Block and Pipe Thermal Insulation.
    - g. C534 – Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
    - h. C547 – Mineral Fiber Preformed Pipe Insulation.
    - i. C552 – Cellular Glass Block and Pipe Thermal Insulation.
    - j. C553 – Mineral Fiber Blanket and Felt Insulation for Commercial and Industrial Applications.
    - k. C578 - Preformed, Block Type Cellular Polystyrene Thermal Insulation.
    - l. C610 - Expanded Perlite Block and Pipe Thermal Insulation.
    - m. C612 – Mineral Fiber Block and Board Thermal Insulation.

- n. C921 – Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
  - o. C1126 – Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
  - p. E84 – Test Method for Surface Burning Characteristics of Building Materials.
2. International Building Code (IBC) with the Denver Amendments.
  3. International Fire Code (IFC) with the Denver Amendments

### 1.05 SUBMITTALS

- A. Submit product description, list of materials and thickness for each service, and locations.
- B. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
- C. Shop Drawings: Show fabrication and installation details for the following:
  1. Application of protective shields, saddles, and inserts at pipe hangers for each type of insulation and hanger.
  2. Attachment and covering of heat trace inside insulation.
  3. Insulation application at pipe expansion joints for each type of insulation.
  4. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  5. Removable insulation at piping specialties and equipment connections.
  6. Application of field-applied jackets.
- D. Samples: For each type of insulation and jacket. Identify each Sample, describing product and intended use. Submit Samples in the following sizes:
  1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
  2. Sheet Form Insulation Materials: 12 inches square.
  3. Jacket Materials: 12 inches long by NPS 2.
  4. Manufacturer's Color Charts: Show the full range of colors available for each type of field-applied finish material indicated.
- E. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.
- F. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.
- G. "As Built" Plans shall be provided in the same format and manner as described above. Each set shall be equipped with a plan holder equal to "Stacor Plan Clamps" for the appropriate size drawings.

### 1.06 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing

and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
  2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.
- B. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products under provisions of Section 15010 and Division 1.
- B. Deliver materials to site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Store insulation in original wrapping and protect from weather and construction traffic.
- D. Protect insulation against dirt, water, chemical, and mechanical damage.

#### 1.08 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

### PART 2 - PRODUCTS

#### 2.01 ACCEPTABLE MANUFACTURERS

- A. Insulation Manufacturers:
  1. CertainTeed Manson.
  2. Johns Manville.
  3. Knauf Fiber Glass.
  4. Owens-Corning Fiberglas.
  5. Rock Wool Manufacturing.
  6. USG Interiors.
  7. Substitutions: Under provisions of Section 15010.

#### 2.02 INSULATION

- A. Type A: Glass fiber insulation; ASTM C 547; maximum 'k' value of 0.24 at 75 degrees F; noncombustible.
  1. Minimum Service Temperature: 0 degrees F.
  2. Maximum Service Temperature: 400 degrees F.
  3. Maximum Moisture Absorption: 0.2 percent by volume.

- B. Type B: Cellular glass; ASTM C 552:
  - 1. 'K' value: 0.40 at 75 degrees F.
  - 2. Maximum Water Vapor Transmission: 0.1 perm.
- C. Type C: Expanded polystyrene; ASTM C 578; rigid closed cell:
  - 1. 'K' value: 0.23 at 75 degrees F.
  - 2. Maximum service temperature: 180 degrees F.
  - 3. Maximum Water Vapor Transmission: 0.1 perm.
- D. Type D: Expanded perlite; ASTM C 610; granular pored:
  - 1. 'K' value: 0.28 at 75 degrees F.
  - 2. Maximum Water Vapor Transmission: 0.1 perm.
- E. Type E: Inorganic High Temperature Insulating Blanket, temperature limit 1300 degrees F conforming to Mil 1-23128, Grade A, Class 1, 2 inches thick, 4 lb. density with expanded metal jacket wired in place. 'K' value 0.80 at 1000 degrees F.
- F. Type F: Hydrous calcium silicate; ASTM C 533; rigid white; asbestos free:
  - 1. 'K' value: ASTM C 177 and C 518; 0.44 at 300 degrees F.
  - 2. Maximum Service Temperature: 1200 degrees F.
  - 3. Density: 13 lb/cu ft; compressive strength (block) 200 PSI with 5% compression at 1-1/2" thickness.
  - 4. Tie with 16 gage stainless steel wire loops with twisted ends, spaced 12 inches on center.
- G. Type G: Polyurethane foam; ASTM C 591, rigid molded modified polyisocyanurate cellular plastic.
  - 1. Maximum 'K' value: ASTM 518; 0.16 at 75 degrees F.
  - 2. Minimum Service Temperature: -250 degrees F.
  - 3. Maximum Service Temperature: 250 degrees F.
  - 4. Maximum Moisture Absorption: ASTM D 2842; 0.054 percent by volume.
  - 5. Moisture Vapor Transmission: 1.26 perm inches.
  - 6. Maximum Flame Spread: ASTM E 84; 20.
  - 7. Connection: Waterproof vapor barrier adhesive.
- H. Type H: Polyethylene foam; ASTM D 1056 or D 1667; flexible, closed cell, polyethylene, slit tubing.
  - 1. 'K' Value: ASTM C 177; 0.25 at 75 degrees F.
  - 2. Minimum Service Temperature: -90 degrees F.
  - 3. Maximum Service Temperature: 212 degrees F.
  - 4. Density: ASTM 1667; 2 lb/cu ft.
  - 5. Maximum Moisture Absorption: 1.0 percent by volume.
  - 6. Moisture Vapor Transmission: ASTM E 96; 0.01 perm inches.
  - 7. Maximum Flame Spread: ASTM E 84; 25.



8. Maximum Smoke Developed: ASTM E 84; 50.
9. Connection: Contact adhesive.
- I. Type I: Cellular foam; ASTM C 534; flexible, cellular elastomeric, molded or sheet.
  1. Maximum 'K' Value: ASTM C 177 or C 518; 0.28 at 75 degrees F.
  2. Minimum Service Temperature: -40 degrees F.
  3. Maximum Service Temperature: 220 degrees F.
  4. Maximum Moisture Absorption: ASTM D 1056; 3.0 percent (pipe) by volume, 2.0 percent (sheet) by volume.
  5. Maximum Moisture Vapor Transmission: ASTM E 96; 0.20 perm inches.
  6. Maximum Flame Spread: ASTM E 84; 25.
  7. Maximum Smoke Developed: ASTM E 84; 50.
  8. Connection: Waterproof vapor barrier adhesive.

### 2.03 JACKETS

- A. General: ASTM C921, Type 1, unless otherwise indicated.
- B. Vapor Retarder Jacket: AP-T PLUS white kraft paper reinforced with glass fiber yarn and bonded to aluminum foil, secured with self-sealing longitudinal laps and butt strips or AP Jacket with outward clinch expanding staples coated with vapor barrier mastic as needed.
- C. PVC Plastic Jacket: ASTM C 921, one piece molded type fitting covers and sheet material, off white color. Secure with tacks, pop rivets, and pressure-sensitive tape of matching color.
  1. Factory-fabricated fitting covers manufactured from 30-mil-thick, high-impact, ultraviolet-resistant PVC.
  2. Minimum Service Temperature: -40 degrees F.
  3. Maximum Service Temperature: 150 degrees F.
  4. Moisture Vapor Transmission: ASTM E 96; 0.002 perm inches.
  5. Maximum Flame Spread: ASTM E 84; 25.
  6. Maximum Smoke Developed: ASTM E 84; 50.
  7. Minimum Thickness: 20 mil.
  8. Connections: Brush on welding adhesive or pressure sensitive color matching vinyl tape.
- D. Aluminum Jacket: ASTM B 209, 3003 alloy, H-14 temper.
  1. Minimum Thickness: 0.024-inch sheet.
  2. Finish: Embossed.
  3. Joining: Longitudinal slip joints and 2-inch laps.
  4. Moisture Barrier: 1-mil-thick, heat-bonded polyethylene and kraft paper.
  5. Fittings: 0.016-inch thick die shaped fitting covers with factory attached protective liner.
  6. Metal Jacket Bands: 3/8 inch wide; .015-inch thick aluminum.
  7. Painted finish, 0.016 inch thick.

- E. Stainless Steel Jacket: ASTM A666, Type 304 or 316.
  - 1. Thickness: 0.016 inch.
  - 2. Finish: Corrugated.
  - 3. Moisture Barrier: 1-mil-thick, heat-bonded polyethylene and kraft paper.
  - 4. Elbows: Gore type, for 45- and 90-degree elbows in same material, finish, and thickness as jacket.
  - 5. Jacket Bands: Stain
  - 6. Metal Jacket Bands: 3/8 inch wide; 0.010-inch thick stainless steel.

#### **2.04 ACCESSORIES**

- A. Insulation Bands: 3/4 inch wide; 0.015-inch thick galvanized steel.
- B. Metal Jacket Bands: 3/8 inch wide; 0.015-inch thick aluminum.
- C. Insulating Cement: ASTM C 195; hydraulic setting mineral wool.
- D. Finishing Cement: ASTM C 449.
- E. Fibrous Glass Cloth: Untreated; 9 oz/sq yd weight.
- F. Adhesives: Compatible with insulation.

### **PART 3 - EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.02 PREPARATION**

- A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.
- B. Install materials after piping has been tested and approved.

#### **3.03 GENERAL APPLICATION REQUIREMENTS**

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

- D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.
- E. Apply multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- H. Keep insulation materials dry during application and finishing.
- I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- J. Apply insulation with the least number of joints practical.
- K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.
- L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.
  - 1. Apply insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
  - 3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.
- M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.
- O. Apply insulation with integral jackets as follows:
  - 1. Pull jacket tight and smooth.
  - 2. Circumferential Joints: Cover with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100 mm) o.c.
  - 3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches (40 mm). Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.
    - a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
  - 4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.

5. At penetrations in jackets for thermometers and pressure gauges, fill and seal voids with vapor-retarder mastic.
- P. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.
- Q. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.
  1. Firestopping and fire-resistive joint sealers are specified in DIVISION 7.
- R. Floor Penetrations: Apply insulation continuously through floor assembly.
  1. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

### 3.04 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions and N.I.C.A. standards.
- B. Continue insulation with vapor barrier through penetrations.
- C. In exposed piping, locate insulation and cover seams in least visible locations.
- D. On insulated piping with vapor barrier, insulate fittings, valves, flanges, strainers, flexible connections, and expansion joints. Insulation and vapor barrier shall be continued without interruption at penetrations, horizontal and vertical supports.
- E. Provide an insert, not less than 6 inches long, of same thickness and contour as adjoining insulation, between support shield and piping, but under the finish jacket, on piping 2 inches diameter or larger, to prevent insulation from being crushed at support points. Inserts shall be calcium silicate or other heavy density insulating material suitable for the planned temperature range. Factory fabricated inserts may be used. Inserts shall also be provided (on both sides) where vertical supports are installed. Sheet metal shields shall be used on cul-sil blocks.
- F. Jackets:
  1. Indoor, Concealed Applications: Insulated pipes conveying fluids above ambient temperature shall have standard jackets, with vapor barrier, factory-applied or field-applied. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass cloth and adhesive. PVC jackets may be used if in accordance with specified flame spread and smoke developed limitations.
  2. Indoor, Concealed Applications: Insulated dual-temperature pipes or pipes conveying fluids below ambient temperature shall have vapor barrier jackets, factory-applied or field-applied. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe, and finish with glass cloth and vapor barrier adhesive.
  3. Indoor, Exposed Applications: For pipe exposed in mechanical equipment rooms or in finished spaces, insulate as for concealed applications. Finish with reinforced white kraft and aluminum foil laminates.
- G. Where staples are used to secure insulation covering for systems requiring vapor barrier, the staples shall be sealed with a vapor barrier mastic.

### 3.05 SCHEDULE

Piping Systems:

**<sup>a</sup> DOMESTIC HOT WATER SYSTEMS INSULATION THICKNESSES**  
 FOR INDICATED PIPE SIZES

Service Water Htg Temp. ( degrees F)	Non-Circulating		Circulating Mains and Runouts		
	Runouts Up to 2" Size		Up to 1-1/4"	1-1/2 to 2"	Over 2"
105 and Above	1.5"		1.5"	1.5"	1.5"

<sup>a</sup> Provisions for runouts (not to exceed 12 feet in length) apply to branch runs to terminal fixtures or equipment.

<u>Piping System</u>	<u>Run- Outs</u> <sup>b</sup>	<u>To 1.5"</u>	<u>2" to 4"</u>	<u>5 - 6"</u>	<u>8" and Larger</u>
Chilled Water (40-55 °F)	1.5"	1.5"	1.5"	1.5"	1.5"
Hot Water:					
Above 350 °F	1.5"	2.5"	3"	3.5"	3.5"
251-350 °F	1.5"	2"	3"	3.5"	3.5"
201-250 °F	1.5"	1.5"	3"	3"	3.5"
141-200 °F	1.5"	1.5"	2"	2"	3"
105-140 °F	1.5"	1.5"	2"	2"	2"

<sup>b</sup> Provisions for runouts (not to exceed 12 feet in length) apply to branch runs up to 2 inches in size extending to individual terminal units.

<sup>c</sup> Thicknesses shown are based on use of insulation with thermal resistivity in the range of 4.0 to 4.6 h-sq ft-degrees F/Btu per inch of thickness; adjust as required for insulations having greater or lower thermal resistivity values. For piping exposed to exterior, increase indicated thicknesses by 1/2 inch.

<sup>d</sup> Insulate only drain bodies, horizontal piping, and fittings discharging into vertical piping above occupied spaces.

**PART 4 - MEASUREMENT**

**4.01 METHOD OF MEASUREMENT**

- A. No separate measurement will be made for work under this Section.

**PART 5 - PAYMENT**

**5.01 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 Lump Sum Contract price.

**END OF SECTION 15260**



**SECTION 15510**  
**HYDRONIC PIPING**

**PART 1 -GENERAL**

**1.01 SECTION INCLUDES**

- A. Pipe and pipe fittings for the following systems including glycol/water solution piping for freeze protection where indicated on the drawings:
  - 1. Heating water piping system.
  - 2. Chilled water piping system.
- B. Valves:
  - 1. Gate valves.
  - 2. Globe or angle valves.
  - 3. Ball valves.
  - 4. Butterfly valves.

**1.02 RELATED SECTIONS**

- A. Division 9 - Painting.
- B. Section 15010 - Basic Mechanical Requirements.
- C. Section 15140 - Supports and Hangers.
- D. Section 15190 - Mechanical Identification.
- E. Section 15245 - Vibration Isolation.
- F. Section 15260 - Piping Insulation.
- G. Section 15515 - Hydronic Specialties.

**1.03 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. Refer to Section 15010 for listing of issuing organizations or agencies.
- B. Applicable Standards:
  - 1. American Society for Testing and Materials (ASTM):
    - a. ASTM A 53 - Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
    - b. ASTM A 234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
    - c. ASTM A 395 - Ferritic Ductile Iron Pressure-Retaining Castings
    - d. ASTM A 536 - Ductile Iron Castings
    - e. ASTM B 32 - Solder Metal.

- f. ASTM B 75 - Seamless Copper Tube.
  - g. ASTM B 88 - Seamless Copper Water Tube.
  - h. ASTM B 152 - Copper Sheet, Strip, Plate and Rolled Bar.
  - i. ASTM B 584 - Copper Alloy Sand Castings for General Applications.
2. American Society of Mechanical Engineers (ASME) :
    - a. ASME - Boiler and Pressure Vessel Codes, SEC 9 - Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.
    - b. ASME B16.3 - Malleable Iron Threaded Fittings Class 50 and 300.
    - c. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
    - d. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
    - e. ASME B31.5 - Refrigeration Piping.
    - f. ASME B31.9 - Building Services Piping.
  3. American Welding Society (AWS):
    - a. AWS A5.8 - Brazing Filler Metal.
    - b. AWS D1.1 - Structural Welding Code.
  4. International Building Code (IBC) with the Denver Amendments
  5. International Fire Code (IFC) with the Denver Amendments
  6. Manufacturers Standardization Society (MSS):
    - a. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacture.
    - b. MSS SP69 - Pipe Hangers and Supports - Selection and Application.
    - c. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

#### 1.04 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- B. Use grooved mechanical couplings and fasteners in accessible locations only. All grooved couplings, fittings and valves should be of one manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
- C. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded connections to valves, equipment or other apparatus.
- D. Use non-conducting dielectric waterway fittings or insulating flanges whenever jointing dissimilar metals in piping systems. Dielectric fittings shall have end connections that match the adjoining pipe.
- E. Provide pipe hangers and supports in accordance with ASTM B31.9 unless indicated otherwise.
- F. Use ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- G. Use globe or butterfly valves for throttling, bypass, or manual flow control services.
- H. Use butterfly valves in heating, chilled and condenser water systems interchangeably with gate and globe valves.



- I. Butterfly valves shall be lug or grooved end type.
- J. Use 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest floor drain.

#### **1.05 SUBMITTALS**

- A. Shop Drawings: Detail fabrication of pipe anchors, hangers, special pipe support assemblies, alignment guides, expansion joints and loops, and their attachment to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
- B. Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings. Include flow and pressure drop curves based on manufacturer's testing for diverting fittings, calibrated balancing valves, and automatic flow-control valves.
- C. Maintenance Data: For hydronic specialties and special-duty valves to include in maintenance manuals specified in SECTION 15050.
- D. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Failed test results and corrective action taken to achieve requirements.

#### **1.06 PROJECT RECORD DOCUMENTS**

- A. Record actual locations of valves, piping and anchors. Submit drawings on a single CD-ROM in latest AutoCAD format.

#### **1.07 OPERATION AND MAINTENANCE DATA**

- A. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

#### **1.08 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing the work of this section with minimum five years' experience.

#### **1.09 REGULATORY REQUIREMENTS**

- A. Conform to ASME B31.9 code for installation of piping system.
- B. Welding Materials and Procedures: Conform to ASME SEC 9 and applicable state labor regulations.
- C. Provide certificate of compliance from authority having jurisdiction indicating approval of welders.

#### **1.10 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, protect and handle products under provisions of Section 15010 and Division 1
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage. Collect and save installation instructions for DIA Project Managers use.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

### **1.11 EXTRA MATERIALS**

- A. Provide two repacking kits for each size and valve type.

## **PART 2 - PRODUCTS**

### **2.01 HEATING WATER PIPING, ABOVE GROUND**

- A. Steel Pipe: ASTM A 53, Schedule 40, black.
  - 1. Fittings: ASTM B 16.3, malleable iron or ASTM A 234, forged steel welding type fittings.
  - 2. Joints: Screwed, grooved mechanical couplings, or AWS D1.1, welded.
- B. Copper Tubing: ASTM B 88, Type L, hard drawn.
  - 1. Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.
  - 2. Fittings for Grooved End Systems: ASTM B 75 or ASTM B 152 and ANSI B16.22 wrought copper, bronze sand casting per ASTM B 584-87 copper alloy CDA 836 (85-5-5-5).
  - 3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
  - 4. Joints: Solder, lead free, ASTM B 32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

### **2.02 CHILLED WATER PIPING, ABOVE GRADE**

- A. Steel Pipe: ASTM A 53, Schedule 40, black.
  - 1. Fittings: ASTM B 16.3, malleable iron or ASTM A 234, forged steel welding type.
  - 2. Joints: Screwed, for pipe 2 inch and under; AWS D1.1 welded for pipe over 2 inch size.
- B. Copper Tubing: ASTM B 88, Type L, hard drawn.
  - 1. Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.
  - 2. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
  - 3. Joints: Solder, lead free, ASTM B 32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

## 2.03 EQUIPMENT DRAINS AND OVERFLOWS

- A. Steel Pipe: ASTM A 53, Schedule 40 galvanized.
  - 1. Fittings: Galvanized cast iron, or ASTM B 16.3 malleable iron.
  - 2. Joints: Threaded, or grooved mechanical couplings.
- B. Copper Tubing: ASTM B 88, Type L, hard drawn.
  - 1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
  - 2. Joints: Solder, lead free, ASTM B 32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

## 2.04 PIPE HANGERS AND SUPPORTS

- A. Conform to requirements of Section 15140.

## 2.05 FLANGES, UNIONS, COUPLINGS, AND MECHANICAL JOINT RESTRAINTS

- A. Unions for Pipe 2 Inches and Under:
  - 1. Ferrous Piping: 150 psig malleable iron, threaded.
  - 2. Copper Pipe: Bronze, soldered joints.
- B. Flanges for Pipe Over 2 Inches:
  - 1. Ferrous Piping: 150 psig forged steel, slip-on.
  - 2. Copper Piping: Bronze.
  - 3. Gaskets: 1/16 inch thick non-asbestos preformed gaskets, aramid fibers with nitrile (NBR) binder; Durlon "8500 Green", Garlock "IFG 5500", or approved equal.
- C. Grooved and Shouldered Pipe End Couplings:
  - 1. Housing Clamps: Malleable iron galvanized to engage and lock, designed to permit some angular deflection, contraction, and expansion. Where rigid connections are required, couplings shall be supplied with angle-pattern bolt pads.
  - 2. Sealing Gasket: C-shape elastomer composition for operating temperature range from -30 to 230 degrees F. Gaskets to be supplied pre-lubricated with dry lubricant to facilitate installation.
  - 3. Accessories: Steel bolts, nuts, and washers.
- D. Dielectric Waterway Fittings: Dielectric fittings designed to effectively separate dissimilar metals exposed to water or other electrolytes, conforming to NSF and ASTM F492 standards for continuous use at temperatures up to 225 degrees F and pressures up to 300 psi. Fittings to have electro-zinc-plated steel casings providing for maintained exterior electrical continuity, threaded or grooved ends as applicable, and inert linings. Provide "ClearFlow" units as manufactured by Perfection Corporation or approved substitute.

## 2.06 ACCEPTABLE MANUFACTURERS - VALVES

- A. Subject to conformance with specified requirements, products of the following manufacturers are acceptable:
  - 1. Gate, Globe, Check, Drain
    - a. Crane

- b. Hammond
  - c. Jenkins
  - d. Milwaukee
  - e. Powell
  - f. Stockham
  - g. Victaulic
  - h. Substitutions: Under provisions of Section 15010.
2. Ball Valves
- a. Apollo-Conbraco
  - b. Bray
  - c. Crane
  - d. Jamesbury
  - e. Jenkins
  - f. Milwaukee
  - g. Nibco
  - h. Stockham
  - i. Victaulic
  - j. Substitutions: Under provisions of Section 15010.
3. Butterfly Valves
- a. Bray
  - b. Jamesbury
  - c. Nibco
  - d. Norris
  - e. Posi-Seal
  - f. Victaulic
  - g. Substitutions: Under provisions of 15010.

## 2.07 VALVES REQUIRING ACTUATORS OR POSITIONERS

- A. For valves to be equipped with electrical or pneumatic actuators or positioners, the valves and the devices required to mechanically position valves shall be supplied as work of Section 15952 of these specifications, with the valves installed in piping systems as work of this Section. Installation of actuators (where not integrally assembled with valve bodies), including furnishing and installation of any brackets, mountings, or other fabrications necessary for physically mounting actuator/positioner devices, shall be performed as work of Section 15952.

## 2.08 GATE VALVES

- A. Up to and Including 2 Inches: Bronze body, bronze trim, screwed bonnet, non-rising stem, handwheel, inside screw with backseating stem, solid wedge disc, alloy seat rings, solder or threaded ends.
- B. Over 2 Inches: Iron body, bronze trim, bolted bonnet, non-rising stem, handwheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged or grooved ends.
- C. Operating pressure rating shall be 250 psig OWG non-shock at 230 degrees F.

## 2.09 GLOBE AND ANGLE VALVES

- A. Up to and Including 2 Inches: Bronze body, bronze trim, screwed bonnet, rising stem and handwheel, inside screw with backseating stem, renewable composition disc and bronze seat, solder or threaded ends.
- B. Over 2 Inches: Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, rotating plug-type disc with renewable seat ring and disc, flanged ends.
- C. Operating pressure rating shall be 200 psig OWG non-shock at 250 degrees F.

## 2.10 BALL VALVES

- A. Up to and Including 2 Inches: Bronze two piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder or threaded ends.
- B. Over 2 Inches: Cast steel body, 316 stainless steel ball, teflon seat and stuffing box seals, lever handle, flanged.
- C. Operating pressure rating shall be 300 psig OWG non-shock at 230 degrees F.

## 2.11 BUTTERFLY VALVES

- A. Cast Iron Resiliently Seated Butterfly Valves 2" to 12": ASTM-A 126 Class B cast iron body to fit between ANSI Class 150 flanges, 250 psi bi-directional shutoff rating, lug style butterfly valve, extended neck, polished aluminum/bronze disc, EPDM replaceable seat rated for 250 degrees F continuous use, bi-directional stem seal, one-piece 316 or 416 SS stem, bronze upper and lower inboard bearings. Valves shall be installed by use of cap screws; threaded rod not acceptable. Bray series 30/31 or equal.
- B. Operator: 2" through 6" to have a 10-position lever handle; throttling valves to have infinite position lever handle with adjustable 2-way memory stop kit. Provide handwheel and gear drive for valves 8" and larger.

## PART 3 -EXECUTION

### 3.01 PIPING APPLICATIONS

- A. Hot and Chilled Water, NPS 2 and Smaller: Aboveground, use Type L drawn-temper copper tubing with soldered joints or Schedule 40 steel pipe with threaded joints. Belowground or within slabs, use Type K annealed-temper copper tubing with soldered joints. Use the fewest possible joints belowground and within floor slabs.
- B. Hot and Chilled Water, NPS 2-1/2 and Larger: Schedule 40 steel pipe with flanged joints or grooved mechanical-joint couplings.
- C. Condensate Drain Lines: Type L drawn-temper copper tubing with soldered joints.

### 3.02 VALVE APPLICATIONS

- A. General-Duty Valve Applications: Unless otherwise indicated, use the following valve types:
  - 1. Shutoff Duty: Gate, ball, and butterfly valves.
  - 2. Throttling Duty: Globe, ball, and butterfly valves.
- B. Install shutoff duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, unless only one piece of equipment is connected in the branch line. Install throttling duty valves at each branch connection to return mains, at return

connections to each piece of equipment, and elsewhere as indicated.

- C. Install calibrated balancing valves in the return water line of each heating or cooling element and elsewhere as required to facilitate system balancing.

### 3.03 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Provide piping connections to equipment with flanges or unions.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps. Protect threads in a similar manner.
- E. After completion, fill, clean, and treat systems.

### 3.04 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install heating water piping to ASME B31.9. Install chilled water piping to ASME B31.5.
- C. Route piping in orderly manner, parallel to building structure, and maintain gradient.
- D. Install piping to conserve building space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Sleeve pipe passing through partitions, walls and floors.
- G. Inserts: Refer to Section 15140.
- H. Pipe Hangers and Supports:
  - 1. Install in accordance with Section 15140.
  - 2. Support horizontal piping as scheduled.
  - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
  - 4. Place hangers within 12 inches of each side of each horizontal elbow. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - 5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
  - 6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
  - 7. Provide copper plated hangers and supports for copper piping.
- I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 15260.
- J. Provide access where valves and fittings are not exposed.

- K. Slope piping and arrange systems to drain at low points; refer to Part 1 system description. Use eccentric reducers to maintain bottom of pipe level.
- L. Provide capped air vents at all high points except as otherwise indicated; refer to Section 15515.
- M. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
- N. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Division 9.
- O. Install manual valves with stems upright or horizontal, not inverted. Stems for motorized valves shall be installed in upright position except where otherwise specifically indicated on the drawings.

### 3.05 CLEANING, FLUSHING, AND INSPECTING

- A. Clean and flush system, with clear water, of all dirt, metal chips, sand, and foreign matter. After flushing, remove, clean, and replace all strainer baskets or screens. Inspect each run of each system for completion of joints, supports, accessory items, and obvious leaks.
- B. Examine and inspect piping in accordance with ANSI B31.1, Chapter VI.

### 3.06 LEAK TESTING

- A. Provide temporary equipment for testing, including pump and gages. Test piping system before insulation is installed, wherever feasible, and remove control devices before testing. Subject entire piping systems to leak tests, either as a whole, or in sections; but leave no part untested.
- B. Test gauges shall have a range that provide for the test pressure to be in the middle third of the gauge scale.
- C. Contractor shall provide written notification to the DIA Project Manager/Engineer and DIA Inspector at least 48 hours before performing leak test. Perform all tests in the presence of the authorized City representative.
- D. Hydrostatic Leak Test:
  - 1. Perform hydrostatic leak test on all piping systems.
  - 2. Hydrostatic Leak Test Procedure:
    - a. Fill piping systems with clear water, vent all air, and pressurize at 150% of operating pressure, (but not less than 100 psi) for 2 hours. Test fails if leakage is observed, or pressure drop exceeds 5% of test pressure.
- E. Testing shall be witnessed by DIA Mechanical Inspector and Project Manager or Designated Representative.
- F. Repair piping systems which fail required piping test, by disassembly and reinstallation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.
- G. Drain test water from piping systems after testing and repair work that has been completed.

- H. Prepare written report of testing procedures and result. Submit in accordance with Section 15010.
  
- I. After completion, fill, clean, and treat systems.

#### **PART 4 - MEASUREMENT**

##### **4.01 METHOD OF MEASUREMENT**

- A. No separate measurement will be made for work under this Section.

#### **PART 5 - PAYMENT**

##### **5.01 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 Lump Sum Contract price.

**END OF SECTION 15510**



**SECTION 15515**  
**HYDRONIC SPECIALTIES**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Air vents.
- B. Combination fittings.
- C. Flow indicators and controls.
- D. Balancing valves.

**1.02 RELATED SECTIONS**

- A. Section 15010 - Basic Mechanical Requirements.
- B. Section 15050 - Basic Mechanical Materials and Methods.
- C. Section 15510 - Hydronic Piping.

**1.03 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. Refer to Section 15010 for listing of issuing organizations or agencies.
  - 1. American Society of Mechanical Engineers (ASME):
    - a. ASME - Boilers and Pressure Vessel Codes, SEC 8-D-Rules for Construction of Pressure Vessels.
  - 2. International Building Code (IBC) with the Denver Amendments
  - 3. International Fire Code (IFC) with the Denver Amendments

**1.04 SUBMITTALS**

- A. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component rough-in requirements, service sizes, and finishes. Include product description, model, dimensions and weight.
- B. Submit inspection certificates for pressure vessels from authority having jurisdiction.
- C. "As Built" Plans shall be provided in the same format as described above. Each set shall be equipped with a plan holder equal to "Stacor Plan Clamps" for the appropriate size drawing.

**1.05 PROJECT RECORD DOCUMENTS**

- A. Record actual locations of expansion tanks and air separators.

**1.06 OPERATION AND MAINTENANCE DATA**

- A. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products under provisions of Section 15010 and Division 1
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

### 1.08 MAINTENANCE SERVICE FOR GLYCOL-PROTECTED SYSTEMS

- A. Perform project visit, 30 days after system startup, to make glycol fluid concentration analysis on site with refractive index measurement instrument. Provide written report of findings to maintenance personnel, covering corrective actions needed including analysis and amounts of glycol or water added as part of Contract work. Include pH analysis of system contents and perform work required to adjust pH to a level of 8.0 or higher, and add inhibitors needed to maintain pH.

### 1.09 EXTRA MATERIALS

- A. Provide one extra 10 gallon drum of propylene glycol.

## PART 2 - PRODUCTS

### 2.01 AIR VENTS

- A. Manufacturers:
  - 1. Amtrol, Inc.
  - 2. Bell & Gossett ITT.
  - 3. Taco Inc.
  - 4. Substitutions: Under provisions of Section 15010.
- B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.
- C. Float Type: Brass body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve. Minimum ratings not less than 250 degrees F and 150 psi working pressure.
- D. Washer Type: Brass with hydroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

### 2.02 BALANCING VALVES

- A. Furnish and install calibrated balance valves as shown on plans and in conformity with manufacturer's recommendations; Model CB as manufactured by Bell and Gossett - ITT or approved substitute.
- B. Pres-set Balance Feature. Valves to be designed to allow installing contractor to pre-set balance schedule.
- C. Valve design and Construction:
  - 1. Valves 1/2" to 3" pipe size, threaded or soldered ends:
    - a. Valves to be of bronze body/brass ball construction with glass and carbon filled TFE seat rings. Valves to have differential pressure read-out ports across valve seat area, with read-out ports be fitted with internal EPT insert and check valve. Valve bodies to have 1/4" NPT tapped drain/purge port. Valves to have memory stop feature to allow valve to be closed for service and then reopened to set point without disturbing balance position. All valves to have calibrated nameplate to assure specific valve setting. Valves to be leak-tight at full rated working pressure.
    - b. Design pressure/Temperature:
      - 1) 1/2" - 3" NPT connections: 300 psig at 250 degrees F.
      - 2) 1/2" and 3/4" solder connections: 200 psig at 250 degrees F.
  - 2. Valves 2-1/2" to 8" pipe size, Flanged Joint type:
    - a. Valves shall be of heavy-duty cast iron construction with 125 psi ANSI flanged connections (as applicable) suitable for up to 175 psi working pressure. Valves 2-1/2" - 3" pipe size shall have a brass ball with glass and carbon filled TFE seat rings. Valves to have differential pressure read-out ports across valve seat area, with read-out ports be fitted with internal EPT insert and check valve. Valves 4"-8" shall be fitted with a bronze seat, replaceable bronze disc with EPDM seal insert and stainless steel stem. Valves to have memory stop feature to allow valve to be closed for service and then reopened to set point without disturbing balance position. All valves to have calibrated nameplate to assure specific valve setting. Valves to be leak-tight at full rated working pressure.
    - b. Design pressure/temperature: 175 psig at 250 degrees F.

## 2.03 FLOW SWITCHES

- A. Manufacturers:
  - 1. Honeywell, Inc.
  - 2. Watts Regulator.
  - 3. Johnson Control.
  - 4. Potter-Roemer Inc.
  - 5. Substitutions: Under provisions of Section 15010.
- B. Brass construction, threaded for insertion into piping system, packless, with paddle with removable segments, vapor proof electrical compartment with switches.

## 2.04 FLOW METERS

- A. Manufacturers:
  - 1. Gustin-Bacon.
  - 2. BIF.
  - 3. Hersey Products Inc.

4. Liquid Controls Corp.
  5. Substitutions: Under provisions of Section 15010.
- B. Orifice principle by-pass circuit with direct reading gage, soldered or flanged piping connections for 125 psig working pressure, with shut off valves, and drain and vent connections.
- C. Direct reading with insert pitot tube, threaded coupling, for 150 psig working pressure, maximum 240 degrees F, 5 percent accuracy.
- D. Cast iron, wafer type, orifice insert flow meter for 250 psig working pressure, with read-out valves equipped with integral check valves with gasketed caps.
- E. Calibrated, plug type balance valve with precision machined orifice, readout valves equipped with integral check valves and gasketed caps, calibrated nameplate and indicating pointer.
- F. Cast iron or bronze, globe style, balance valve with handwheel with vernier type ring setting and memory stop, readout valves equipped with integral check valves and gasketed caps.
- G. Provide full-size isolation valves on the inlet to and outlet from flow meters, and full-size pipe bypass with globe valve to permit system operation during flow meter maintenance.
- H. Portable meter consisting of case containing two 3 percent accuracy pressure gages with 0-135 inches and 0-60 feet pressure ranges for 500 psig maximum working pressure, color coded hoses for low and high pressure connections, and connectors suitable for connection to read-out valves.

## **2.05 FLOW CONTROL VALVES**

- A. Control Valves shall be Flow Control Industries Delta P valves as indicated on drawings. Substitutions not allowed.
- B. Valves and actuators shall be for normally-open or normally-closed operation as shown on the drawings or as required by the operating sequences.
- C. Refer to Section 15952 – Controls and Instrumentation for control valve actuators.

## **2.06 PRESSURE AND TEMPERATURE PLUGS**

- A. Manufacturers:
1. Duro Instrument Co.
  2. Trerice Co.
  3. Universal.
  4. Weksler.
  5. Substitutions: Under provisions of Section 15010.
- B. Stainless steel combination pressure-temperature test plugs with neoprene valve core where shown on the drawings. Provide 2 1" bi-metal pocket test thermometers with 0 to 220 degrees F scale and plug adapter to the DIA Project Manager. Provide two 0-100 psi, 4-1/2" dial NPT conn. pressure gauges with pressure gauge adaptors to DIA Project Manager.

## **PART 3 - EXECUTION**

**3.01 INSTALLATION AND APPLICATION**

- A. Install specialties in accordance with manufacturer's instructions to provide intended performance.
- B. Provide manual air vents at system high points and as indicated. Provide isolation valves on water inlet to terminal heating units such as radiation, unit heaters, and fan coil unit.

**PART 4 - MEASUREMENT**

**4.01 METHOD OF MEASUREMENT**

- A. No separate measurement will be made for work under this Section.

**PART 5 - PAYMENT**

**5.01 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 Lump Sum Contract price.

**END OF SECTION 15515**



## SECTION 15952

### CONTROLS AND INSTRUMENTATION

#### PART 1 -GENERAL

##### 1.01 WORK INCLUDED

- A. Provide all labor, equipment, and material necessary for complete and fully operational temperature control system, as shown on the drawings, point schedules, and as specified herein.
- B. Provide necessary materials and fieldwork necessary to connect control components factory-supplied as part of equipment controlled, unless specified otherwise. Generally, self-contained valves, filter gages, liquid level controllers, and similar instruments are not to be installed under this Section.
- C. The automatic temperature control system shall be electronic direct digital control (DDC) type, with electric and electronic components. Unless otherwise specified, all controls shall be fully proportioning. Proportional/integral (PI) and proportional/integral/derivative (PID) control shall be utilized where specified. The system shall be complete in every respect and shall be put into operation, tested, and adjusted under operating conditions.
- D. The control system shall include all control devices, valves, dampers, operators, thermostats, control panels, and control wiring and conduit as specified and required to fulfill the intent of the specifications and the sequence of operation. Coordinate all work with the equipment suppliers and the Division 16 installer.
- E. Provide all completion services specified hereinafter, including final system performance verification, to insure the system functions as specified in the Sequence of Operations.
- F. Instruction of Owner's Personnel: Upon completion of the system demonstration, instruct the Owner's operating personnel in the proper operation and maintenance of the control system provided under this Section.
- G. Refer to Division 15 sections for requirements for interfacing controls and instrumentation with mechanical equipment and systems; interface work included as work of this Section.
- H. Conform to Division 16 sections for raceways, cables and conductors, terminations and splices, boxes, cabinets, supports, hangers, seals, and other applicable requirements governing the installation of the electrical components of the controls systems.

##### 1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 15910 - Ductwork Accessories: Installation of automatic dampers.

##### 1.03 RELATED WORK

- A. Section 15010 - Basic Mechanical Requirements: for miscellaneous piping, materials and methods, and general requirements.
- B. Base Building Controls Sections (15952, 15954, 15955, 15956, 15957, 15958, 15959): for installation of connections to the Building Automation System.
- C. Section 15985 - Sequence of Operation: For overall system operation

- D. Section 16142 - Electrical Connections for Equipment: Installation and connection of all power wiring. Power wiring shall be defined as follows:
1. Wiring of power feeds through all disconnect starters and variable speed controllers to electric motors.
  2. 120 VAC Emergency power feeds to all critical BAS and/or temperature control panels.
  3. 120 VAC wiring to DDC/VAV terminal units without fan motors or heaters as scheduled. Required voltage to DDC/VAV boxes with fan motors and/or heaters shown on Electrical Plans.
  4. Wiring of any remote start/stop switches and manual or automatic motor speed control devices not furnished by the BAS Contractor.

#### 1.04 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. Refer to Section 15010 for listing of issuing organizations or agencies.
- B. Applicable Standards:
1. Air Movement and Control Association (AMCA):
    - a. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
  2. American National Standards Institute (ANSI)
    - a. American National Standards Institute (ANSI) publication C57.13, Requirements for Instrument Transformers
    - b. ANSI MC96.1-Temperature Measurement Thermocouples.
  3. American Society of Mechanical Engineers (ASME)
    - a. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure fittings.
    - b. ASME MC85.1 - Terminology for Automatic Control.
  4. American Society for Testing of Materials (ASTM):
    - a. ASTM B 32 - Solder Metal.
    - b. ASTM B 280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
    - c. ASTM D 1693 - Environmental Stress - Cracking of Ethylene Plastics.
  5. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
    - a. ASHRAE 85 - Automatic Control Terminology for Heating, Ventilating, Air Conditioning.
  6. Electronic Industries Association (EIA) Publications:
    - a. RS-232-C-69: Interface Between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange.
    - b. RS-422-A-78: Electrical Characteristics of Balanced Voltage Digital Interface Circuits.
    - c. RS-423-A-78: Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits.
  7. International Building Code (IBC) with the Denver Amendments
  8. International Fire Code (IFC) with the Denver Amendments
  9. Military Standards (MIL):
    - a. MIL-STD-461, Electronic Interface Characteristic Requirements for Equipment.
    - b. MIL-F-18280 - Fittings, Flareless Tube, Fluid Connection



- c. MIL-S-29175 - Switch, Thermostatic, Low Voltage, Non- (Setback/ Setup) and Setback/Setup, Limiting: Heating, Cooling and Heating-Cooling
  - d. FS-GG-G-76 - Gages, Pressure and Vacuum, Dial Indicating (for Air, Steam, Oil, Water, Ammonia, Chloro- Fluorohydrocarbon Gases, and Compressed Gases).
10. National Electrical Manufacturers Association (NEMA):
- a. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
  - b. NEMA DC 3 - Low-Voltage Room Thermostats
  - c. NEMA EMC1 - Energy Management Systems Definitions.
11. National Fire Protection Association (NFPA):
- a. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
12. Underwriters' Laboratories: Provide electrical components and assemblies which have been UL listed and labeled.

### 1.05 SYSTEM DESCRIPTION

- A. System Architecture: The control system shall be a network of fully independent direct digital controllers. The controllers shall be interconnected via a multiplexed digital data trunk. Data available to any one controller shall be available to all controllers on the trunk. Each main controller may supervise a sub-network of lower level direct digital controllers. Sensor input devices and output devices may be connected to either the main or lower level direct digital controllers. Operator interface shall be via a prompting system using an English language format on a color monitor. A hard-copy printer shall be furnished to provide a permanent record of all alarm occurrences. Operator interface and bulk data storage shall be through a PC based CPU. The PC will allow a user to interface with the network via dynamic color graphics. Each mechanical system, building floor plan, and control device will be depicted by point-and-click graphics.

### 1.06 QUALITY ASSURANCE

- A. Control System Manufacturer: Shall have a complete engineering, sales, installation, and service organization in operation within the area for a period of not less than five years.
- B. Electrical and Mechanical Installation: Shall be by trained electricians and mechanics in the continuous employment of an installer whose normal business is the installation of automatic temperature control systems. This installer shall have been in continuous operation in this business for a period of not less than five years. Installations by wholesalers, installers, or any firm whose normal business is not that of furnishing and installing automatic temperature control systems will not be permitted.
- C. Interoperability With Existing System: The BAS shall be fully interoperable, and backward compatible with the existing Building Automation Systems (BAS).
- D. Acceptable Manufacturers/Installers: Products of the following manufacturers shall be used:
- |                    |                                       |
|--------------------|---------------------------------------|
| Terminal Building  | Honeywell, Inc.                       |
| Concourse A        | Honeywell, Inc.                       |
| Concourse B        | Kreuter Manufacturing Controls. (KMD) |
| Concourse C        | Honeywell, Inc.                       |
| Central Plant HVAC | Johnson Controls, Inc.                |
| Outlying Buildings | Johnson Controls, Inc.                |
- E. Regulatory Requirements: Control wiring and pneumatic piping shall comply with all applicable codes and regulations.

## 1.07 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 15010.
- B. Submit the following not less than ten days prior to beginning any installation:
  - 1. Product Data: Submit for all components.
  - 2. Control system schematic diagrams: Submit schematic diagrams for each system controlled. The diagram should be arranged similar to the graphic display provided at the operator workstation. Diagrams shall include all input and output points, uniquely identified, as well as all virtual or software calculated points required by the system. The sequence of operation for each system shall appear on its respective control schematic diagram.
  - 3. System architecture diagram: Submit an overall system architecture, or riser diagram which indicates controller arrangement with respect to each other, and their method of communication, i.e., which communicate over Ethernet, MS/TP, PTP, etc.
  - 4. Schedules: Submit control valve schedule indicating valve size, line size, design flow, pressure drop at design flow, percentage open at design flow and valve coefficient.
  - 5. A list of the color graphic screens to be provided. For each screen, provide a conceptual layout of pictures and data, and show or explain which other screens can be directly accessed.
  - 6. System configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
  - 7. "As Built" Plans shall be provided in the same format and manner as described above. Each set shall be equipped with a plan holder equal to "Stacor Plan Clamps" for the appropriate size drawings.

## 1.08 PROJECT RECORD DOCUMENTS

- A. Accurately record actual location of control components, including panels, thermostats, and sensors.
- B. Revise shop drawings to reflect actual installation and operating sequences.
- C. Include data specified in "Submittals" in final "Record Documents" form.
- D. At completion of work, submit report of checkout of automatic control system.
  - 1. Provide control diagrams for each system.
  - 2. Include manufacturer's installation instructions.

## 1.09 OPERATION AND MAINTENANCE DATA

- A. Prior to system demonstration by Contractor, submit three copies of operation and maintenance manuals.
- B. Include Operating Instructions for: Starting, stopping, adjustment, and regulation.
- C. Inspection and Maintenance Instructions, Including: Schedules and procedures for equipment replacement, adjustments, cleaning and cleaning materials, protection, testing, calibration and calibration tolerances.
- D. Operating Instructions, Including: Equipment characteristics and operating procedures.

- E. Maintenance Instructions and Procedures: Schedule of routine maintenance, maintenance procedures, and trouble-shooting.
- F. Parts list and recommended spare parts list.
- G. Warranty arrangements.
- H. Include interconnection wiring diagrams for complete field installed system with identified and numbered system components and devices.
- I. Include keyboard illustrations and step-by-step procedures indexed for each operator function.

#### **1.10 SEQUENCING AND SCHEDULING**

- A. Sequence and schedule work under the provisions of Division 1.
- B. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.
- C. Coordinate work under provisions of Division 1 and ensure system is completed and commissioned by Date of Substantial Completion.
- D. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

#### **1.11 WARRANTY**

- A. Warranty of all equipment described in this Section shall meet warranty requirements of Section 15010 - Basic Mechanical Requirements.
- B. All system components furnished under this contract shall be guaranteed against defective design, materials, and workmanship for the full warranty time which is standard with the manufacturer, but in no case less than two (2) years from the date of system acceptance.

#### **1.12 MAINTENANCE SERVICE**

- A. Furnish service and maintenance of automatic controls system for one year from Date of Substantial Completion.
- B. Provide complete service of controls systems, including callbacks. Make minimum of two complete normal inspections of approximately eight hours duration in addition to normal service calls to inspect, calibrate, and adjust controls, and submit written reports.

#### **1.13 OWNERSHIP OF PROPRIETARY MATERIAL**

- A. All project-developed software and documentation shall become the property of the Owner. These include, but are not limited to:
  - 1. Project graphic images.
  - 2. Record drawings.
  - 3. Project database.
  - 4. Project-specific application programming code.
  - 5. All documentation.

## PART 2 - PRODUCTS

### 2.01 GENERAL

- A. Provide control products in sizes and of capacities indicated, conforming to manufacturer's standard materials and components as published in their product information; designed and constructed as recommended by manufacturer, and as required for the applications indicated.
- B. System capabilities and requirements specified herein are intended to describe the ultimate capability of the BAS, even though all such functions may not be utilized initially. Refer to the Sequence of Operation and Control Object Schedule.

### 2.02 SYSTEM PERFORMANCE

- A. Performance Standards: The system shall conform to the following:
  - 1. Graphic Display: The system shall display a graphic with 20 dynamic points with all current data within 10 seconds.
  - 2. Object Command: The maximum time between the command of a binary object by the operator and the reaction by the device shall be less than 2 seconds. Analog objects should start to adjust within 2 seconds.
  - 3. Object Scan: All changes of state and change of analog values will be transmitted over the high-speed network such that any data used or displayed at a controller or workstation will have been current within the previous 60 seconds.
  - 4. Alarm Response Time: The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed 45 seconds.
  - 5. Program Execution Frequency: Custom and standard applications shall be capable of running as often as once every 5 seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
  - 6. Performance: Programmable controllers shall be able to execute DDC PID control loops at a selectable frequency of at least once per second. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
  - 7. Multiple Alarm Annunciation: All workstations on the network must receive alarms within 5 seconds of each other.
  - 8. Reporting Accuracy: The system shall report all values with an end-to-end accuracy as listed or better than those listed in below.
    - a. Water Temperature: +/- 0.5 degree F.
    - b. Delta T: +/- 0.25 degree F.
    - c. Water Flow: +/- 5 % of full scale.
    - d. Electrical (Amperes, Volts, Watts, Power factor): +/- 5 % of reading (see Note 3).

Note 1: 10%-100% of scale  
Note 2: For both absolute and differential pressure  
Note 3: Not including utility-supplied meters

  - 9. Stability of Control: Control loops shall maintain measured variable at set point within the following tolerances (for range of medium shown, where applicable):
    - a. Temperature: 1.0 degree F accuracy.

### 2.03 COMMUNICATION

- A. The Contractor shall provide all communication media, connectors, repeaters, hubs, and routers necessary for the inter-network.

- B. All controllers shall have a communication port for connections with the operator interface devices.
- C. Communication services over the Internet work shall result in operator interface and value passing that is transparent to the Internet work architecture as follows:
  - 1. Connection of an operator interface device to any one controller on the Internet work will allow the operator to interface with all other controllers as if that interface were directly connected to the other controllers. Data, status information, reports, system software, custom programs, etc., for all controllers shall be available for viewing and editing from any one controller on the Internet work.
  - 2. All database values (e.g., objects, software variables, custom program variables) of any one controller shall be readable by any other controller on the Internet work. This value passing shall be automatically performed by a controller when a reference to a object name not located in that controller is entered into the controller's database. An operator/installer shall not be required to set up any communication services to perform Internet work value passing.

## 2.04 CONTROLLER SOFTWARE

- A. Furnish the following applications software for building and energy management. All software applications shall reside and operate in the system controllers. Editing of applications shall occur at the operator workstation. These specifications are intended to describe the overall capability of the software package. Each activity described below may not necessarily be reflected in the Sequence of Operation, or elsewhere in the Contract Documents.
- B. System Security:
  - 1. User access shall be secured using individual security passwords and user names.
  - 2. Passwords shall restrict the user to the objects, applications, and system functions as assigned by the system manager.
  - 3. User Log On/Log Off attempts shall be recorded.
  - 4. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user-definable.
- C. Scheduling: Provide the capability to schedule each object or group of objects in the system. Each schedule shall consist of the following:
  - 1. Weekly Schedule: Provide separate schedules for each day of the week. Each of these schedules should include the capability for start, stop, optimal start, optimal stop, and night economizer. Each schedule may consist of up to 4 events. When a group of objects are scheduled together, provide the capability to adjust the start and stop times for each member.
  - 2. Exception Schedules: Provide the ability for the operator to designate any day of the year as an exception schedule. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed, it will be discarded and replaced by the standard schedule for that day of the week.
  - 3. Holiday Schedules: Provide the capability for the operator to define up to 99 special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period.
  - 4. System Coordination: Provide a standard application for the proper coordination of equipment. This application shall provide the operator with a method of grouping together equipment based on function and location. This group may then be used for scheduling and other applications.

5. Lead/Lag Equipment Selection: Provide the capability for the operator to select lead and lag equipment, and to schedule switching of the lead equipment via time schedule(s).
- D. Binary Alarms: Each binary object shall be set to alarm based on the operator-specified state. Provide the capability to automatically and manually disable alarming.
- E. Analog Alarms: Each analog object shall have both high and low alarm limits. Alarming must be able to be automatically and manually disabled.
- F. Alarm Reporting: The operator shall be able to determine the action to be taken in the event of an alarm. Alarms shall be routed to the appropriate workstations based on time and other conditions. An alarm shall be able to start programs, print, be logged in the event log, generate custom messages, and display graphics.
- G. Remote Communication: The system shall have the ability to communicate off-site in the event of an alarm, through a telephone auto-dialer or other means of communication.
- H. Demand Limiting:
  1. The demand limiting program shall monitor building power consumption from signals generated by a pulse generator (provided by others) mounted at the building power meter, or from a watt transducer or current transformer attached to the building feeder lines.
  2. The demand limiting program shall predict the probable power demand such that action can be taken to prevent exceeding the demand limit. When demand prediction exceeds demand limit, action will be taken to reduce loads in a predetermined manner. When demand prediction indicates the demand limit will not be exceeded, action will be taken to restore loads in a predetermined manner.
  3. Demand reduction shall be accomplished by the following means:
    - a. Reset air handling unit supply temperature set point up by 2 degrees F.
    - b. Reset space temperature set points up by 2 degrees F.
    - c. De-energize equipment based upon priority.
  4. Demand limiting parameters, frequency of calculations, time intervals, and other relevant variables shall be based on the means by which the local power company computes demand charges.
  5. Provide demand limiting prediction and control for any individual meter monitored by the system or for the total of any combination of meters.
  6. Provide the means for an operator to make the following changes on-line:
    - a. Addition and deletion of loads controlled.
    - b. Changes in demand intervals.
    - c. Changes in demand limit for meter(s).
    - d. Maximum shutoff time for equipment.
    - e. Minimum shutoff time for equipment.
    - f. Select rotational or sequential shedding and restoring.
    - g. Shed/restore priority.
  7. Provide the following information and reports, to be available on an hourly, daily, and monthly basis:
    - a. Total electric consumption.
    - b. Peak demand.
    - c. Date and time of peak demand.
    - d. Daily peak demand.

- I. Maintenance Management: The system shall monitor equipment status and generate maintenance messages based upon user-designated run-time, starts, and/or calendar date limits.
- J. Sequencing: Provide application software to properly sequence the start and stop of chillers, boilers, and pumps to minimize energy usage in the facility.
- K. PID Control: A PID (proportional-integral-derivative) algorithm with direct or reverse action and anti-windup shall be supplied. The algorithm shall calculate a time-varying analog value that is used to position an output or stage a series of outputs. The controlled variable, set point, and PID gains shall be user-selectable.
- L. Staggered Start: This application shall prevent all controlled equipment from simultaneously restarting after a power outage. The order in which equipment (or groups of equipment) is started, along with the time delay between starts, shall be user-selectable.
- M. Energy Calculations: Provide software to allow instantaneous power (e.g., kW) or flow rates (e.g., L/s GPM) to be accumulated and converted to energy usage data. Provide an algorithm that calculates a sliding-window kW demand value.
- N. Anti-Short Cycling: All binary output objects shall be protected from short cycling. This feature shall allow minimum on-time and off-time to be selected.
- O. On/Off Control with Differential: Provide an algorithm that allows a binary output to be cycled based on a controlled variable and set point. The algorithm shall be direct-acting or reverse-acting, and incorporate an adjustable differential.
- P. Run-Time Totalization: Provide software to totalize run-times for all binary input objects. A high run-time alarm shall be assigned, if required, by the operator.
- Q. History and Trend Logs.

## 2.05 CONTROLLER SOFTWARE

- A. Provide sufficient internal memory for the specified sequences of operation and trend logging. There shall be a minimum of 25% of available memory free for future use.

- B. Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index. Use the following naming convention:

AA.BBB.CCDDE where:

AA is used to designate the location of the point within the building such as mechanical room, wing, or level, or the building itself in a multi-building environment.

BBB is used to designate the mechanical system with which the point is associated (e.g., A01, HTG, CLG, LTG).

CC represents the equipment or material referenced (e.g., SF for supply fan, RW for return water, EA for exhaust air, ZN for zone).

D or DD may be used for clarification or for identification if more than one of CC exists (e.g., SF10, ZNB).

E represents the action or state of the equipment or medium (e.g., T for temperature, H for humidity, C for control, S for status, D for damper control, I for current).

- C. Software Programming.
1. Provide programming for the system and adhere to the sequences of operation provided. All other system programming necessary for the operation of the system, but not specified in this document, also shall be provided by the Contractor. Imbed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequences of operation. Use the appropriate technique based on the following programming types:
    - a. Text-based:
      - 1) Must provide actions for all possible situations.
      - 2) Must be modular and structured.
      - 3) Must be commented.
    - b. Graphic-based:
      - 1) Must provide actions for all possible situations.
      - 2) Must be documented.
    - c. Parameter-based:
      - 1) Must provide actions for all possible situations.
      - 2) Must be documented.
- D. Operator Interface:
1. Standard Graphics: Provide graphics for all mechanical systems and floor plans of the building. This includes each chilled water system, hot water system, chiller, boiler, air handler, and all terminal equipment. Point information on the graphic displays shall dynamically update. Show on each graphic all input and output points for the system. Also show relevant calculated points such as set points.
  2. Show terminal equipment information on a "graphic" summary table. Provide dynamic information for each point shown.
  3. The Contractor shall provide all the labor necessary to install, initialize, start up, and troubleshoot all operator interface software and their functions as described in this section. This includes any operating system software, the operator interface database, and any third-party software installation and integration required for successful operation of the operator interface.

## 2.06 BUILDING CONTROLLERS

- A. General: Provide an adequate number of Building Controllers to achieve the performance specified in the Part 1 Article on "System Performance." Each of these panels shall meet the following requirements.
1. The Building Automation System shall be comprised of one or more independent, standalone, microprocessor-based Building Controllers to manage the global strategies described in the System Software section.
  2. The Building Controller shall have sufficient memory to support its operating system, database, and programming requirements.
  3. Data shall be shared between networked Building Controllers.
  4. The operating system of the Building Controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information, and allow central monitoring and alarms.
  5. Controllers that perform scheduling shall have a real-time clock.
  6. The Building Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:
    - a. Assume a predetermined failure mode.
    - b. Generate an alarm notification.



7. The Building Controller shall communicate with other objects on the inter-network using Read (Execute and Initiate) and Write (Execute and Initiate) Property services.
- B. Building Controllers shall be selected to provide a minimum of 15% spare I/O point capacity for each point type. If input points are not universal, 10% of each type is required. If outputs are not universal, 10% of each type is required. A minimum of one spare is required for each type of point used. Future use of spare capacity shall require providing the field device, field wiring, point database definition, and custom software. No additional controller boards or point modules shall be required to implement use of these spare points
- C. Communication:
  1. Each Building Controller shall reside on a network using the ISO 8802-3 (Ethernet) Data Link/ Physical layer protocol. Each Building Controller also shall perform routing if connected to a network of Custom Application and Application Specific Controllers.
  2. The controller shall provide a service communication port using Data Link/ Physical layer protocol for connection to a hand-held workstation.
- D. Environment: Controller hardware shall be suitable for the anticipated ambient conditions.
  1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at -40 to 150 degrees F.
  2. Controllers used in conditioned space shall be mounted in dust-proof enclosures, and shall be rated for operation at 32 to 120 degrees F.
- E. Serviceability: Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field- removable, modular terminal strips - or to a termination card connected by a ribbon cable.
- F. Memory: The Building Controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
- G. Immunity to Power and Noise: Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 feet.

## 2.07 CUSTOM APPLICATION CONTROLLERS

- A. Provide a separate controller for each AHU or other HVAC system. A DDC controller may control more than one system provided that all points associated with the system are assigned to the same DDC controller. Points used for control loop reset such as outside air or space temperature are exempt from this requirement. Each of these panels shall meet the following requirements.
  1. The Custom Application Controller shall have sufficient memory to support its operating system, database, and programming requirements.
  2. Data shall be shared between networked Custom Application Controllers.
  3. The operating system of the Controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information, and allow central monitoring and alarms.
  4. Controllers that perform scheduling shall have a real-time clock.
  5. The Custom Application Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:
    - a. Assume a predetermined failure mode.

- b. Generate an alarm notification.
6. The Custom Application Controller shall communicate with other objects on the inter-network using the Read (Execute and Initiate) and Write (Execute and Initiate) Property services.
- B. Custom Application Controllers shall be selected to provide a minimum of 15% spare I/O point capacity for each point type. If input points are not universal, 10% of each type is required. If outputs are not universal, 10% of each type is required. A minimum of one spare is required for each type of point used. Future use of spare capacity shall require providing the field device, field wiring, point database definition, and custom software. No additional controller boards or point modules shall be required to implement use of these spare points
- C. Provide sufficient internal memory for the specified sequences of operation and trend logging. There shall be a minimum of 25% of available memory free for future use.
- D. Communication:
  1. Each Custom Application Controller shall reside on a network using the MS/TP Data Link/ Physical layer protocol.
  2. The controller shall provide a service communication port using Data Link/ Physical layer protocol for connection to a hand-held workstation.
- E. Environment: Controller hardware shall be suitable for the anticipated ambient conditions.
  1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at -40 to 150 degrees F.
  2. Controllers used in conditioned space shall be mounted in dust-proof enclosures, and shall be rated for operation at 32 to 120 degrees F.
- F. Serviceability: Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips - or to a termination card connected by a ribbon cable.
- G. Memory: The Custom Application Controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
- H. Immunity to Power and Noise: Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 feet.

## 2.08 APPLICATION SPECIFIC CONTROLLERS

- A. General: Application Specific Controllers (ASCs) are microprocessor-based DDC controllers which through hardware or firmware design are dedicated to control a specific piece of equipment. They are not fully user-programmable, but are customized for operation within the confines of the equipment they are designed to serve. Application Specific Controllers shall communicate with other objects on the network using the Read (Execute) Property service.
  1. Each ASC shall be capable of standalone operation and shall continue to provide control functions without being connected to the network.
  2. Each ASC will contain sufficient I/O capacity to control the target system.
- B. Application: ASCs may be applied to fan powered, single and dual duct terminal units, and to packaged HVAC equipment such as rooftop units and heat pumps, to the extent that they are able to successfully execute the sequence of operation specified in section 15985.

- C. Communication:
  - 1. The controller shall reside on a network using the MS/TP Data Link/ Physical layer protocol. Each network of controllers shall be connected to one Building Controller.
  - 2. Each controller shall have a Data Link/ Physical layer compatible connection for a laptop computer or a portable operator's tool.
- D. Environment: The hardware shall be suitable for the anticipated ambient conditions.
  - 1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at -40 to 150 degrees F.
  - 2. Controllers used in conditioned space shall be mounted in dust-proof enclosures, and shall be rated for operation at 32 to 120 degrees F.
- E. Serviceability: Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips - or to a termination card connected by a ribbon cable.
- F. Memory: The Application Specific Controller shall use non-volatile memory and maintain all BIOS and programming information in the event of a power loss.
- G. Immunity to Power and Noise: Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%. Operation shall be protected against electrical noise of 5-120 Hz and from keyed radios up to 5 W at 3 feet.
- H. Transformer. Power supply for the ASC must be rated at minimum of 125% of ASC power consumption, and shall be fused or current limiting type.

## 2.09 INTEROPERABILITY WITH OTHER SYSTEMS

- A. The BAS shall be interoperable with systems provided by others to the extent indicated on the Drawings and specified below. Gateways specified shall be capable of complete interoperation between the system and BAS, including all system operating functions and system programming.

## 2.10 INPUT/OUTPUT INTERFACE

- A. Hardwired inputs and outputs may tie into the system through Building or Custom Application.
- B. All input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24 V of any duration, such that contact with this voltage will cause no damage to the controller. Inputs and outputs shall be arranged on interchangeable modules or circuit boards to allow the replacement of a damaged module or board without replacing the entire controller.
- C. Binary inputs shall allow the monitoring of On/Off signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices, and shall be protected against the effects of contact bounce and noise. Binary inputs shall sense "dry contact" closure without external power (other than that provided by the controller) being applied.
- D. Pulse Accumulation Input Objects: This type of object shall conform to all the requirements of binary input objects, and also accept up to 10 pulses per second for pulse accumulation.

- E. Analog inputs shall allow the monitoring of low-voltage (0 to 10 VDC), current (4 to 20 mA), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with - and field-configurable to - commonly available sensing devices.
- F. Binary outputs shall provide for On/Off operation, or a pulsed low- voltage signal for pulse width modulation control. Binary outputs on Building and Custom Application Controllers shall have three-position (On/Off/Auto) override switches and status lights. Outputs shall be selectable for either normally open or normally closed operation.
- G. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0 to 10 VDC or a 4 to 20 mA signal as required to provide proper control of the output device. Analog outputs on Building or Custom Application Controllers shall have status lights and a two-position (AUTO/MANUAL) switch and manually adjustable potentiometer for manual override. Analog outputs shall not exhibit a drift of greater than 0.4% of range per year.
- H. Tri-State Outputs: Provide tri-state outputs (two coordinated binary outputs) for control of three-point floating type electronic actuators without feedback. Use of three-point floating devices shall be limited to zone control and terminal unit control applications (VAV terminal units, duct mounted heating coils, zone dampers, radiation, etc.). Control algorithms shall run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
- I. Input/Output points shall be universal type, i.e., controller input or output may be designated (in software) as either a binary or analog type point with appropriate properties. Application Specific Controllers are exempted from this requirement.
- J. System Object Capacity: The system size shall be expandable to at least twice the number of input/output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The operator interfaces installed for this project shall not require any hardware additions or software revisions in order to expand the system.

## 2.11 POWER SUPPLIES AND LINE FILTERING

- A. Control transformers shall be UL Listed. Furnish Class 2 current-limiting type, or furnish over-current protection in both primary and secondary circuits for Class 2 service per NEC requirements. Limit connected loads to 80% of rated capacity.
  - 1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100 microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection, and shall be able to withstand a 150% current overload for at least 3 seconds without trip-out or failure.
  - 2. Unit shall operate between 32 F and 120 degrees F. EM/RF shall meet FCC Class B.
- B. Power Line Filtering: Provide transient voltage and surge suppression for all workstations and controllers either internally or as an external component. Surge protection shall have the following at a minimum:
  - 1. Dielectric strength of 1,000 volts minimum.
  - 2. Response time of 10 nanoseconds or less.
  - 3. Transverse mode noise attenuation of 65 dB or greater.
  - 4. Common mode noise attenuation of 150 dB or better at 40 Hz to 100 Hz.

## 2.12 ELECTRIC AND ELECTRONIC ACTUATORS

- A. Control valve actuators shall be of sufficient capacity to operate the valve under all conditions, as specified, against system pressure encountered. Each actuator shall be fully proportioning or 2-position type as required by the operating sequence, and shall include travel limit stops and controls as required to prevent over-travel. Actuators shall be provided with spring-return for normally-closed or normally-open position on power interruption as indicated on the drawings and/or in the operating sequences. Modulating actuators shall provide linear response to the applied control signal, which may be a 0-10 VDC, 4-20 ma current or tri-state floating point type. All proportioning actuators shall be provided with positive positioning devices or indicators.
- B. Actuators acting in sequence with other valve actuators shall be capable of adjustment of the control operating span as required for the operating characteristics of the system.

## 2.13 CONTROL WIRING

- A. Electrical Wiring: Provide in accordance with Section 16120 as required for the temperature control system, including electrical interlock wiring. Comply with the National Electrical Code, local codes, and Division 16 of these specifications.
- B. Internal control wiring for equipment shall be provided by the manufacturers of that equipment.

## 2.14 CONTROL PANELS

- A. All controllers, relays, switches, etc, for equipment located within equipment rooms shall be mounted in enclosed metallic control panels with hinged, locking doors. Indicating devices and pressure differential devices shall be mounted on the face of the control panel door. All control devices for equipment located in exposed areas subject to outside weather conditions, shall be mounted inside weatherproof enclosures. Nameplates shall be provided beneath each panel-mounted control device describing the function of the device.
- B. Provide UL listed cabinets for use with line voltage devices.
- C. All pneumatic devices within the panel shall be factory pre-piped. A "pneumatic terminal" numbering system shall be applied to all pneumatic lines within each panel with aforementioned numbers matching pneumatic terminals shown on the as-built control diagrams.
- D. All electrical devices within the panel shall be pre-wired to terminal strips, with all inter-device wiring within the panel completed prior to installation of the system. A terminal numbering system shall be applied to all wires within each panel, with the numbers matching the wiring terminals shown on the as-built control diagrams.

## 2.15 CONTROL TRANSFORMERS

- A. Provide control transformers as required for a complete and fully operational control system.
- B. Transformers to have adequate capacity for all connected controls. Input and output voltages to be as required for the control power voltage available, and the voltages required by the control components.

## 2.16 ELECTRONIC TEMPERATURE SENSORS

- A. All temperature sensors, unless otherwise indicated on the drawings, shall be thermistors having a resistance of 10,000 ohms at 21 degrees C (70 degrees F), an accuracy of 0.3

degrees C (0.5 degrees F) or better throughout the temperature range of 0 to 100 degrees C (32 to 212 degrees F). Averaging temperature sensors shall be used to measure the temperature of mixed air streams in ductwork. The averaging sensors shall include a continuous sensing element of sufficient length to permit mounting in accordance with the drawings.

- B. Thermistors may be used in lieu of 1000 ohm platinum RTD's, if equivalent system accuracy will be achieved, for VAV terminal box control.
- C. Electronic temperature sensors shall be 3- or 4-wire devices, for connection into a bridge circuit on the analog input interface at the controller, or they shall be connected in a 4-wire circuit in which the excitation current flows through a separate pair of wire devices with signal conditioning provided at the sensor to convert resistance to a standard current range for transmission to the controller.
- D. Thermowells shall be Series 300 stainless steel.

## 2.17 RELAYS

- A. Control relays shall be UL Listed plug-in type with dust cover and LED "energized" indicator. Contact rating, configuration, and coil voltage suitable for application.
- B. Time delay relays shall be UL Listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable (200% (minimum) from set point shown on plans. Contact rating, configuration, and coil voltage suitable for application. Provide NEMA 1 enclosure when not installed in local control panel.
- C. Override timers shall be spring-wound line voltage UL Listed, contact rating and configuration as required by application. Provide 0-to-6-hour calibrated dial unless otherwise specified; suitable for flush mounting on control panel face, located on local control panels or where shown.
- D. Current transmitters.
  - 1. AC current transmitters shall be self-powered combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4 to 20 mA two-wire output. Unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A full scale, internal zero and span adjustment, and (1% full scale accuracy at 500 ohm maximum burden).
  - 2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA Recognized.
  - 3. Unit shall be split-core type for clamp-on installation on existing wiring.
- E. Current transformers.
  - 1. AC current transformers shall be UL/CSA Recognized and completely encased (except for terminals) in approved plastic material.
  - 2. Transformers shall be available in various current ratios and shall be selected for (1% accuracy at 5 A full scale output).
  - 3. Transformers shall be fixed-core or split-core type for installation on new or existing wiring, respectively.
- F. Voltage transmitters.
  - 1. AC voltage transmitters shall be self-powered single loop (two-wire) type, 4 to 20 mA output with zero and span adjustment.

2. Ranges shall include 100 to 130 VAC, 200 to 250 VAC, 250 to 330 VAC, and 400 to 600 VAC full-scale, adjustable, with (1% full-scale accuracy with 500 ohm maximum burden).
  3. Transmitters shall be UL/CSA Recognized at 600 VAC rating and meet or exceed ANSI/ISA S50.1 requirements.
- G. Voltage transformers.
1. AC voltage transformers shall be UL/CSA Recognized, 600 VAC rated, complete with built-in fuse protection.
  2. Transformers shall be suitable for ambient temperatures of 4 to 55|C 40 to 130|F and shall provide (0.5% accuracy at 24 VAC and a 5 VA load.
  3. Windings (except for terminals) shall be completely enclosed with metal or plastic material.
- H. Power monitors.
1. Power monitors shall be three-phase type furnished with three-phase disconnect/shorting switch assembly, UL Listed voltage transformers and UL Listed split-core current transformers.
  2. Shall provide a selectable rate pulse output for kWh reading and a 4 to 20 mA output for kW reading. Shall operate with 5 A current inputs with a maximum error of 2% at 1.0 power factor.
- I. Current switches: Current-operated switches shall be self-powered, solid-state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system.

## **2.18 WATER FLOW SENSING ELEMENTS**

- A. Dual turbine, impedance sensing flow meter with bright tin plated brass wetted parts.
- B. Accuracy shall be 2% of actual reading from 0.4 to 20 feet per second.
- C. Pressure drop shall be less than 1 PSI at 1100 feet per minute.
- D. Meter shall be rated for operating pressures up to 400 PSI and temperatures up to 200 degrees F.
- E. Approved product: Onicon, Model 1210 series.

## **PART 3 -EXECUTION**

### **3.01 EXAMINATION**

- A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.
- B. The Contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the Engineer for resolution before rough-in work is started.
- C. The Contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate - or if any discrepancies occur between the plans and the Contractor's work, and the plans and the work of others - the Contractor shall

report these discrepancies to the Engineer and shall obtain written instructions for any changes necessary to accommodate the Contractor's work with the work of others.

### 3.02 PROTECTION

- A. The Contractor shall protect all work and material from damage by its work or employees, and shall be liable for all damage thus caused.
- B. The Contractor shall be responsible for its work and equipment until finally inspected, tested, and accepted. The Contractor shall protect any material that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

### 3.03 COORDINATION

- A. Site:
  - 1. Where the mechanical work will be installed in close proximity to, or will interfere with work of other trades, the Contractor shall assist in working out space conditions to make a satisfactory adjustment. If the Contractor installs its work before coordinating with other trades, so as to cause any interference with work of other trades, the Contractor shall make the necessary changes in its work to correct the condition without extra charge.
  - 2. Coordinate and schedule work with all other work in the same area, or with work which is dependent upon other work, to facilitate mutual progress.
- B. Test and Balance:
  - 1. The Contractor shall furnish all tools necessary to interface to the control system for test and balance purposes.
  - 2. The Contractor shall provide training in the use of these tools. This training will be planned for a minimum of 4 hours.
  - 3. In addition, the Contractor shall provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.
  - 4. The tools used during the test and balance process will be returned at the completion of the testing and balancing.
- C. Life Safety:
  - 1. Interfere with building fire alarm systems in place for lockout on the event there is a fire in the zone served by this AHU.
  - 2. Duct smoke detectors required for air handler shutdown are supplied under Division 16. The Contractor shall interlock smoke detectors to air handlers for shutdown as described in the sequence of operation.
  - 3. The Contractor shall interlock smoke dampers and actuators required for duct smoke isolation to the air handlers as described in the sequence of operation.
  - 4. Control of fire/smoke dampers and actuators required for fire rated walls shall be by Division 16. The Contractor shall provide control air, if required, to the dampers.
- D. Coordination with Controls Specified in Other Sections or Divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the Contractor as follows:
  - 1. Each supplier of a controls product is responsible for the configuration, programming, startup, and testing of that product to meet the sequence of operation.



2. The Contractor shall coordinate and resolve any incompatibility issues that arise between the control products provided under this Section and those provided under other sections or divisions of this specification.
3. The Contractor is responsible for providing all controls described in the contract documents regardless of where within the contract documents these controls are described.
4. The Contractor is responsible for the interface of control products provided by multiple suppliers regardless of where this interface is described within the contract documents.

### 3.04 GENERAL WORKMANSHIP

- A. Install equipment, piping, and wiring/raceway parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.
- B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
- C. Install all equipment in readily accessible locations as defined by Chapter 1, Article 100, Part A of the National Electrical Code (NEC).
- D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.
- E. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

### 3.05 FIELD QUALITY CONTROL

- A. All work, materials, and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this specification.
- B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship.

### 3.06 WIRING

- A. All control and interlock wiring shall comply with national and local electrical codes and Division 16 of this specification. Where the requirements of this section differ with those in Division 16, the most stringent requirements shall apply.
- B. All NEC Class 1 (line voltage) wiring shall be UL Listed in approved raceway per NEC and Division 16 requirements.
- C. All low-voltage wiring shall meet NEC Class 2 requirements. (Low-voltage power circuits shall be sub-fused when required to meet Class 2 current-limit.)
- D. Where NEC Class 2 (current-limited) wires are in concealed and accessible locations including ceiling return air plenums, approved cables not in raceway may be used, provided that cables are UL Listed for the intended application. For example, cables used in ceiling plenums shall be UL Listed specifically for that purpose.
- E. All wiring in mechanical, electrical, or service rooms - or where subject to mechanical damage - shall be installed in raceway at levels below 10 feet.

- F. Class 2 wiring shall not be installed in raceway containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).
- G. Do not install wiring in raceway containing tubing.
- H. Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems.
- I. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
- J. Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the Contractor shall provide step-down transformers.
- K. All wiring shall be installed as continuous lengths, with no splices permitted between termination points.
- L. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.
- M. Size of raceway and size and type of wire shall be the responsibility of the Contractor, in keeping with the manufacturer's recommendation and NEC requirements, except as noted elsewhere.
- N. Use coded conductors throughout with different colored conductors.
- O. Conceal all raceways, except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 6" from high-temperature equipment (e.g., flues).
- P. Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.
- Q. Adhere to Division 16 requirements where raceway crosses building expansion joints.
- R. The Contractor shall terminate all control and/or interlock wiring, and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.
- S. Flexible metal raceways and liquid-tight, flexible metal raceways shall not exceed 3 feet in length and shall be supported at each end.
- T. Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings (per code). Terminations must be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed.

### **3.07 COMMUNICATION WIRING**

- A. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.
- B. Maximum pulling, tension, and bend radius for cable installation as specified by the cable manufacturer shall not be exceeded during installation.

- C. Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.
- D. When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lightning arrestor shall be installed according to the manufacturer's instructions.
- E. All runs of communication wiring shall be unspliced length when that length is commercially available.
- F. All communication wiring shall be labeled to indicate origination and destination data.
- G. Grounding of coaxial cable shall be in accordance with NEC regulations Article on Communications Circuits, Cable and Protector Grounding.

### 3.08 FIBER OPTIC CABLE SYSTEM

- A. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post-installation residual cable tension shall be within cable manufacturer's specifications.
- B. All cabling and associated components shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii as specified by cable manufacturer shall be maintained.

### 3.09 INSTALLATION OF SENSORS

- A. Install sensors in accordance with the manufacturer's recommendations.
- B. Mount sensors rigidly and adequately for the environment within which the sensor operates.
- C. All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.
- D. Sensors used in mixing plenums, and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner vertically across duct. Each bend shall be supported with a capillary clip.
- E. Low limit sensors used in mixing plenums shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip. Provide 1 foot of sensing element for each 1 square foot of coil area.
- F. All pipe-mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.
- G. Install outdoor air temperature sensors on north wall, complete with sun shield at designated location.
- H. Differential Air Static Pressure:
  - 1. Supply Duct Static Pressure: Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the high-pressure tap tubing of the corresponding building static pressure sensor (if applicable), or to the location of the duct high-pressure tap and leave open to the plenum.
  - 2. Return Duct Static Pressure: Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the low-pressure tap tubing of the corresponding

building static pressure sensor (if applicable), or to the location of the duct high-pressure tap and leave open to the plenum.

3. Building Static Pressure: Pipe the low-pressure port of the pressure sensor to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe the high-pressure port to a location behind a thermostat cover.
4. The piping to the pressure ports on all pressure transducers shall contain a capped test port located adjacent to the transducer.
5. All pressure transducers, other than those controlling VAV boxes, shall be located in field device panels, not on the equipment monitored or on ductwork. Mount transducers in a location accessible for service without use of ladders or special equipment.
6. All air and water differential pressure sensors shall have gauge tees mounted adjacent to the taps. Water gauges shall also have shutoff valves installed before the tee.

### 3.10 FLOW SWITCH INSTALLATION

- A. Use correct paddle for pipe diameter.
- B. Adjust flow switch in accordance with manufacturer's instructions.

### 3.11 ACTUATORS

- A. Mount and link control damper actuators per manufacturer's instructions.
  1. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
  2. Provide all mounting hardware and linkages for actuator installation.
- B. Electric/Electronic:
  1. Dampers: Actuators shall be direct-mounted on damper shaft or jackshaft unless shown as a linkage installation. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5 degree available for tightening the damper seals. Actuators shall be mounted following manufacturer's recommendations.
  2. Valves: Actuators shall be connected to valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following the actuator manufacturer's recommendations.

### 3.12 IDENTIFICATION OF HARDWARE AND WIRING

- A. All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 2" of termination with the DDC address or termination number.
- B. Permanently label or code each point of field terminal strips to show the instrument or item served.
- C. Identify control panels with minimum 1/2" letters on laminated plastic nameplates.
- D. Identify all other control components with permanent labels. All plug-in components shall be labeled such that removal of the component does not remove the label.
- E. Identify room sensors relating to terminal box or valves with nameplates.
- F. Manufacturers' nameplates and UL or CSA labels to be visible and legible after equipment is installed.

- G. Identifiers shall match record documents.

### 3.13 CONTROL SYSTEM CHECKOUT AND TESTING

- A. Startup Testing: All testing listed in this article shall be performed by the Contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the Owner's Representative is notified of the system demonstration. Provide written report of checkout and testing results to Owner's Representative. Control System Demonstration and Acceptance will not be scheduled until this written report has been reviewed by the Owner's Representative.
1. The Contractor shall furnish all labor and test apparatus required to calibrate and prepare for service of all instruments, controls, and accessory equipment furnished under this specification.
  2. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
  3. Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures per manufacturers' recommendations.
  4. Verify that all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.
  5. Verify that all analog output devices (I/Ps, actuators, etc.) are functional, that start and span are correct, and that direction and normal positions are correct. The Contractor shall check all control valves and automatic dampers to ensure proper action and closure. The Contractor shall make any necessary adjustments to valve stem and damper blade travel.
  6. Verify that the system operation adheres to the Sequences of Operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops and optimum Start/Stop routines.
  7. Alarms and Interlocks:
    - a. Check each alarm separately by including an appropriate signal at a value that will trip the alarm.
    - b. Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.
    - c. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.

### 3.14 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

- A. Demonstration:
1. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed its own tests.
  2. The tests described in this section are to be performed in addition to the tests that the Contractor performs as a necessary part of the installation, startup, and debugging process and as specified in the "Control System Checkout and Testing" Article in Part 3 of this specification. The Owner's Representative will be present to observe and review these tests. The Owner's Representative shall be notified at least 10 days in advance of the start of the testing procedures.

3. The demonstration process shall follow that approved in Part 1: "Submittals." The approved checklists and forms shall be completed for all systems as part of the demonstration.
  4. The Contractor shall provide at least two persons equipped with two-way communication, and shall demonstrate actual field operation of each control and sensing point. Any test equipment required to prove the proper operation shall be provided by and operated by the Contractor.
  5. As each control input and output is checked, a log shall be completed showing the date, technician's initials, and any corrective action taken or needed.
  6. Demonstrate compliance with Part 1: "System Performance."
  7. Demonstrate compliance with Sequences of Operation through all modes of operation.
  8. Demonstrate complete operation of Operator Interface.
  9. Demonstrate trend logs for each system that indicate all set points, operating points, valve positions, mode, and equipment status to the Owner's Representative. These logs shall cover three 48-hour periods and have a sample frequency as indicated in the object schedule. The logs shall be provided in both printed and disk formats.
  10. Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The Contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests.
- B. Acceptance:
1. All tests described in this specification shall have been performed to the satisfaction of the Owner's Representative prior to the acceptance of the control system as meeting the requirements of Completion. Any tests that cannot be performed due to circumstances beyond the control of the Contractor may be exempt from the Completion requirements if stated as such in writing by the Owner's Representative. Such tests shall then be performed as part of the warranty.
  2. The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved.

### 3.15 CLEANING

- A. The Contractor shall clean up all debris resulting from its activities daily. The Contractor shall remove all cartons, containers, crates, etc., under its control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.
- B. At the completion of work in any area, the Contractor shall clean all of its work, equipment, etc., keeping it free from dust, dirt, and debris, etc.
- C. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

### 3.16 TRAINING

- A. Provide a minimum of five on-site or classroom training sessions, eight hours each, throughout the contract period for personnel designated by the Owner.
- B. Train the designated Day-to-day Operators of the Owner to enable them to:
  1. Proficiently operate the system.

2. Understand control system architecture and configuration.
  3. Understand DDC system components.
  4. Understand system operation, including DDC system control and optimizing routines (algorithms).
  5. Operate the workstation and peripherals.
  6. Log on and off the system.
  7. Access graphics, point reports, and logs.
  8. Adjust and change system set points, time schedules, and holiday schedules.
  9. Recognize malfunctions of the system by observation of the printed copy and graphical visual signals.
  10. Understand system drawings, and Operation and Maintenance manual.
  11. Understand the job layout and location of control components.
  12. Access data from DDC controllers and ASCs.
  13. Operate portable operator's terminals.
- C. Train the designated Advanced Operators of the Owner to enable them to:
1. Make and change graphics on the workstation.
  2. Create, delete, and modify alarms, including annunciation and routing of these.
  3. Create, delete, and modify point trend logs, and graph or print these both on an ad-hoc basis and at user-definable time intervals.
  4. Create, delete, and modify reports.
  5. Add, remove, and modify system's physical points.
  6. Create, modify, and delete programming.
  7. Create, delete, and modify system displays - both graphical and otherwise.
  8. Perform DDC system field checkout procedures.
  9. Perform DDC controller unit operation and maintenance procedures.
  10. Perform workstation and peripheral operation and maintenance procedures.
  11. Perform DDC system diagnostic procedures.
  12. Configure hardware including PC boards, switches, communication, and I/O points.
  13. Maintain, calibrate, troubleshoot, diagnose, and repair hardware.
  14. Adjust, calibrate, and replace system components.
- D. Train the designated System Managers/Administrators of the Owner to enable them to:
1. Maintain software and prepare backups.
  2. Add new users and understand password security procedures.
- E. These objectives will be divided into three logical groupings. Participants may attend one or more of these, depending on level of knowledge required:
1. Day-to-day Operators: Subject matter as listed.
  2. Advanced Operators: Training to include subject matter listed for Day-to-day Operators.

3. System Managers/Administrators: Training to include subject matter listed for Day-to-day Operators and Advanced Operators.
  - F. Provide course outline and materials. The instructor(s) shall provide one copy of training material per student.
  - G. The instructor(s) shall be factory-trained and experienced in presenting this material.
  - H. Classroom training shall be done using a network of working controllers representative of the installed hardware.

**3.17 OPERATING SEQUENCES**

- A. Refer to Section 15985.

**3.18 POINTS LIST**

- A. Constant Volume Air Handling Unit

	System Graphic	Digital Output	Digital Input	Analog Output	Analog Input	Alarm Point	Software Point
AHU	X						
Supply Fan Start-Stop and Status		X	X			X	
Return Fan Start-Stop and Status		X	X			X	
Outside Air Temperature (system shared point)					X		
Mixed Air Temperature					X		
Discharge Air Temperature					X		
Mixing Dampers				X			
Heating Coil Control Valve				X			
Cooling Coil Control Valve				X			
Low Temperature Thermostat			X			X <sup>1</sup>	
Duct Smoke Detectors (as needed)			X				
Dirty Filter			X				
Notes:							
1. For manual reset device							

- B. Variable Air Volume Air Handling Unit

	System Graphic	Digital Output	Digital Input	Analog Output	Analog Input	Alarm Point	Software Point
AHU	X						
Supply Fan Start-Stop and Status		X	X			X	
Return Fan Start-Stop and Status		X	X			X	
Supply Fan Speed Control				X			



Return Fan Speed Control				X			
Outside Air Temperature (system shared point)					X		
Mixed Air Temperature					X		
Discharge Air Temperature					X		
Discharge Air Static Pressure					X		
Space Static Pressure					X		
Discharge Air Velocity Pressure (as needed)					X		
Discharge Air CFM (as needed)							X
Mixing Dampers				X			
Heating Coil Control Valve				X			
Cooling Coil Control Valve				X			
Low Temperature Thermostat			X			X <sup>1</sup>	
Duct Smoke Detectors (as needed)			X				
Duct Static High Limit			X			X <sup>1</sup>	
Dirty Filter			X				
Notes:							
1. For manual reset device							

**PART 4 - MEASUREMENT**

**4.01 METHOD OF MEASUREMENT**

- A. No separate measurement will be made for work under this Section.

**PART 5 - PAYMENT**

**5.01 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 Lump Sum Contract price.

**END OF SECTION 15952**



## SECTION 15953

### BUILDING AUTOMATION SYSTEM (KMC)

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Extent of control systems work required by this Section is indicated on drawings and schedules, and by requirements of this Section.
  - 1. Control sequences are specified in SECTION 15985 - SEQUENCE OF OPERATION.
  - 2. Control sequences are specified in this Section.

##### 1.02 SECTION INCLUDES

- A. All components of the KMD Building Automation System including:
  - 1. Control Equipment.
  - 2. Control valves.

##### 1.03 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 15515 - Hydronic Specialties: Installation of control valves, flow switches, temperature sensor wells, gauge taps, flow meters.

##### 1.04 AGENCY LISTINGS

- A. UL 916 - Energy Management Systems.
- B. FCC - Part 15 Subparagraph J, Class A Emissions requirements.

##### 1.05 GENERAL PROVISIONS

- A. The General Provisions of the Contract, including the General Conditions and Supplementary General Conditions, apply to the work specified in this Section.

##### 1.06 RELATED SECTIONS

- A. Section 15010 - Basic Mechanical Requirements.

##### 1.07 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. Refer to Section 15010 for listing of issuing organizations or agencies.
- B. Applicable Standards:
  - 1. Air Movement and Control Association (AMCA):
    - a. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
  - 2. American National Standards Institute (ANSI)
    - a. ANSI C57.13, Requirements for Instrument Transformers and MC96.1, Temperature Measurement Thermocouples.

3. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
  - a. ASHRAE 85 - Automatic Control Terminology for Heating, Ventilating, Air Conditioning.
4. American Society of Mechanical Engineers (ASME):
  - a. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure fittings.
  - b. ASME MC85.1 - Terminology for Automatic Control.
5. American Society for Testing and Materials (ASTM):
  - a. ASTM B 32 - Solder Metal.
  - b. ASTM B 280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
6. Electronic Industries Association (EIA) Publications:
  - a. RS-232-C-69: Interface Between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange.
  - b. RS-422-A-78: Electrical Characteristics of Balanced Voltage Digital Interface Circuits.
  - c. RS-423-A-78: Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits.
7. International Building Code (IBC) with the Denver Amendments
8. International Fire Code (IFC) with the Denver Amendments
9. Military Standards:
  - a. MIL-STD-461, Electronic Interface Characteristic Requirements for Equipment.
  - b. MIL-F-18280 - Fittings, Flareless Tube, Fluid Connection.
  - c. MIL-S-29175 - Switch, Thermostatic, Low Voltage, Non- (Setback/ Setup) and Setback/Setup, Limiting: Heating, Cooling and Heating-Cooling
  - d. FS-GG-G-76 - Gages, Pressure and Vacuum, Dial Indicating (for Air, Steam, Oil, Water, Ammonia, Chloro- Fluorohydrocarbon Gases, and Compressed Gases).
10. National Electrical Manufacturers Association:
  - a. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
  - b. NEMA DC 3 - Low-Voltage Room Thermostats.
  - c. NEMA EMC1 - Energy Management Systems Definitions.
11. National Fire Protection Association (NFPA):
  - a. NFPA 70 - National Electrical Code (NEC).
  - b. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
12. Underwriters' Laboratories: Provide electrical components and assemblies which have been UL listed and labeled.

#### **1.08 GENERAL INSTRUCTIONS**

- A. KMC systems only occur in Concourse B.
- B. The Building Automation System as specified herein shall be provided in its entirety by the BAS Contractor. The BAS Contractor shall base his Bid on the system as specified, the sequence of operations and the points list.
- C. In general, the Building Automation System shall be based on a completely electronic system, including valve and damper actuators. Some large actuators will require pneumatic operators.

## 1.09 SCOPE

- A. The Building Automation System modifications shall be supplied and installed completely under the BAS Contract. Control components shall be mounted and wired by the BAS Contractor except as otherwise noted in this Section.
- B. The engineering, installation, calibration, software programming and checkout necessary for complete and fully operational Building Automation System, as specified herein, shall be provided by the BAS Contractor.

## 1.10 SUBMITTALS

- A. The following data/information shall be submitted for approval:
  - 1. Complete sequence of operation.
  - 2. Control system AutoCAD generated drawings including all pertinent data to provide a functional operating system. Submit drawings on a single CD-ROM in latest AutoCAD format.
  - 3. Valve schedules showing size, configuration, capacity and location of all equipment.
  - 4. Data sheets for all hardware and software control components.
  - 5. Samples of graphics with all monitored points for each type of equipment.
  - 6. Provide as part of the submittal five copies of all data and control drawings.
  - 7. Identify all tie in points to existing systems. ID all existing comm. lines, and equipment affected or controlled by BHS in project scope.

## 1.11 PROJECT RECORD DOCUMENTS

- A. The following data/information shall be submitted for at completion of the Work.:
  - 1. "As Built" Plans shall be provided in the same format and manner as described above. Record actual locations of equipment and piping, including instrument air piping and associated accessories. Drawings shall comply with drafting requirements in the DIA Design Standards Manual 1 available from the DIA Project Manager. Each set shall be equipped with a plan holder equal to "Stacor Plan Clamps" for the appropriate size drawings. All drawings shall be full size. All devices shall be included in the Operations and Maintenance Manual as specified in Section 15010 - Basic Mechanical Requirements.
  - 2. Electronic "As Built Plans": Submit the following information on single CD-ROM.
    - a. All drawings in latest AutoCAD format. All external references shall be bound to the individual drawings. Drawings shall comply with drafting requirements in the DIA Design Standards Manual 1 available from the DIA Project Manager.
    - b. A single, book-marked, security free PDF file of all submittal data and drawings. PDF shall be in Adobe Acrobat 5.02 or newer.
  - 3. Provide a minimum of three (3) sets or hard-copy information and CD-ROM's or additional sets as directed by Division 1.

## 1.12 QUALITY ASSURANCE

- A. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. No additional costs will be approved for these increases, if

larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.

- B. All new controls and modules shall connect to the existing Building Automation System without any upgrades to the existing head end of that system.

## **PART 2 - PRODUCTS AND SYSTEMS**

### **2.01 MANUFACTURERS**

- A. The specified system is based on a Krueter (KMD) 5502 system.

### **2.02 GENERAL**

- A. The Building Automation System shall include but not be limited to the following components:
  - 1. The Operator Interface shall consist of software upgrades that allow full user monitoring and adjustment of system parameters.
  - 2. Application Specific Controllers shall provide distributed, pre-engineered control, specific to the mechanical equipment specified.
  - 3. The system software shall include system software for global application functions, application software for distributed controllers, and operator interface software.
  - 4. End devices such as sensors, actuators, and valves.
- B. The failure of any single component shall not interrupt the control strategies of other operational devices. System expansion shall be through the addition of end devices, controllers, and other devices described in this specification.

### **2.03 APPLICATION SPECIFIC CONTROLLERS**

- A. Application Specific Controllers shall be stand-alone, microprocessor based Direct Digital Controllers with sufficient memory to handle its operating system, database and programming requirements.
- B. The Application Specific Controller shall be pre-programmed, tested, and factory mounted on the mechanical equipment to ensure reliability.
  - 1. Where factory mounting is not possible, the controllers shall be factory programmed and tested prior to shipment to the jobsite. The controllers shall be clearly labeled as to controller type, where it is to be installed, and software address (if applicable). The controller shall be fully tested upon installation to ensure that it is properly matched to the equipment it is controlling.
  - 2. Where controllers are installed on an existing BAS, the controller shall be fully compatible with the existing BAS without any modifications to the BAS front end.
- C. The controller shall communicate with other devices on the communication network and be fully integrated with the other system components.
- D. The hardware shall be suitable for the anticipated ambient conditions.
  - 1. Controller used in conditioned ambient shall be mounted in dust-proof enclosures, and shall be rated for operation at 32 degrees F to 120 degrees F.

## 2.04 INPUT/OUTPUT INTERFACE

- A. Hardwired inputs and outputs may tie into the system through Application Specific Controllers. Slave devices are also acceptable. Any critical points requiring immediate reaction shall be tied directly into the controller hosting the control software algorithm for the critical function.
- B. Binary inputs shall allow the monitoring of on/off signals from remote devices. The binary inputs shall provide a wetting current of 12MA at 12VDC to be compatible with commonly available control devices.
  - 1. All status points shown on the point list shall be positive proof differential pressure or current sensing binary switches.
- C. Analog inputs shall allow the monitoring of low voltage, current, or resistance signals and shall have a minimum resolution of 0.1% of the sensing range. Analog inputs shall be compatible with, and field configurable to commonly available sensing devices.
- D. Binary outputs shall provide a continuous low voltage signal for on/off control of remote devices. Where specified in the sequence of operations or indicated on the points list, binary outputs shall have 3-position (on/off/auto) override switches, status lights, and shall be selectable for either normally open or normally closed position.
- E. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0 to 10 VDC or a 4 to 20 milliampere signal as required to provide proper control of the output device.
- F. System architecture shall allow for point expansion in one of the following ways:
  - 1. The addition of input/output cards to an existing System Application Controller.
  - 2. A slave controller may be used to expand point capacity.
  - 3. 10 % expansion capacity for all point types in all DDC panels.

## 2.05 AUXILIARY CONTROL DEVICES

- A. Control Valves: Refer to Section 15515 – Hydronic Specialties
- B. Control Valve Actuators: Refer to Section 15952 – Controls and Instrumentation.
- C. Temperature Sensors:
  - 1. Temperature sensors shall be Resistance Temperature Detector (RTD) or Thermistor as dictated by the requirements of this specification.
  - 2. Immersion sensors shall be provided with a separable stainless steel well.
  - 3. Accuracies shall be +/- 1 degree F for standard applications. Where high accuracy is required, accuracies shall be +/- .2 degrees F.

## 2.06 SYSTEM APPLICATION CONTROLLER SOFTWARE

- A. System Security:
  - 1. User access shall be secured using individual security passwords for a minimum of eight users.
  - 2. Passwords shall have at least three levels of user access with data entry restrictions being assignable by password.

3. User logon/logoff attempts shall be recorded.
  4. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user definable.
- B. Alarms:
1. The Building Automation System shall provide audio, visual, contact closure, and remote telephone annunciation for:
    - a. Remote equipment failure.
    - b. Equipment run time.
    - c. Number of start/stops.
    - d. Program failure.
    - e. Card failure.
    - f. Sensor failure.
  2. Each analog sensor and binary point shall be individually alarmed for values in excess of individual high/low limits or status.
  3. When an alarm state is detected, the alarm shall automatically be stored and the user notified by printing the alarm message, sounding an audible tone, and flashing an alarm message on the CRT.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION REQUIREMENTS**

- A. All electrical work performed in the installation of the BAS system as described in this specification shall be per the National Electrical Code (NEC) and per applicable state and local codes. Where exposed, conduit shall be run parallel to building lines properly supported and sized at a maximum of 40% fill. In no cases shall field installed conduit smaller than 1/2" trade size be allowed. Where conductors are concealed (tenant spaces), cable rated for use in return air plenums shall be used.

### **3.02 OWNER TRAINING**

- A. The BAS Contractor shall provide 3 copies of an operator's manual describing all operating and routine maintenance service procedures to be used with the temperature control and Building Automation System supplied. This Contractor shall instruct the DIA Project Manager's designated representatives in these procedures during the startup and test period. The duration of the instruction period shall be no less than 12 hours, during normal working hours.

### **3.03 ADJUSTING AND CLEANING**

- A. Start-Up: Start-up, test, and adjust control systems in presence of manufacturer's authorized representative. Demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- B. After completion of the installation, perform final calibrations and adjustments of the equipment provided under this contract and supply services incidental to the proper performance of the Building Automation System under warranty below.
- C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces and manufacturer's touch-up paint.



- D. Final Adjustment: After completion of installation, adjust thermostats, control valves, motors, and similar equipment provided as work of this Section.
  - 1. Final adjustment shall be performed by specially trained personnel in direct employ of manufacturer of primary temperature control system.

### **3.04 ACCEPTANCE PROCEDURE**

- A. Upon completion of the calibration, Contractor shall startup the system and perform all necessary testing and run diagnostic tests to ensure proper operation. The BAS Contractor shall be responsible for generating all software and entering all database necessary to perform the sequence of control and specified software routines. An acceptance test in the presence of the DIA Project Manager's representative shall be performed.
- B. Upon successful completion of control system installation, the DIA Project Manager's authorized representative shall be requested in writing to inspect and approve the satisfactory operation of the control system, subsystem(s), and accessories. System operation, sequences, alarm reporting and operator workstation performance shall be demonstrated to meet Specifications prior to acceptance. Upon receipt of the detailed system adjustment list from the DIA Project Manager's authorized representative, an installation inspection report shall be prepared by Building Automation Contractor, showing by system each outstanding item on the system adjustments list. After all items appearing on the installation/inspection report are complete, a second written request for system approval will be made to the DIA Project Manager's authorized representative. As each or all items are approved, an appropriated notation will be entered at the time of the joint inspection of the system report with counter signature of the DIA Project Manager's authorized representative and date. A copy of this report shall be made for the DIA Project Manager's authorized representative.

### **3.05 WARRANTY**

- A. Warranty of all equipment described in this Section shall meet warranty requirements of Section 15010 - Basic Mechanical Requirements.
- B. All BAS devices and installation shall be warranted to be free from defects in workmanship and material for a period of two years from the date of job acceptance by the DIA Project Manager. Any equipment, software, or labor found to be defective during this period shall be repaired or replaced without expense to the DIA Project Manager. Factory authorized warranty service shall be available.

## **PART 4 - SEQUENCE OF OPERATIONS**

### **4.01 EXISTING HYDRONIC BUILDING SECONDARY PUMPS**

- A. The building automation system (BAS) shall be modified so that building secondary pump control strategies are eliminated. Existing points associated with the building secondary pumps that are to remain are identified on the point list.
- B. THE BAS Contractor shall ensure all points listed on the point list are connected to the BAS and all associated graphical monitoring and diagnostics are provided.

## **PART 5 - POINTS LISTS**

### **5.01 HYDRONIC TEMPERATURE CONTROL SYSTEM (BRDG-TNDR)**

Action		System Graphic	Digital Outputs	Digital Inputs	Analog Outputs	Analog Inputs	Alarm Point	Software Point
	BRDG-TNDR	X						
Remove	Outside Air Temperature					X		
Remove	Pump A Start-Stop and Status		X	X			X	
Remove	Pump B Start-Stop and Status		X	X			X	
Remain	Primary Water Supply Temperature		X					
Remain	Primary Water Return Temperature		X					
Remain	Secondary Water Supply Temperature		X					
Remain	Secondary Water Return Temperature		X					
Remain	Primary Water Flow		X					
Remain	Secondary Water Flow		X					
Remove	Water Setpoint			X				
Remove	Pump Moisture Alarm (Optional)			X			X	

**5.02 HYDRONIC PUMPS**

Action		System Graphic	Digital Outputs	Digital Inputs	Analog Outputs	Analog Inputs	Alarm Point	Software Point
	Hydronic Pump	X						
Remove	Status		X					
Remove	Pump Speed Control				X			
Remove	GPM					X		X
Remove	Water Temp Setpoint to BRDG-TNDR					X		

**PART 6 - MEASUREMENT**

**6.01 METHOD OF MEASUREMENT**

A. No separate measurement will be made for work under this Section.

**PART 7 - PAYMENT**

**7.01 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 Lump Sum Contract price.

**END OF SECTION 15953**

## SECTION 15954

### BUILDING AUTOMATION SYSTEM (HONEYWELL)

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Extent of control systems work required by this Section is indicated on drawings and schedules, and by requirements of this Section.
  - 1. Control sequences are specified in SECTION 15985 - SEQUENCE OF OPERATION.

##### 1.02 SECTION INCLUDES

- A. All components of the Honeywell Building Automation System including:
  - 1. Control Equipment.
  - 2. Control valves.

##### 1.03 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 15515 - Hydronic Specialties: Installation of control valves, flow switches, temperature sensor wells, gauge taps, flow meters.

##### 1.04 AGENCY LISTINGS

- A. UL 916 - Energy Management Systems.
- B. FCC - Part 15 Subparagraph J, Class A Emissions requirements.

##### 1.05 GENERAL PROVISIONS

- A. The General Provisions of the Contract, including the General Conditions and Supplementary General Conditions, apply to the work specified in this Section.

##### 1.06 RELATED SECTIONS

- A. Section 15010 - Basic Mechanical Requirements.

##### 1.07 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. Refer to Section 15010 for listing of issuing organizations or agencies.
- B. Applicable Standards:
  - 1. Air Movement and Control Association (AMCA):
    - a. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
  - 2. American National Standards Institute (ANSI)
    - a. ANSI C57.13, Requirements for Instrument Transformers and MC96.1, Temperature Measurement Thermocouples.
  - 3. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):

- a. ASHRAE 85 - Automatic Control Terminology for Heating, Ventilating, Air Conditioning.
4. American Society of Mechanical Engineers (ASME):
  - a. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure fittings.
  - b. ASME MC85.1 - Terminology for Automatic Control.
5. American Society for Testing and Materials (ASTM):
  - a. ASTM B 32 - Solder Metal.
  - b. ASTM B 280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
6. Electronic Industries Association (EIA) Publications:
  - a. RS-232-C-69: Interface Between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange.
  - b. RS-422-A-78: Electrical Characteristics of Balanced Voltage Digital Interface Circuits.
  - c. RS-423-A-78: Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits.
7. International Building Code (IBC) with the Denver Amendments
8. International Fire Code (IFC) with the Denver Amendments
9. National Electrical Manufacturers Association:
  - a. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
  - b. NEMA DC 3 - Low-Voltage Room Thermostats.
  - c. NEMA EMC1 - Energy Management Systems Definitions.
10. National Fire Protection Association (NFPA):
  - a. NFPA 70 - National Electrical Code (NEC).
  - b. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
11. Underwriters' Laboratories: Provide electrical components and assemblies which have been UL listed and labeled.

#### **1.08 GENERAL INSTRUCTIONS**

- A. Honeywell systems occur in the Terminal, AOB, Concourse A and portions of Concourse C (refer to section 15955).
- B. The Building Automation System modifications as specified herein shall be provided in its entirety by the BAS Contractor. The BAS Contractor shall base his Bid on the system as specified, the sequence of operations and the points list.
- C. In general, the Building Automation System shall be based on a completely electronic system, including valve actuators.

#### **1.09 SCOPE**

- A. The Building Automation System modification shall be supplied and installed completely under the BAS Contract. Control components shall be mounted and wired by the BAS Contractor except as otherwise noted in this Section.
- B. The engineering, installation, calibration, software programming and checkout necessary for complete and fully operational Building Automation System, as specified herein, shall be provided by the BAS Contractor.

## 1.10 SUBMITTALS

- A. The following data/information shall be submitted for approval:
1. Complete sequence of operation.
  2. Control system AutoCAD generated drawings including all pertinent data to provide a functional operating system. Submit drawings on a single CD-ROM in latest AutoCAD format.
  3. Valve schedules showing size, configuration, capacity and location of all equipment.
  4. Data sheets for all hardware and software control components.
  5. Samples of graphics with all monitored points for each type of equipment.
  6. Provide as part of the submittal five copies of all data and control drawings.
  7. Identify all tie in points to existing systems. ID all existing comm. lines, and equipment affected or controlled by BHS in project scope.

## 1.11 PROJECT RECORD DOCUMENTS

- A. The following data/information shall be submitted for at completion of the Work:
1. "As Built" Plans shall be provided in the same format and manner as described above. Record actual locations of equipment and piping, including instrument air piping and associated accessories. Drawings shall comply with drafting requirements in the DIA Design Standards Manual 1 available from the DIA Project Manager. Each set shall be equipped with a plan holder equal to "Stacor Plan Clamps" for the appropriate size drawings. All drawings shall be full size. All devices shall be included in the Operations and Maintenance Manual as specified in Section 15010 - Basic Mechanical Requirements.
  2. Electronic "As Built Plans": Submit the following information on single CD-ROM.
    - a. All drawings in latest AutoCAD format. All external references shall be bound to the individual drawings. Drawings shall comply with drafting requirements in the DIA Design Standards Manual 1 available from the DIA Project Manager.
    - b. A single, book-marked, security free PDF file of all submittal data and drawings. PDF shall be in Adobe Acrobat 5.02 or newer.
  3. Provide a minimum of three (3) sets or hard-copy information and CD-ROM's or additional sets as directed by Division 1.

## 1.12 QUALITY ASSURANCE

- A. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. No additional costs will be approved for these increases, if larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.
- B. All new controls and modules shall connect to the existing Building Automation System without any upgrades to the existing head end of that system.

## PART 2 - PRODUCTS AND SYSTEMS

## 2.01 MANUFACTURERS

- A. The specified system is based on a Honeywell Excel Plus system.

## 2.02 GENERAL

- A. The Building Automation System modification shall include but not be limited to the following components:
  - 1. The Operator Interface shall consist of software upgrades that allows full user monitoring and adjustment of system parameters.
  - 2. Application Specific Controllers shall provide distributed, pre-engineered control, specific to the mechanical equipment specified.
  - 3. The system software shall include system software for global application functions, application software for distributed controllers, and operator interface software.
  - 4. End devices such as sensors, actuators, and valves.
- B. The failure of any single component shall not interrupt the control strategies of other operational devices. System expansion shall be through the addition of end devices, controllers, and other devices described in this specification.

## 2.03 APPLICATION SPECIFIC CONTROLLERS (MICROCELL OR MACRO CELL)

- A. Application Specific Controllers shall be stand-alone, microprocessor based Direct Digital Controllers with sufficient memory to handle its operating system, database and programming requirements.
- B. The Application Specific Controller shall be pre-programmed, tested, and factory mounted on the mechanical equipment to ensure reliability.
  - 1. Where factory mounting is not possible, the controllers shall be factory programmed and tested prior to shipment to the jobsite. The controllers shall be clearly labeled as to controller type, where it is to be installed, and software address (if applicable). The controller shall be fully tested upon installation to ensure that it is properly matched to the equipment it is controlling.
  - 2. Where controllers are installed on an existing BAS, the controller shall be fully compatible with the existing BAS without any modifications to the BAS front end.
- C. The controller shall communicate with other devices on the communication network and be fully integrated with the other system components.
- D. The hardware shall be suitable for the anticipated ambient conditions.
  - 1. Controller used in conditioned ambient shall be mounted in dust-proof enclosures, and shall be rated for operation at 32 degrees F to 120 degrees F.

## 2.04 INPUT/OUTPUT INTERFACE

- A. Hardwired inputs and outputs may tie into the system through Application Specific Controllers. Slave devices are also acceptable. Any critical points requiring immediate reaction shall be tied directly into the controller hosting the control software algorithm for the critical function.

- B. Binary inputs shall allow the monitoring of on/off signals from remote devices. The binary inputs shall provide a wetting current of 12MA at 12VDC to be compatible with commonly available control devices.
  - 1. All status points shown on the point list shall be positive proof differential pressure or current sensing binary switches.
- C. Analog inputs shall allow the monitoring of low voltage, current, or resistance signals and shall have a minimum resolution of 0.1% of the sensing range. Analog inputs shall be compatible with, and field configurable to commonly available sensing devices.
- D. Binary outputs shall provide a continuous low voltage signal for on/off control of remote devices. Where specified in the sequence of operations or indicated on the points list, binary outputs shall have 3-position (on/off/auto) override switches, status lights, and shall be selectable for either normally open or normally closed position.
- E. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0 to 10 VDC or a 4 to 20 milliampere signal as required to provide proper control of the output device.
- F. System architecture shall allow for point expansion in one of the following ways:
  - 1. The addition of input/output cards to an existing System Application Controller.
  - 2. A slave controller may be used to expand point capacity.
  - 3. 10 % expansion capacity for all point types in all DDC panels.

## 2.05 AUXILIARY CONTROL DEVICES

- A. Control Valves: Refer to Section 15515 – Hydronic Specialties
- B. Control Valve Actuators: Refer to Section 15952 – Controls and Instrumentation.
- C. Temperature Sensors:
  - 1. Temperature sensors shall be Resistance Temperature Detector (RTD) or Thermistor as dictated by the requirements of this specification.
  - 2. Immersion sensors shall be provided with a separable stainless steel well.
  - 3. Accuracies shall be +/- 1 degree F for standard applications. Where high accuracy is required, accuracies shall be +/- .2 degrees F.

## 2.06 SYSTEM APPLICATION CONTROLLER SOFTWARE

- A. System Security:
  - 1. User access shall be secured using individual security passwords for a minimum of eight users.
  - 2. Passwords shall have at least three levels of user access with data entry restrictions being assignable by password.
  - 3. User logon/logoff attempts shall be recorded.
  - 4. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user definable.
- B. Alarms:

1. The Building Automation System shall provide audio, visual, contact closure, and remote telephone annunciation for:
  - a. Remote equipment failure.
  - b. Equipment run time.
  - c. Number of start/stops.
  - d. Program failure.
  - e. Card failure.
  - f. Sensor failure.
2. Each analog sensor and binary point shall be individually alarmed for values in excess of individual high/low limits or status.
3. When an alarm state is detected, the alarm shall automatically be stored and the user notified by printing the alarm message, sounding an audible tone, and flashing an alarm message on the CRT.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION REQUIREMENTS**

- A. Coordinate installation with Division 16 requirements.
- B. All electrical work performed in the installation of the BAS system as described in this specification shall be per the National Electrical Code (NEC) and per applicable state and local codes. Where exposed, conduit shall be run parallel to building lines properly supported and sized at a maximum of 40% fill. In no cases shall field installed conduit smaller than 1/2" trade size be allowed. Where conductors are concealed (tenant spaces), cable rated for use in return air plenums shall be used.
- C. Contractor shall disable alarms in existing controllers that are taken offline for construction. Alarms shall be re-established after work is complete.

#### **3.02 OWNER TRAINING**

- A. The BAS Contractor shall provide 3 copies of an operator's manual describing all operating and routine maintenance service procedures to be used with the temperature control and Building Automation System supplied. This Contractor shall instruct the Owner's designated representatives in these procedures during the startup and test period. The duration of the instruction period shall be no less than 4 hours, during normal working hours.

#### **3.03 ADJUSTING AND CLEANING**

- A. Start-Up: Start-up, test, and adjust control systems in presence of manufacturer's authorized representative. Demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- B. After completion of the installation, perform final calibrations and adjustments of the equipment provided under this contract and supply services incidental to the proper performance of the Building Automation System under warranty below.
- C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces and manufacturer's touch-up paint.
- D. Final Adjustment: After completion of installation, adjust thermostats, control valves, motors, and similar equipment provided as work of this Section.



1. Final adjustment shall be performed by specially trained personnel in direct employ of manufacturer of primary temperature control system.

### **3.04 ACCEPTANCE PROCEDURE**

- A. Upon completion of the calibration, Contractor shall startup the system and perform all necessary testing and run diagnostic tests to ensure proper operation. The BAS Contractor shall be responsible for generating all software and entering all database necessary to perform the sequence of control and specified software routines. An acceptance test in the presence of the Owner's representative shall be performed.
- B. Upon successful completion of control system installation, the Owner's authorized representative shall be requested in writing to inspect and approve the satisfactory operation of the control system, subsystem(s), and accessories. System operation, sequences, alarm reporting and operator workstation performance shall be demonstrated to meet Specifications prior to acceptance. Upon receipt of the detailed system adjustment list from the Owner's authorized representative, an installation inspection report shall be prepared by Building Automation Contractor, showing by system each outstanding item on the system adjustments list. After all items appearing on the installation/inspection report are complete, a second written request for system approval will be made to the Owner's authorized representative. As each or all items are approved, an appropriated notation will be entered at the time of the joint inspection of the system report with counter signature of the Owner's authorized representative and date. A copy of this report shall be made for the Owner's authorized representative.

### **3.05 WARRANTY**

- A. Warranty of all equipment described in this Section shall meet warranty requirements of Section 15010 - Basic Mechanical Requirements.
- B. All BAS devices and installation shall be warranted to be free from defects in workmanship and material for a period of two years from the date of job acceptance by the DIA Project Manager. Any equipment, software, or labor found to be defective during this period shall be repaired or replaced without expense to DIA. Factory authorized warranty service shall be available.

## **PART 4 - SEQUENCE OF OPERATIONS**

### **4.01 EXISTING HYDRONIC BUILDING SECONDARY PUMPS**

- A. The building automation system (BAS) shall be modified so that building secondary pump control strategies are eliminated. Existing points associated with the building secondary pumps that are to remain are identified on the point list.
- B. THE BAS Contractor shall ensure all points listed on the point list are connected to the BAS and all associated graphical monitoring and diagnostics are provided.

## **PART 5 - POINTS LISTS**

### **5.01 HYDRONIC TEMPERATURE CONTROL SYSTEM (BRDG-TNDR)**

Action		System Graphic	Digital Outputs	Digital Inputs	Analog Outputs	Analog Inputs	Alarm Point	Software Point
	BRDG-TNDR	X						
Remove	Outside Air Temperature					X		
Remove	Pump A Start-Stop and Status		X	X			X	
Remove	Pump B Start-Stop and Status		X	X			X	
Remain	Primary Water Supply Temperature		X					
Remain	Primary Water Return Temperature		X					
Remain	Secondary Water Supply Temperature		X					
Remain	Secondary Water Return Temperature		X					
Remain	Primary Water Flow		X					
Remain	Secondary Water Flow		X					
Remove	Water Setpoint			X				
Remove	Pump Moisture Alarm (Optional)			X			X	

**5.02 HYDRONIC PUMPS**

Action		System Graphic	Digital Outputs	Digital Inputs	Analog Outputs	Analog Inputs	Alarm Point	Software Point
	Hydronic Pump	X						
Remove	Status		X					
Remove	Pump Speed Control				X			
Remove	GPM					X		X
Remove	Water Temp Setpoint to BRDG-TNDR					X		

**PART 6 - MEASUREMENT**

**6.01 METHOD OF MEASUREMENT**

A. No separate measurement will be made for work under this Section.

**PART 7 - PAYMENT**

**7.01 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 Lump Sum Contract price.

**END OF SECTION 15954**

**SECTION 15955  
BUILDING AUTOMATION SYSTEM (HONEYWELL EBI)**

**PART 1 -GENERAL**

**1.01 SECTION INCLUDES**

- A. Extent of control systems work required by this Section is indicated on drawings and schedules, and by requirements of this Section.
  - 1. Control sequences are specified in this Section.

**1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION**

- A. Control valves

**1.03 RELATED SECTIONS**

- A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are a part of this specification and shall be used in conjunction with this section as a part of the Contract documents. Consult them for further instructions pertaining to this work. The Contractor is bound by the provisions of Division 0 and Division 1.
- B. The following sections constitute related work:
  - 1. Section 15010 - Basic Mechanical Requirements
  - 2. Section 15952 - Controls and Instrumentation
  - 3. Section 15985 - Sequence of Operation.
  - 4. Section 15990 - Test and Balance
  - 5. Section 16010 - Basic Electrical Requirements

**1.04 DESCRIPTION**

- A. The Honeywell EBI system only occurs in the center core and west subcore of concourse C.
- B. Furnish all labor, materials, equipment, and service necessary for a complete and operating temperature control system, utilizing a high-speed, peer-to-peer network of Direct Digital Controls, operator workstation (OWS) with color graphic displays, routers, repeaters, and electronic interfaces and actuation devices, as shown on the drawings and as described herein. The system shall support any standard NetBios; Ethernet Novell, Token Ring, and ARCNET; as well as TCP/IP, and serial communication protocols. The system shall be based on industry standard protocol. Standard protocol shall be LonTalk®. The system may be based on a single open protocol or on a combination of the two previous acceptable protocols. Non-LonTalk® compliant or proprietary equipment or systems using gateways shall not be acceptable and are specifically prohibited. Drawings are diagrammatic only. Equipment and labor not specifically referred to here or on the plans, which are required to meet the functional intent, shall be provided without additional cost to the Owner. Performance and capabilities are based on the Honeywell Building Solutions Facility Management System (FMS).
- C. Temperature control system to be DDC with electronic sensors and electronic actuation of mechanical equipment room (MER) valves and dampers, and electronic actuation of terminal equipment valves and actuators as specified.

- D. At a minimum, the following data shall be accessible:
  - 1. Valve positions
  
- E. Lon Works communications: The new components shall interface to LonWorks. Interface shall provide the functionality to operate a building management system based on LON devices, including alarming, data acquisition, supervisory control, and trending.
  - 1. Interface shall use standard components such as Serial LonTalk Adapters (SLTA), PC LonTalk Adapters (PCLTA), or Ethernet to LonTalk routers such as the Echelon I-LON router to connect the FMS to the LonWorks network and devices. Solutions requiring gateways or data servers (e.g., OPC to LON or DDE to LON) are not acceptable.
  - 2. The FMS interface to LonWorks shall be based on LON Network Services (LNS) Release 3.0 or later. The interface shall allow access to be configured for any network variable (NV) or configuration property (CP) in the LON device. LON devices conforming to LonMark functional profiles shall be able to be integrated into FMS without the need for software changes in FMS.
  - 3. The system shall permit standard graphics to be created for configurable LonWorks devices so that all points for the same device type to use the same graphic.
  - 4. The LonWorks interface shall be compatible with any LonWorks vendor whose products conform to standard LonMark profiles.

#### **1.05 APPROVED CONTROL SYSTEM MANUFACTURING CONTRACTORS**

- A. The following are the approved control system contractors and manufacturers:
  - 1. Company Name: Honeywell
  - 2. Manufacturer: Honeywell
  - 3. Product Line: Enterprise Building Integrator (EBI) and XL 5000
  - 4. Address/Telephone/Contact:  
Honeywell International  
345 Inverness Way South #240 Englewood, Co. 80112  
Tel: 303 792-1667
  
- B. The manufacturing contractors shall use only products corresponding to the product line listed.
  
- C. The list of manufacturers above applies to client and server software, controller software, computer-generated custom application programming, general purpose controllers, and unitary controllers. Although it is preferred that other products specified herein (e.g., sensors, valve dampers, and actuators) originate from same manufacturer, this is not a requirement.

#### **1.06 QUALITY ASSURANCE**

- A. Manufacturer contracting qualifications:
  - 1. All work described in this section shall be installed, wired, circuit tested, and calibrated by factory-certified technicians qualified for this work and in the direct employment of the temperature control system manufacturer.
  - 2. The FMS contractor shall have a full service facility within 50 miles of the project that is staffed with engineers trained in integrating interoperable systems and technicians fully capable of providing LonWorks™ instructions and routine emergency maintenance service on all system components.

3. The FMS contractor shall maintain a UL monitoring center manned 24 hours a day, 7 days a week, 365 days a year by company personnel capable of continuous monitoring of environmental conditions in various areas throughout the building. This monitoring center shall have certified energy managers and HVAC experts on staff, and it cannot be an answering service.
4. Contractor shall provide 100 percent of all services with company personnel except for the electrical installation work. Only those electrical contractors who are experienced in the installation of the specified Honeywell control products shall be considered. No portion of services can be subcontracted to others without express written permission of the Owner; with such permission, all specifications, terms, and conditions specified herein shall be the responsibility of the prime Contractor.
5. Mechanical equipment manufacturers desiring to provide Lon Works DDC-type controls as factory-mounted equipment shall provide a separate bid for their products, less all controls, actuators, valve assemblies, and sensors, which are specified to be provided by the FMS Contractor.

### **1.07 CODES AND STANDARDS**

- A. All work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of the local, state, and federal authorities. Such codes, when more restrictive, shall take precedence over these drawings and specifications. As a minimum, the installation shall comply with the current editions in effect 90 days prior to receipt of bids of the following codes:
  1. National Electric Code (NEC)
  2. International Building Code (IBC)
  3. International Mechanical Code (IMC)
  4. UL-916 Energy Management Systems, LonMark™, UL, ULC, FCC, Part 15, subpart J, Class A Computing Devices
  5. Unitary controllers, intelligent sensors, and intelligent actuators shall conform to the appropriate LonMark™ functional profile configurations based on intended use and shall be so labeled.

### **1.08 SUBMITTALS**

- A. Product data and shop drawings: Meet requirements of Division 1 for Shop Drawings, Product Data, and Samples. In addition, contractor shall provide shop drawings or other submittals on all hardware, software, and installation to be provided. No work may begin on any segment of this project until submittals have been successfully reviewed for conformity with the design intent. 1 copies are required. All drawings shall be prepared on a CAD system that produces drawing files compatible with AutoCAD Release 2002 or higher and Adobe Acrobat and be provided on CD-ROM and as full-size reproducible drawings. When a manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and drawing that the submittal is to cover. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Submittals shall include:
  1. Quantities of items submitted shall be reviewed, but are the responsibility of the contractor.
  2. A description of the proposed process, along with all report formats and checklists to be used in Part 3: "Control System Demonstration and Acceptance."
  3. For LonWorks and LonMark devices, supply external interface (XIF) documentation and appropriate LonMark™ profiles indicating conformance to the LonMark

Interoperability Standards.

- B. Project record documents: Upon completion of installation, submit 1 copies of record as-built documents. Documents shall be submitted for approval prior to final completion and shall include:
1. Project record drawings. Shall be as-built versions of the submittal shop drawings. Provide one set of magnetic media, including CAD, .DWG, or .DXF and PDF drawing files.
  2. Testing and commissioning reports and checklists. Completed versions of all reports and checklists, along with all trend logs, used to meet the requirements of Part 3: "Control System Demonstration and Acceptance."
  3. Certification of the pressure test required in Part 3: "Control Air Tubing."
  4. Operation and Maintenance (O & M) Manual. This shall include as-built versions of the submittal product data. In addition to the information required for submittals, the O & M Manual shall include:
    - a. Names, addresses, and 24-hour telephone numbers of contractors installing equipment and the control systems, and the service representatives of each.
    - b. Operator's manual with procedures for operating the control systems, including logging on and off, alarm handling, producing point reports, trending data, overriding computer control, and changing set points and other variables.
    - c. One set of programming manuals with a description of the programming language (including syntax), statement descriptions (including algorithms and calculations used), point database creation and modification, program creation and modification, and use of the editor.
    - d. Engineering, installation, and maintenance manual(s) that explain how to design and install new points, panels, and other hardware; preventive maintenance and calibration procedures; how to debug hardware problems; and how to repair or replace hardware.
    - e. A listing and documentation of all custom software created using the programming language, including the set points, tuning parameters, and object database. One set of magnetic or optical media containing files of the software and database shall also be provided.
    - f. Complete original issue documentation, installation, and maintenance information for all third-party hardware provided, including computer equipment and sensors.
    - g. Complete original issue diskettes for all software provided, including operating systems, programming language, operator workstation software, and graphics software.
    - h. Licenses, guarantees, and warranty documents for all equipment and systems.

**1.09 WARRANTY**

- A. Warranty of all equipment described in this Section shall meet warranty requirements of Section 15010 - Basic Mechanical Requirements.
- B. Warrant all work as follows:
1. Labor and materials for the control system specified shall be warranted free from defects for a period of 24 months after final completion and acceptance. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to the DIA. The contractor shall respond to the DIA's request for warranty service within 48 hours during normal business hours or if in an emergency situation, defined as no heating or cooling capability, warranty service shall be provided after hours including weekends and holidays.

2. All work shall have a single warranty date, even when the Owner has received beneficial use due to an early system start-up. If the work specified is split into multiple contracts or a multiphase contract, then each contract or phase shall have a separate warranty start date and period.
3. At the end of the final start-up, testing, and commissioning phase, if equipment and systems are operating satisfactorily to the DIA Project Manager, the DIA Project Manager, shall sign certificates certifying that the control system's operation has been tested and accepted in accordance with the terms of this Specification. The date of acceptance shall be the start of warranty.
4. Exception: Contractor shall not be required to warrant reused devices, except for those that have been rebuilt or repaired. Contractor shall warrant all installation labor and materials, however, and shall demonstrate that all reused devices are in operable condition at the time of the Engineer's acceptance.

#### **1.10 OWNERSHIP OF PROPRIETARY MATERIAL**

- A. Project-developed software and documentation shall become the property of DIA. These include, but are not limited to:
  1. Project graphic images
  2. Record drawings
  3. Project database
  4. Project-specific application programming code
  5. All documentation

### **PART 2 - PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. The specified system is based on a Honeywell Enterprise Building Integrator (EBI) operator software platform with Excel 5000 system products.

#### **2.02 MATERIALS**

- A. All products used in this project installation shall be new and currently under manufacture and shall have been applied in similar installations for a minimum of two years. This installation shall not be used as a test site for any new products unless explicitly approved by the Owner's representative in writing. Spare parts shall be available for at least five years after completion of this contract.

#### **2.03 UNITARY CONTROLLERS**

- A. General: Unitary DDC controllers (UCs) shall be standalone, EEPROM-based, configured to perform the sequences specified, and I/O selected for the application. All unitary DDC controllers (UCs) shall be LonMark-approved products and shall support the LonMark Functional Profile for the given application. UC s shall be tested and listed under UL916 for computing devices. UC enclosures shall be flame retardant, compact plastic conforming to UL94-V5 for plenum mounting or plated steel. UCs shall be CE approved and meet FCC Part 15 class B requirements. UC s shall be configured for DIN rail mounting, using industry-standard clip-on adapters, or for direct panel mounting. Each ASC shall be capable of standalone operation and shall continue to provide control functions without being connected to the network. Each ASC will contain sufficient I/O capacity to control the target system.

- B. Communication: The unitary controller shall communicate with other devices on the internetwork using EIA standard 709.1, the LonTalk™ protocol, as the common communication protocol with a minimum transmission speed of 78Kbaud. A twisted-pair cable utilizing T-Taps, star, and mixed topologies on the same network shall support this network. The free topology transceiver (FTT) network shall not be polarity sensitive. Network media shall be Level IV, 22AWG, twisted-pair wire, and shall conform to UL Category 4 for high-speed networks. Cable shall be supplied in plenum and non-plenum-rated versions. Network length shall not exceed 1640 ft without the addition of Echelon LonWorks repeater achieving an additional length of 3280 ft. For lengths in excess of 3280 ft, a daisy chain wiring scheme can be employed; using a repeater, this length can be extended to 10,000 ft. Lengths in excess of 10,000 ft will not be allowed. Repeater bus topologies shall include bus segments of 60 nodes unless routers are utilized. Systems communicating at slower speeds shall not exceed 30 nodes per segment to ensure adequate global data and alarm response times.
- C. Environment: The hardware shall be suitable for the anticipated ambient conditions.
1. Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for ambient temperature operation at 0 degree C to +50 degrees C (32 degrees F to +122 degrees F) and humidity of 5 to 95 percent RH noncondensing.
- D. Serviceability: Each UC shall be provided with face-mounted LED type annunciation to continually display its operational mode—power, normal, or in an alarm state. As an alternative to the face-mounted integral LED, the control contractor shall provide relay-driven pilot lights mounted at the UC location, which shall provide the specified annunciation. UCs shall be configured for DIN rail mounting, using industry-standard clip-on adapters, or for direct panel mounting. Each controller shall be designed with on-board jacks for quick commissioning and troubleshooting with a portable programming tool.
- E. Immunity to power and noise: Controllers shall be able to operate at 90 percent to 110 percent of nominal voltage rating and shall perform an orderly shutdown below 80 percent. Operation shall be protected against electrical noise of 5-120 Hz and from keyed radios up to 5 W at 1 m (3 ft).
- F. Transformer: Power supply for the ASC shall be rated at a minimum of 125 percent of ASC power consumption and shall be of the fused or current-limiting type.
- G. Provide a distributed input and output module that connects sensors and actuators onto the Echelon field bus network for use with a LonWorks general purpose controllers (GPCs) and unitary DDC controllers (UC). LonWorks controllers shall be configured to read and command these points as required or specified. These distributed I/O modules shall use a Neuron® chip and an FTT-10A free topology transceiver for communication on a LonWorks bus, and comply with LonMark Application Layer Guidelines V3.2. I/O. The device shall have extended operating temperature rating from -40 degrees F to +150 degrees F, so it can be mounted directly in a wiring cabinet of monitored appliances. The I/O device shall include a temperature wall module connection that may be used in applications where the wall module shall sense temperature, control set point temperature, control occupied and unoccupied, or control fan speed.

## 2.04 INPUT AND OUTPUT INTERFACE

- A. Hardwired inputs and outputs may tie into the system through unitary controllers.
- B. All input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24 V of any duration, such that contact with this voltage will cause no damage to the controller. Inputs and outputs shall be arranged on



interchangeable modules or circuit boards to allow the replacement of a damaged module or board without replacing the entire controller.

- C. Digital inputs shall allow the monitoring of on and off signals from remote devices. The digital inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices, and shall be protected against the effects of contact bounce and noise. Digital inputs shall sense "dry contact" closure without external power (other than that provided by the controller) being applied.
- D. Analog inputs for GPCs shall be minimum 12-bit resolution and allow the monitoring of low-voltage (0 to 10 VDC), current (0 to 20 mA), negative temperature coefficient (NTC), and resistance to detector (RTD). Analog inputs shall be compatible with and field-configurable to commonly available sensing devices. To prevent thermal loading, RTDs and thermistors shall be scanned rather than have continuous power applied.
- E. Inputs shall be electrically isolated from their associated field points.
- F. Digital outputs shall provide for on and off operation, or a pulsed low-voltage signal for pulse width modulation control. Outputs shall be selectable for either normally open or normally closed operation.
- G. Analog outputs shall be minimum 8-bit resolution and provide a modulating signal for the control of end devices. Outputs shall provide either a 0 to 10 VDC or a 4 to 20 mA signal as required to provide proper control of the output device. Analog outputs on general purpose or custom application controllers shall have status lights and a two-position (Auto and Manual) switch and manually adjustable potentiometer with feedback for manual operation. Analog outputs shall not exhibit a drift of greater than 0.4 percent of range per year.

## 2.05 POWER SUPPLIES AND LINE FILTERING

- A. Control transformers shall be UL and CSA Listed. Furnish Class 2 current-limiting type or furnish over-current protection in both primary and secondary circuits for Class 2 service per NEC requirements. Limit connected loads to 80 percent of rated capacity
  - 1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0 percent line and load combined, with 100-microsecond response time for 50 percent load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand a 150 percent current overload for at least three seconds without trip-out or failure.
    - a. Unit shall operate between 0 degree C to +50 degrees C (32 degrees F and +120 degrees F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MIL-STD 810C for shock and vibration.
    - b. Line voltage units shall be UL Recognized and CSA approved.
- B. Power line filtering:
  - 1. Provide transient voltage and surge suppression for all workstations and controllers, either internally or as an external component. Surge protection shall have the following at a minimum:
    - a. Dielectric strength of 1,000 volts minimum
    - b. Response time of 10 nanoseconds or less
    - c. Transverse mode noise attenuation of 65 dB or greater
    - d. Common mode noise attenuation of 150 dB or better at 40 Hz to 100 Hz

## 2.06 AUXILIARY CONTROL DEVICES

- A. Control Valves: Refer to Section 15515 – Hydronic Specialties
- B. Control Valve Actuators: Refer to Section 15952 – Controls and Instrumentation.
- C. Temperature sensors:
  - 1. Temperature sensors shall be resistance temperature detector (RTD) or thermistor.
  - 2. Immersion sensors shall be provided with a separable stainless steel or copper well. Pressure rating of well shall be consistent with the system pressure in which it is to be installed. The well shall withstand flow velocities in the pipe. Honeywell C7041.
  - 3. Provide matched temperature sensors for differential temperature measurement.
- D. Local control panels:
  - 1. All indoor control cabinets shall be fully enclosed NEMA 1 construction with hinged door, key-lock latch, and removable sub-panels. A single key shall be common to all field panels and sub-panels.
  - 2. Interconnections between internal and face-mounted devices pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL Listed for 600 volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
  - 3. Provide on and off power switch with over-current protection for control power sources to each local panel.
  - 4. All control panels shall be built in accordance with UL508A standards and be labeled with separate UL label numbers.

## 2.07 WIRING AND RACEWAYS

- A. General: Provide copper wiring, plenum cable, and raceways as specified in the applicable sections of Division 16.
- B. All insulated wire to be copper conductors, UL labeled for 90C minimum service.

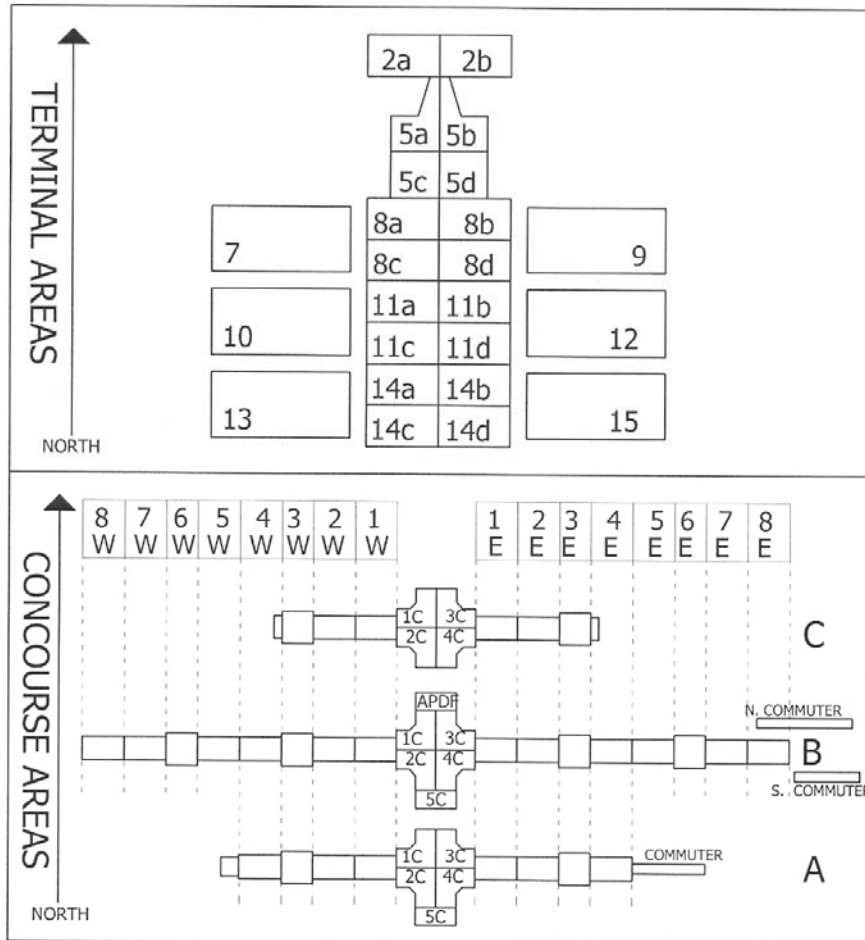
## 2.08 FIBER OPTIC CABLE SYSTEM

- A. Optical cable: Optical cables shall be duplex 900 mm tight-buffer construction designed for intra-building environments. The sheath shall be UL Listed OFNP in accordance with NEC Article 770. The optical fiber shall meet the requirements of FDDI, ANSI X3T9.5 PMD for 62.5/125mm.
- B. Connectors: All optical fibers shall be field-terminated with ST type connectors. Connectors shall have ceramic ferrules and metal bayonet latching bodies.

## 2.09 CONTROLLER NAMING CONVENTION

- A. General: All controllers in the Terminal, AOB and Concourses shall use the following naming convention in programming.
  - 1. WW-X-YY-ZZZ
    - a. WW: The building identification of the controller
      - 1) MT = Main Terminal
      - 2) NT = North Terminal
      - 3) A = Concourse A

- 4) B = Concourse B
- 5) C = Concourse C
- 6) AOB = AOB.
- b. X: The building level location of the controller.
  - 1) B=Basement
  - 2) 1=Apron or Ramp level
  - 3) 2=Concourse level
  - 4) 3= Mezzanine level
  - 5) 4= fourth level, Etc.
- c. Y: The building area location of the controller (IE: 3C, 2E, etc). See figure below.



- d. ZZZ: DIA equipment tag (IE: AHU42) or numerical sequence of VAV controller. VAV sequencing starts at 1 and increases by 1 for each VAV (IE: 7,8,etc).

**PART 3 -EXECUTION**

**3.01 EXAMINATION**

- A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the Architect and Engineer for resolution before rough-in work is started.
- B. The Contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the Engineer for resolution before rough-in work is started.

- C. The Contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate—or if any discrepancies occur between the plans and the Contractor’s work, and the plans and the work of others—the Contractor shall report these discrepancies to the Engineer and shall obtain written instructions for any changes necessary to accommodate the Contractor’s work with the work of others.
- D. Contractor shall disable alarms in existing controllers that are taken offline for construction. Alarms shall be re-established after work is complete.

### 3.02 PROTECTION

- A. The Contractor shall protect all work and material from damage from its work or employees, and shall be liable for all damages thus caused.
- B. The Contractor shall be responsible for its work and equipment until finally inspected, tested, and accepted. The Contractor shall protect any material that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

### 3.03 COORDINATION

- A. Site:
  - 1. Where the mechanical work will be installed in close proximity to, or will interfere with, the work of other trades, the Contractor shall assist in working out space conditions to make a satisfactory adjustment. If the Contractor installs its work before coordinating with other trades, so as to cause any interference with the work of other trades, the Contractor shall make the necessary changes in its work to correct the condition without extra charge.
  - 2. Coordinate and schedule work with all other work in the same area, or with work that is dependent upon other work, to facilitate mutual progress.
- B. Submittals: Refer to “Submittals” Article in Part 1 of this Specification for requirements.
- C. Test and balance:
  - 1. The Contractor shall furnish all tools necessary to interface to the control system for test and balance purposes.
  - 2. The Contractor shall provide training in the use of these tools. This training will be planned for a minimum of four hours.
  - 3. In addition, the Contractor shall provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.
  - 4. The tools used during the test and balance process will be returned at the completion of the testing and balancing.
- D. Coordination with controls specified in other sections or divisions: Other sections and divisions of this Specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the Contractor as follows:
  - 1. All communication media and equipment shall be provided as specified in Part 2: “Communication” of this Specification.
  - 2. Each supplier of a control product is responsible for the configuration, programming, startup, and testing of that product to meet the sequences of operation described in this section.

### 3.04 GENERAL WORKMANSHIP

- A. Install equipment, piping, and wiring raceway parallel to the building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.
- B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
- C. Install all equipment in readily accessible locations as defined by Chapter 1, Article 100, Part A of the National Electric Code (NEC).
- D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.
- E. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility, and be executed in strict adherence to local codes and standard practices.

### 3.05 FIELD QUALITY CONTROL

- A. All work, materials, and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this Specification.
- B. Contractor shall continually monitor the field installation for code compliance and quality workmanship.
- C. Contractor shall have work inspected by local or state authorities having jurisdiction over the work.

### 3.06 WIRING

- A. All control and interlock wiring shall comply with national and local electrical codes and Division 16 of this specification. Where the requirements of this section differ with those in Division 16, the requirements of this section shall take precedence.
- B. All NEC Class 1 (line voltage) wiring shall be UL Listed in approved raceway per NEC and Division 16 requirements.
- C. All low-voltage wiring shall meet NEC Class 2 requirements. (Low-voltage power circuits shall be sub-fused when required to meet the Class 2 current limit.)
- D. Where NEC Class 2 (current limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in the raceway may be used, provided that the cables are UL Listed for the intended application. For example, plenums shall be UL Listed specifically for that purpose.
- E. All wiring in mechanical, electrical, or service rooms—or where subject to mechanical damage—shall be installed in raceway at levels below 3m [10ft].
- F. Do not install Class 2 wiring in raceway containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).
- G. Do not install wiring in raceway containing tubing.
- H. Where Class 2 wiring is run exposed, wiring is to be run parallel along a surface or perpendicular to it, and neatly tied at 3m [10 ft] intervals.

- I. Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems.
- J. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be made at a terminal block or wire nut at junction box.
- K. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
- L. Maximum allowable voltage for control wiring shall be 120v. If only higher voltages are available, the contractor shall provide step-down transformers.
- M. All wiring shall be installed as continuous lengths, with no splices permitted between termination points.
- N. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.
- O. Size of raceway and size and type of wire shall be the responsibility of the Contractor, in keeping with the manufacturer's recommendation and NEC requirements, except as noted elsewhere.
- P. Include one pull string in each raceway 2.5 cm [1"] or larger.
- Q. Use coded conductors throughout with different colored conductors.
- R. Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures, unless they also contain Class 1 starters.
- S. Conceal all raceways, except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 15 cm [6"] from high-temperature equipment (e.g., steam pipes or flues).
- T. Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.
- U. Adhere to Division 16 requirements where raceway crosses building expansion joints.
- V. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of all vertical raceways.
- W. The contractor shall terminate all control and interlock wiring, and shall maintain updated wiring diagrams with terminations identified at the job site.
- X. Flexible metal raceways and liquid-tight, flexible metal raceways shall not exceed 1m [3 ft] in length and shall be supported at each end. Flexible metal raceway less than 1/2 in. electrical trade size shall not be used. In areas exposed to moisture—including chiller and boiler rooms—liquid-tight, flexible metal raceways shall be used.
- Y. Raceway shall be rigidly installed, adequately supported, properly reamed at both ends and left clean and free of obstructions. Raceway sections shall be joined with couplings (per code). Terminations shall be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed.

### **3.07 COMMUNICATION WIRING**

- A. The contractor shall adhere to the items listed in the "Wiring" Article in Part 3 of the Specification.
- B. Follow manufacturer's installation recommendations for all communication cabling.
- C. Do not install communication wiring in raceway and enclosures containing Class 1 or other Class 2 wiring.
- D. Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer, shall not be exceeded during the installation.
- E. Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.
- F. When a cable enters or exits a building, a lightning arrestor shall be installed between the lines and ground. The lightning arrestor shall be installed according to the manufacturer's instructions.
- G. All runs of communication wiring shall be unspliced lengths when that length is commercially available.
- H. All communication wiring shall be labeled to indicate origination and destination data.
- I. Grounding of coaxial cable shall be in accordance with NEC regulations Article on Communication Circuits, Cable and Protector Grounding.

### **3.08 FIBER OPTIC CABLE SYSTEM**

- A. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post-installation residual cable tension shall be within the cable manufacturer's specifications.
- B. All cabling and associated components shall be installed in accordance with manufacturer's instructions. Minimum cable and unjacketed fiber bend radii as specified by the cable manufacturer shall be maintained.

### **3.09 INSTALLATION OF SENSORS**

- A. Install sensors in accordance with the manufacturer's recommendations.
- B. Mount sensors rigidly and adequately for the environment within which the sensor operates.
- C. All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.
- D. All pipe-mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.

### **3.10 FLOW SWITCH INSTALLATION**

- A. Use correct paddle for pipe diameter.
- B. Adjust flow switch in accordance with manufacturer's instructions.

### 3.11 ACTUATORS

- A. Mount and link control damper actuators per manufacturer's instructions.
  - 1. Check operation of damper and actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
  - 2. Provide all mounting hardware and linkages for actuator installation.
- B. Electric and electronic actuators:
  - 1. Dampers: Actuators shall be direct-mounted on damper shaft or jackshaft unless shown as a linkage installation. Actuators shall be mounted following manufacturer's recommendations.
  - 2. Valves: Actuators shall be connected to valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following the actuator manufacturer's recommendations.

### 3.12 IDENTIFICATION OF HARDWARE AND WIRING

- A. All wiring, cabling, and tubing within factory-fabricated panels shall be labeled within 5 cm [2"] of termination with DDC address or termination number.
- B. All pneumatic tubing shall be labeled at each end within 5cm (2") of termination with descriptive identifier.
- C. Identify control panels with minimum 1 cm [1/2"] letters on laminated plastic nameplates.
- D. Manufacturers' name plates and UL or CSA labels are to be visible and legible after equipment is installed.
- E. Identifiers shall match record documents.

### 3.13 PROGRAMMING

- A. Provide sufficient internal memory for the specified sequences of operation and trend logging. There shall be a minimum of 25 percent of available memory free for future use.
- B. Point naming and point value: System point names and values shall be of sufficient size to allow flexibility in design, allowing easy operator interface without the use of a written point index or cryptic alphanumeric shorthand.
  - 1. Point ID is used to designate the location of the point within the building, such as mechanical room, wing, or level, or the building itself in a multi-building environment. Point ID shall be a minimum of 40 characters in length.
  - 2. Point descriptors shall be a minimum of 132 characters.
  - 3. Point states shall be a minimum of 8 characters in length.
  - 4. Point engineering units shall be a minimum of 6 characters in length.
  - 5. Point values shall be a minimum of 15 characters in length with a variable decimal point.
- C. Software programming:
  - 1. Provide programming for the system and adhere to the sequences of operation provided. Imbed into the control program sufficient comment statements to clearly describe each section of the program.



- a. Graphic-based:
    - 1) Shall provide actions for all possible situations.
    - 2) Shall be documented in the form of a logic flowchart.
  - b. Text based:
    - 1) Shall provide actions for all possible situations.
    - 2) Shall be modular and structured.
    - 3) Shall be commented.
  - c. Parameter-based:
    - 1) Shall provide actions for all possible situations.
    - 2) Shall be documented.
- D. Operator interface:
- 1. Standard graphics: Provide graphics for all mechanical systems and floor plans of the building. This includes each chilled water system, hot water system, chiller, boiler, air handler, and all terminal equipment. Point information on the graphic displays shall dynamically update. Show on each graphic all input and output points for the system. Also show relevant calculated points such as set points.
  - 2. Show terminal equipment information on a "graphic" summary table. Provide dynamic information for each point shown.
  - 3. The contractor shall provide all the labor necessary to install, initialize, start up, and troubleshoot all operator interface software and their functions as described in this section. This includes any operating system software, the operator interface database, and any third-party software installation and integration required for successful operation of the operator interface.

### 3.14 CONTROL SYSTEM CHECKOUT AND TESTING

- A. Startup testing: All testing listed in this Article shall be performed by the Contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the Owner's representative is notified of the system demonstration.
- 1. The Contractor shall furnish all labor and test apparatus required to calibrate and prepare for service all instruments, controls, and accessory equipment furnished under this Specification.
  - 2. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
  - 3. Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures per manufacturers' recommendations.
  - 4. Verify that all digital output devices (relays, solenoid valves, two-position actuators and control valves, and magnetic starters) operate properly and that the normal positions are correct.
  - 5. Verify that all analog output devices (I/Ps, actuators) are functional, that start and span are correct, and that direction and normal positions are correct. The Contractor shall check all control valves and automatic dampers to ensure proper action and closure. The Contractor shall make any necessary adjustments to valve stem and damper blade travel.
  - 6. Verify that the system operation adheres to the Sequences of Operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops and optimum start and stop routines.
  - 7. Alarms and interlocks:
    - a. Check each alarm separately by including an appropriate signal at a value that will trip the alarm.

- b. Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.
- c. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.

### 3.15 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

#### A. Demonstration:

1. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this Specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed its own tests.
2. As each control input and output is checked, a log shall be completed showing the date, technician's initials, and any corrective action taken or needed.
3. Demonstrate compliance with Part 1: "System Performance."
4. Demonstrate compliance with Sequences of Operation through all modes of operation.
5. Demonstrate complete operation of the operator interface.
  - a. Any device supplied by others but connected to the LonWorks™ system shall be checked out and commissioned by the supplier, and verification of interface interoperability shall be conducted by the Contractor.
6. Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The Contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests.

#### B. Acceptance:

1. All tests described in this Specification shall have been performed to the satisfaction of both the Engineer and Owner prior to the acceptance of the control system as meeting the requirements of Completion. Any tests that cannot be performed due to circumstances beyond the control of the Contractor may be exempt from the Completion requirements if stated as such in writing by the Engineer. Such tests shall then be performed as part of the warranty.
2. The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved as required in Part 1: "Submittals."

### 3.16 CLEANING

- A. The Contractor shall clean up all debris resulting from its activities daily. The Contractor shall remove all cartons, containers, and crates under its control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.
- B. At the completion of work in any area, the Contractor shall clean all of its work and equipment, keeping it free from dust, dirt, and debris.
- C. At the completion of work, all equipment furnished under this Section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

### 3.17 TRAINING

- A. Provide a minimum of 4 hours of training.

1. Provide a minimum of two on-site or classroom training sessions, one half day each.
2. Provide one additional training session at 6 months following building's turnover.

**PART 4 -SEQUENCE OF OPERATIONS**

**4.01 EXISTING HYDRONIC BUILDING SECONDARY PUMPS**

- A. The building automation system (BAS) shall be modified so that building secondary pump control strategies are eliminated. Existing points associated with the building secondary pumps that are to remain are identified on the point list.
- B. THE BAS Contractor shall ensure all points listed on the point list are connected to the BAS and all associated graphical monitoring and diagnostics are provided.

**PART 5 -POINTS LISTS**

**5.01 HYDRONIC TEMPERATURE CONTROL SYSTEM (BRDG-TNDR)**

Action		System Graphic	Digital Outputs	Digital Inputs	Analog Outputs	Analog Inputs	Alarm Point	Software Point
	BRDG-TNDR	X						
Remove	Outside Air Temperature					X		
Remove	Pump A Start-Stop and Status		X	X			X	
Remove	Pump B Start-Stop and Status		X	X			X	
Remain	Primary Water Supply Temperature		X					
Remain	Primary Water Return Temperature		X					
Remain	Secondary Water Supply Temperature		X					
Remain	Secondary Water Return Temperature		X					
Remain	Primary Water Flow		X					
Remain	Secondary Water Flow		X					
Remove	Water Setpoint			X				
Remove	Pump Moisture Alarm (Optional)			X			X	

**5.02 HYDRONIC PUMPS**

Action		System Graphic	Digital Outputs	Digital Inputs	Analog Outputs	Analog Inputs	Alarm Point	Software Point
	Hydronic Pump	X						
Remove	Status		X					
Remove	Pump Speed Control				X			
Remove	GPM					X		X
Remove	Water Temp Setpoint to BRDG-TNDR					X		

**PART 6 -MEASUREMENT**

**6.01 METHOD OF MEASUREMENT**

- A. No separate measurement will be made for work under this Section.

**PART 7 -PAYMENT**

**7.01 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 Lump Sum Contract price.

**END OF SECTION 15954**

**SECTION 15980**  
**INSTRUMENTS AND CONTROL ELEMENTS**

**PART 1 -GENERAL**

**1.01 SECTION INCLUDES**

- A. Control valves.
- B. Miscellaneous accessories.

**1.02 RELATED SECTIONS**

- A. Section 15010 - Basic Mechanical Requirements.
- B. Section 15050 - Basic Mechanical Materials and Methods.
- C. Section 15135 - Gages and Meters: Thermometer sockets, gage taps.
- D. Section 15510 - Hydronic Piping: Installation of control valves, flow switches, temperature sensor sockets, gage taps.
- E. Section 15985 - Sequence of Operation.

**1.03 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. Refer to Section 15010 for listing of issuing organizations or agencies.
- B. Applicable Standards:
  - 1. Air Movement and Control Association (AMCA):
    - a. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
  - 2. American Society of Mechanical Engineers (ASME)
    - a. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
  - 3. American Society for Testing of Materials (ASTM)
    - a. ASTM B 32 - Solder Metal.
    - b. ASTM B 280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
    - c. ASTM D 1693 - Environmental Stress - Cracking of Ethylene Plastics.
  - 4. International Building Code (IBC) with the Denver Amendments
  - 5. International Fire Code (IFC) with the Denver Amendments
  - 6. National Electrical Manufacturers Association (NEMA):
    - a. NEMA DC 3 - Low-Voltage Room Thermostats.
  - 7. National Fire Protection Association (NFPA):
    - a. NFPA 70 - National Electrical Code.
    - b. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

#### 1.04 SUBMITTALS

- A. Submittals For Review
  - 1. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.
  - 2. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.
- B. Submittals At Project Closeout
  - 1. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
  - 2. Revise shop drawings to reflect actual installation and operating sequences.
  - 3. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.
  - 4. Warranty: Submit manufacturers warranty and ensure forms have been filled out in DIA Project Managers name and registered with manufacturer.

#### 1.05 PROJECT RECORD DOCUMENTS

- A. The following data/information shall be submitted at completion of the Work:
  - 1. "As Built" Plans shall be provided in the same format and manner as described above. Record actual locations of equipment and piping, including instrument air piping and associated accessories. Drawings shall comply with drafting requirements in the DIA Design Standards Manual 1 available from the DIA Project Manager. Each set shall be equipped with a plan holder equal to "Stacor Plan Clamps" for the appropriate size drawings. All drawings shall be full size. All devices shall be included in the Operations and Maintenance Manual as specified in Section 15010 - Basic Mechanical Requirements.
  - 2. Electronic "As Built Plans": Submit the following information on single CD-ROM.
    - a. All drawings in latest AutoCAD format. All external references shall be bound to the individual drawings. Drawings shall comply with drafting requirements in the DIA Design Standards Manual 1 available from the DIA Project Manager.
    - b. A single, book-marked, security free PDF file of all submittal data and drawings. PDF shall be in Adobe Acrobat 5.02 or newer.
  - 3. Provide a minimum of three (3) sets or hard-copy information and CD-ROM's or additional sets as directed by Division 1.

#### 1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum of five years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum of three years experience.
- C. Design system under direct supervision of a Professional Engineer experienced in design of this Work and licensed in the State of Colorado.

## **1.07 REGULATORY REQUIREMENTS**

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc. (or other testing agency acceptable to the authority having jurisdiction) as suitable for the purpose specified and indicated.

## **1.08 PREINSTALLATION MEETING**

- A. Convene one week before starting work of this section.

## **1.09 WARRANTY**

- A. Warranty of all equipment described in this Section shall meet warranty requirements of Section 15010 - Basic Mechanical Requirements.
- B. Correct defective Work within a five year period after Substantial Completion.

## **1.10 MAINTENANCE SERVICE**

- A. Provide service and maintenance of control system for one year from Date of Substantial Completion.
- B. Provide complete service of controls systems, including call backs. Make minimum of 2 complete normal inspections of approximately 8 hours duration in addition to normal service calls to inspect, calibrate, and adjust controls, and submit written reports.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Manufacturers:
  - 1. Automated Logic.
  - 2. Delta.
  - 3. Kreuter Manufacturing Controls.
  - 4. Johnson Controls.
  - 5. Honeywell
  - 6. Invensys.
  - 7. Trane Company.
- B. Section 15010: Product options and substitutions. Substitutions: Permitted.

### **2.02 CONTROL PANELS**

- A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gages, pilot lights, push buttons and switches flush on cabinet panel face. Identify each control device; refer to Section 15190.
- B. NEMA 250, general purpose utility enclosures with enameled finished face panel.
- C. Provide common keying for all panels.

## 2.03 CONTROL VALVES

- A. Valves: Refer to Section 15510 - Hydronic Piping as applicable.
- B. Electronic Operators:
  - 1. Valves shall spring return to normal position as indicated on freeze, fire, or temperature protection.
  - 2. Select operator for full shut off at maximum pump differential pressure.

## 2.04 TRANSMITTERS

- A. Temperature Transmitters: One pipe, directly proportional output signal to measured variable, linearity within plus or minus 1/2 percent of range for 200 degrees F span and plus or minus 1 percent for 50 degrees F span, with 200 degrees F temperature range, compensated bulb, averaging capillary, or rod and tube operation on 20 psig input pressure and 3 to 15 psig output.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Verify that systems are ready to receive work.
- B. Beginning of installation means installer accepts existing conditions.
- C. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.
- D. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
- E. Ensure installation components are complementary to installation of similar components.
- F. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

### 3.02 INSTALLATION

- A. Install in accordance with manufacturers instructions.
- B. Provide separable sockets for liquids and flanges for air bulb elements.
- C. Provide valves with position indicators and with pilot positioners where sequenced with other controls.
- D. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.
- E. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.

## PART 4 - MEASUREMENT



**4.01 METHOD OF MEASUREMENT**

- A. No separate measurement will be made for work under this Section.

**PART 5 - PAYMENT**

**5.01 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 Lump Sum Contract price.

**END OF SECTION 15980**



## SECTION 15985

### SEQUENCE OF OPERATION

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. This Section includes control sequences for HVAC systems, subsystems, and equipment

##### 1.02 RELATED SECTIONS

- A. Section 15010 - Basic Mechanical Requirements.
- B. Section 15980 - Instruments and Control Elements.

##### 1.03 SYSTEM DESCRIPTION

- A. This Section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other Sections.

##### 1.04 SUBMITTALS FOR REVIEW

- A. Shop Drawings: Indicate mechanical system controlled and control system components.
  - 1. Label with settings, adjustable range of control and limits. Include written description of control sequence.
  - 2. Include flow diagrams for each control system, graphically depicting control logic.
  - 3. Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.

##### 1.05 SUBMITTALS AT PROJECT CLOSEOUT

- A. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

##### 1.06 QUALITY ASSURANCE

- A. Design system under direct supervision of a Professional Engineer experienced in design of this Work and licensed in the State of Colorado.

#### PART 2 - PRODUCTS - NOT USED

#### PART 3 - TERMINAL, AOB, CENTRAL PLANT, AND CONCOURSE SYSTEMS

##### 3.01 BUILDING PRIMARY PUMP BYPASSES

- A. New Delta P Control Valve shall modulate to maintain temperature setpoint of 190° downstream of bypass connection on the Heating Water Supply to the suction side of the pumps.

**3.02 NEW AHU/FCU CONTROL VALVES**

1. All new Delta P control valves at air handling units, fan coil units, etc. are to function as existing valves perform: Valve modulates to maintain discharge air temperature. All air handling unit and fan coil unit system sequences shall be modified to incorporate new control valves into existing sequence.

**PART 4 -MEASUREMENT**

**4.01 METHOD OF MEASUREMENT**

- A. No separate measurement will be made for work under this Section.

**PART 5 - PAYMENT**

**5.01 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 Lump Sum Contract price.

**END OF SECTION 15985**

## SECTION 15990

### TESTING, ADJUSTING, AND BALANCING

#### PART 1 -GENERAL

##### 1.01 GENERAL

- A. This section of the Specifications covers testing and balancing of environmental systems, including, but not limited to distribution systems and the connected equipment and apparatus. The testing and balancing of all environmental systems shall be the responsibility of a single Testing, Balancing, and Adjusting (TBA) firm.
- B. Related Work Specified Elsewhere: General Requirements of Division One and Section 15010 "Basic Mechanical Requirements," pertain to and are hereby made part of the Work of this section of the Specifications.

##### 1.02 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems (supply, exhaust and ventilation).
- B. Testing, adjustment, and balancing of hydronic systems.
- C. Measurement of final operating condition of environmental systems.
- D. Verifying that automatic control devices are functioning properly.
- E. Reporting results of activities and procedures specified in this Section.

##### 1.03 RELATED SECTIONS

- A. Section 01400 - Contractor Quality Control: Employment of testing agency and payment for services.
- B. Section 01650 – System Startup, Testing and Training.
- C. Section 15010 - Basic Mechanical Requirements.

##### 1.04 ALLOWANCES

- A. Cash Allowance: Include under provisions of Division 1.
- B. Allowance includes testing, adjusting, and balancing of mechanical systems. Work is included in this section and is part of the Contract Sum/Price.

##### 1.05 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. AABC: Associated Air Balance Council.
- C. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

- D. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.
- E. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- F. NEBB: National Environmental Balancing Bureau.
- G. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- H. Report Forms: Test data sheets for recording test data in logical order.
- I. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- J. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- K. TAB: Testing, adjusting, and balancing.
- L. TABB: Testing, Adjusting, and Balancing Bureau.
- M. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- N. Test: A procedure to determine quantitative performance of systems or equipment.
- O. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

## **1.06 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. Refer to Section 15010 for listing of issuing organizations or agencies.
- B. Applicable Standards:
  - 1. Associated Air Balance Council (AABC):
    - a. National Standards for Total System Balance.
  - 2. Air Diffusion Council (ADC):
    - a. Test Code for Grilles, Registers, and Diffusers.
  - 3. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
    - a. ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.
  - 4. International Building Code (IBC) with the Denver Amendments
  - 5. International Fire Code (IFC) with the Denver Amendments
  - 6. National Environmental Balancing Bureau (NEBB):
    - a. Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

7. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA):
  - a. HVAC Systems Testing, Adjusting, and Balancing.

#### 1.07 SUBMITTALS

- A. Submit name of adjusting and balancing agency for approval within 30 days after award of Contract to ensure that the TAB firm has met the requirements this section of the Specifications and is on the project from the outset of construction.
- B. Field Reports: Submit under provisions of Section 15010.
- C. Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- D. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.
- E. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for DIA Project Manager and for inclusion in operating and maintenance manuals.
- F. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty prior to commencing system balance.
- G. Test Reports: Indicate data on AABC National Standards for Total System Balance forms, or forms prepared following ASHRAE 111, NEBB or TABB forms. When necessary, supplement with forms containing information indicated in Schedules.
- H. Final Report: At least fifteen (15) days prior to Contractor's request for final inspection, submit in letter size, 3-ring binder manuals and a single PDF file of the final test report on applicable reporting forms for review. Each individual final reporting form must bear the signature of the person who recorded data and that of the reporting organization. Identify instruments of all types which were used and last date of calibration of each. Report shall include all items listed in PART 3- Execution.
  1. A statement outlining all abnormal or notable conditions not covered in above data.
  2. Proposed resolutions to equipment that is performing outside of the specified performance ranges.
- I. "As Built" Plans shall be provided in the same format and manner as described above. Each set shall be equipped with a plan holder equal to "Stacor Plan Clamps" for the appropriate size drawings.

#### 1.08 QUALITY ASSURANCE

- A. Perform total system balance in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance, or ASHRAE 111, or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

#### 1.09 QUALIFICATIONS

- A. TAB Contractor Qualifications: Engage a TAB entity with minimum of three years documented experience and certified by NEBB.
  1. TAB Field Supervisor: Employee of the TAB contractor and certified by NEBB or registered Colorado Professional Engineer experienced in performance of this Work.
  2. TAB Technician: Employee of the TAB contractor and who is certified by NEBB as a

TAB technician.

### 1.10 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Notice: Notify the DIA Project Manager, DIA Mechanical Inspector and DIA Mechanical Engineer in writing a minimum of 72 hours prior to testing of any equipment and/or systems. Include scheduled test dates and times.
- C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

### 1.11 PRE-BALANCING CONFERENCE

- A. Convene a conference oneweek prior to commencing work of this section.
- B. Attendance shall include representatives of all systems and equipment Installers having performed, or in the process of performing, project work subject to testing, balancing, and adjustment by the TAB firm.
- C. Conference agenda shall include review of status of installation and completion of each system requiring testing balancing and adjusting, for the purpose of confirming that the schedule of work to be performed will be planned so as to ensure readiness of systems.

### 1.12 SEQUENCING AND SCHEDULING

- A. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.
- B. Schedule and provide assistance in final adjustment and test of life safety and smoke evacuation system with Fire Authority.

### 1.13 WARRANTY

- A. Warranty of all equipment described in this Section shall meet warranty requirements of Section 15010 - Basic Mechanical Requirements.
- B. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Duration of Guarantee shall be 365 days. Guarantee shall include the following provisions:
  - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
  - 2. Systems are balanced to optimum performance capabilities within design and installation limits.

## PART 2 - PRODUCTS - NOT USED.

## PART 3 - EXECUTION

### 3.01 AGENCIES



- A. Subject to conformance with specified requirements, the following agencies are acceptable:
  - 1. TAB Services, Inc.
  - 2. Griffith Engineering Service.
  - 3. Able Balance Corp.
  - 4. JPG Engineering, Inc.
  - 5. Substitutions: Under provisions of Section 15010.

### 3.02 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
  - 1. Systems are started and operating in a safe and normal condition.
  - 2. Temperature control systems are installed complete and operable.
  - 3. Hydronic systems are flushed, filled, and vented.
  - 4. Service and balance valves are open.
- B. Contractor shall pre-test existing heating and chilled water systems during their respective season and report the current performance of the systems. The pre-test shall include air temperature in and out and the water temperature in and out of the associated coil and coincident outside air temperature for all air handling units scheduled to receive new control valves . The tests shall be performed prior to any construction work occurs on the units.
- C. Submit field reports. Report defects and deficiencies noted during performance of services, which prevent system balance.
- D. Beginning of work means acceptance of existing conditions.

### 3.03 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to DIA Project Manager to facilitate spot checks during testing.
- B. Provide additional balancing devices as required.

### 3.04 ADJUSTING

- A. AHU and FCU Control Valves:
  - 1. Verify the water flow rates that are indicated with the valve information as it relates to flow and pressure corresponds to measured flows at the coils.
  - 2. Test all discharge air temperature sensors and recalibrate as necessary,
- B. Building Primary Pumps
  - 1. Test supply and return water temperature sensors and flow measuring devices for accuracy and recalibrate as required.
  - 2. Ensure recorded data represents actual measured or observed conditions.
  - 3. Verify permanently marked settings of existing valves and other adjustment devices are at their original settings. Notify DIA Project Manager if settings are significantly different from original settings..
  - 4. After adjustment, take measurements to verify balance has not been disrupted or that

such disruption has been rectified.

- C. Leave systems in proper working order, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- D. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the DIA Project Manager.
- E. Check and adjust systems approximately six months after final acceptance and submit report.

### **3.05 TEMPERATURE CONTROLS**

- A. Verify that existing AHU and FC discharge air controllers and new hot water supply temperature controllers are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record existing and new controller settings and note variances between set points and actual measurements.
- D. Check free travel and proper operation of control devices such as valve operators.
- E. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.
- F. Check the interaction of electrically operated switch transducers.
- G. Check the interaction of interlock and lockout systems.
- H. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.
- I. Note operation of electric actuators using spring return for proper fail-safe operations.
- J. Include a written certificate (include in balance report) that the above items are functioning properly.

### **3.06 GENERAL PROCEDURES FOR TESTING AND BALANCING:**

- A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.
- B. Cut insulation and pipes for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including valve position indicators and similar controls and devices, to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

### 3.07 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5%.
- B. Prepare schematic diagrams of systems' "as-constructed" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
  - 1. Open all manual valves for maximum flow.
  - 2. Check flow-control valves for specified sequence of operation and set at indicated flow.
  - 3. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
  - 4. Set system controls so automatic valves are wide open to heat exchangers.
  - 5. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
  - 6. Check air vents for a forceful liquid flow exiting from vents when manually operated.

### 3.08 PROCEDURES FOR PRIMARY BUILDING PUMP HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures, except for positive-displacement pumps:
  - 1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
  - 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
  - 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
  - 4. Report flow rates that are not within plus or minus 5% of design.
- B. Set calibrated balancing valves, if installed, at calculated presettings.
- C. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- D. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

### 3.09 SCHEDULES

- A. Equipment Requiring Testing, Adjusting, and Balancing:
  - 1. Building Primary Pumps

- B. Equipment Requiring Testing and Adjusting
  - 1. Air Handling Units
  - 2. Fan Coil Units

### 3.10 REPORT OF WORK

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
  - 1. Include a list of instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to certified field report data, include the following:
  - 1. Pump curves.
  - 2. Manufacturers' test data.
  - 3. Field test reports prepared by system and equipment installers.
  - 4. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.
- D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
  - 1. Title page.
  - 2. Name and address of TAB firm.
  - 3. Project name.
  - 4. Project location.
  - 5. Architect and Engineer's name and address.
  - 6. Contractor's name and address.
  - 7. Report date.
  - 8. Signature of TAB firm who certifies the report.
  - 9. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  - 10. Summary of contents including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  - 11. Nomenclature sheets for each item of equipment.
  - 12. A set of contract document drawings indicating 'as-built' conditions shall be included in the report with all terminals (VAV boxes, outlets, inlets, coils, unit heaters, etc.) and thermostat locations clearly marked and all equipment designated. Locations of all tests shall be clearly indicated.
  - 13. Notes to explain why certain final data in the body of reports varies from indicated values and proposed resolutions for equipment measured outside of the acceptable specified ranges.

- E. System Diagrams: Include schematic layouts of hydronic distribution systems. Present each system with single-line diagram and include the following:
  - 1. Water flow rates.
  - 2. Pipe and valve sizes and locations.
  - 3. Balancing stations, locations, size, velocity and flow.
  - 4. Position of balancing devices.
  
- F. Equipment measurements shall include the following information.
  - 1. Instrument list including instrument, manufacturer, model, serial number, range, calibration date.
  - 2. Cooling Coil data including identification/number, location, service, manufacturer, air flow (specified and actual), entering air DB and WB temperatures (specified and actual), leaving air DB and WB temperatures (specified and actual), water flow (specified and actual), water pressure drop (specified and actual), entering water temperature (specified and actual), leaving water temperature (specified and actual), air pressure drop (specified and actual).
  - 3. Heating Coil data including identification/number, location, service, manufacturer, air flow (specified and actual), water flow (specified and actual), water pressure drop (specified and actual), entering and leaving water temperatures (specified and actual), entering and leaving air temperatures (specified and actual), air pressure drop (specified and actual).
  - 4. Instrument Calibration Reports:
    - a. Report Data:
      - 1) Instrument type and make.
      - 2) Serial number.
      - 3) Application.
      - 4) Dates of use.
      - 5) Dates of calibration.

### 3.11 INSPECTIONS

- A. Initial Inspection:
  - 1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.
  - 2. Randomly check the following for each system:
    - a. Verify that balancing devices are marked with final balance position.
    - b. Note deviations to the Contract Documents in the Final Report.
  
- B. Final Inspection:
  - 1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by DIA Project Manager, DIA Mechanical Engineer or their designated representative(s).
  - 2. TAB firm test and balance engineer shall conduct the inspection in the presence of DIA Project Manager, DIA Mechanical Engineer or their designated representative(s).
  - 3. DIA Project Manager, DIA Mechanical Engineer or their designated representative(s) shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10% of the total measurements recorded, or

- the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
  5. If the number of "FAILED" measurements is greater than 10% of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
  6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
  7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

### **3.12 ADDITIONAL TESTS**

- A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

## **PART 4 - MEASUREMENT**

### **4.01 METHOD OF MEASUREMENT**

- A. No separate measurement will be made for work under this Section.

## **PART 5 - PAYMENT**

### **5.01 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 Lump Sum Contract price.

**END OF SECTION 15990**

**DIVISION 16 – ELECTRICAL**  
**SECTION 16010**  
**BASIC ELECTRICAL REQUIREMENTS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. 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.
- B. Where a panel is installed, at least 25% of panel capacity, including main panel capacity, shall remain as spare capacity after project completion.
- C. Where existing panels are used for additional work, when three (3) or less spaces remain a new panel shall be installed.
- D. All electrical/electronic circuits, including audio, video and fire alarm systems, shall be in an approved raceway system. No “wild circuits” will be accepted.
- E. All electrical/electronic equipment shall meet or exceed IEEE 519; limit individual harmonic voltage distortion (HDV) to 3% and total harmonic voltage distortion (THDV) to 5%.
- F. The Designer of Record shall not design or specify and the Contractor shall not install rigid metal conduit, electrical metallic tubing, flexible steel conduit, liquid-tight flexible steel conduit, non-metallic rigid conduit or innerduct in any horizontal or vertical concrete wall or slab structures or portions thereof, e.g., cast-in-place concrete floor slab on steel decking; cast-in-place concrete slabs integral with concrete structural support systems; prestressed concrete slabs; post-tensioned concrete slabs; precast concrete construction with or without field applied or plant fabricated concrete topping slabs, slabs on grade, foundation walls or in concrete cast-in-place walls, etc.

**1.02 RELATED DOCUMENTS**

- A. Drawings, General and Special Conditions, Division 1 - General Requirements and other applicable technical specifications apply to work of this Section.

**1.03 RELATED SECTIONS**

- A. Basic Electrical Requirements specifically applicable to all Division 16 Sections, in addition to Division 1 - General Requirements, and Division 15.
- B. All electrical/electronic circuits and equipment from any other Division shall meet the requirements of Division 16.
- C. 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.

- D. Temporary Power: See Division 1 for construction power constraints.

#### 1.04 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. Latest editions of the following:
1. ANSI/NFPA 70 - National Electrical Code (as adopted and amended by the Denver Building Code).
  2. Uniform Fire Code (as amended by the Denver Fire Department).
  3. ANSI/IEEE C2 - National Electrical Safety Code.
  4. NECA - Standard of Installation.
  5. ICEA - Insulated Cable Engineers Association
  6. NEMA - National Electrical Manufactures Association
  7. OSHA - Occupational Safety and Health Administration, as Amended
  8. Underwriter's Laboratory (UL)
  9. National Fire Protection Association (NFPA)
  10. Other references as listed elsewhere in these specifications.
  11. IEEE standard 519- recommended practices and requirement for harmonic control in electrical power systems.

#### 1.05 DEFINITIONS

- A. "Furnish" or "Provide": To supply, install and connect 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. "Or Equal. Or Approved Equal": Refers to products that, in the opinion of the DIA Project Manager, are similar in all respect to products specified by proprietary brand name. (Refer to Section 01630 for procedures for submittal of proposed substitutions.)
- H. "Exposed": Not installed underground or "concealed" as defined above.



- I. "Indicated," "Shown" or "Noted": As indicated, shown or noted on drawings or specifications.
- J. "Similar" or "Equal": Same in materials, weight, size, design, construction, capacity, performance, and efficiency of specified product.
- K. "Reviewed," "Satisfactory," "Accepted," or "Directed": As reviewed, satisfactory, accepted, or directed by or to Project Manager.
- L. "Related Work" includes all "Work" required for a complete working system.
- M. "Equipment": A general term including material, fittings, devices, appliances, fixtures, apparatus, and the like used as a part of, or in connection with, an electrical installation.
- N. "Busbar": A rigid metallic conductor, lug or bar used to make a common connection between more than one circuit. (Includes all termination assemblies.)
- O. "Shall": Mandatory requirements of this specification are characterized by the use of the word "shall".
- P. Refer to Article 100 of the currently adopted National Electrical Code for other definitions as applicable to this project.

#### **1.06 WORK SEQUENCE**

- A. Construct Work in sequence under provisions of Division 1 where applicable.

#### **1.07 DRAWINGS AND SPECIFICATIONS**

- A. The drawings indicate the general arrangement of circuits, outlets, panelboards and other work. Information shown on the drawings is schematic; however, re-circuiting will not be permitted without specific acceptance. In cases of conflict between specifications and drawings, the specification shall have precedence. Data presented on the 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 required. Review all of the contract documents and adjust all work to conform to all conditions shown therein.
- B. Prior to submitting a bid, a site visit is required to ascertain all conditions affecting the proposed installation and to adjust all work accordingly. Costs for providing for these adjustments, including response to site constraints, shall be itemized and listed in the bid proposal.
- 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 Project Manager in writing 72 hours before the date of bid opening. In the event such discrepancies exist, and the Project Manager is not so notified, the adjudication of responsibility shall be solely at the discretion of the Project Manager.

#### **1.08 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.

- B. Any electrical work penetrating concrete walls or floors shall require saw cutting and/or core drilling and shall require approval by the Project Manager. The contractor shall submit shop drawings of any saw cutting or core drilling to the Project Manager prior to performing the work. Refer to Section 01410 - Cutting and Patching."
- C. Any power outages necessary to install or test electrical systems and/or equipment shall be coordinated with Denver International Airport Maintenance/Engineering A written shutdown request form shall be submitted to and approved by the Project Manager two weeks prior to the shutdown.

### 1.09 COORDINATION DRAWING

- A. Where the Contractor modifies the design, through selection of equipment differing from that shown, coordination drawings shall be provided by the Contractor in accordance with Division 1 to a scale of 1/4"=1'0" or larger for equipment rooms, details, congested areas and sections; other plans at a scale of 1/8"=1'0". These drawings are to detail major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components. The Contractor shall indicate locations where space is limited for installation and access 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. Indicate the proposed locations of raceway systems, equipment, and materials. Include the following:
    - a. Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.
    - b. Exterior wall and foundation penetrations.
    - c. Fire-rated wall and floor penetrations.
    - d. Equipment connections and support details.
    - e. Sizes and location of required concrete pads and bases.
    - f. Support details.
  - 2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
  - 3. Floor plans, elevations, and appropriate details are required to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

### 1.10 SUBMITTALS (REFER TO SECTIONS 01300 AND 01340)

- A. Submit shop drawings and product data in accordance with provisions of Division 1. Under a separate cover sheet ( CM-30 ) submit on one item only; for example, 16110-2.01, A ,or 16110-2.01,B.
- B. Prior to submission, shop drawings, material lists and catalog cut sheets 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. Project Manager's Name
  7. Contractor's Name
- D. Clearly mark printed material, catalog cut sheets, 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 Project Manager are not change orders; that the purpose of submittals is to demonstrate to the Project Manager 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 accepted shop drawings at the project field office until completion of the project, and make this copy available, upon request, to representatives of the Project Manager 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 by the Project Manager accepting their use.
- I. Shop drawings and manufacturer's published data shall be submitted for all equipment required for this project. A non-inclusive list follows:
1. All switchboards, panelboards
  2. Uninterruptible Power Supplies
  3. Transformers
  4. Lighting fixtures (catalog cuts)
  5. Fire alarm system
  6. Lightning protection system
  7. Automatic transfer switch
  8. Standby Generator
  9. Wiring Devices
  10. Conduit, Conduit Spacers, and Fittings
  11. Support Equipment

### 1.11 RECORD DOCUMENTS

- A. Maintain a contract set of electrical drawings and specifications at the site. Neatly mark all changes, discoveries and deviations from the original drawings. Use a reproducible color that contrasts with the prints. This shall be a separate set of drawings, not used for construction purposes, and shall be updated daily as the job progresses and shall be made available for inspection by the Project Manager at all times. Upon completion of the contract, this set of record drawings shall be delivered to the Project Manager. The Record Documents shall include one electronic copy of Auto CADD 14 or later version and one legible set of drawings. Follow DIA CADD standards, to be furnished to the successful bidder. Record documents to be provided by the Contractor shall clearly and accurately show the following:
- B. Provide horizontal and vertical dimensions for all 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.
- C. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
- D. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

### 1.12 REGULATORY REQUIREMENTS

- A. Conform to the 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 and telephone companies furnishing service to this installation.
  - 5. Other requirements as listed elsewhere in these specifications.
- B. Obtain and pay for all permits, plan review, and inspections from authority having jurisdiction.
- 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 the drawings and specifications.
- D. All equipment shall be equal to or exceed the minimum requirements of NEMA, IEEE, Underwriters Laboratories Inc., and Electrical Standards.

### 1.13 ENVIRONMENTAL CONDITIONS

- A. The equipment shall be designed and constructed to operate successfully at the rated values under the following environmental conditions:
  - 1. Location (Indoors)
  - 2. Altitude (5,500 feet above sea level)
  - 3. Temperature range -30°F to 120°F

## **PART 2 - PRODUCTS**

### **2.01 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. All equipment and materials installed shall be new, unless otherwise specified.
- C. Defective or damaged materials shall be replaced or repaired, prior to final acceptance, in a manner acceptable to the Project Manager or Owner and at no additional cost to the Owner.
- D. All electrical "equipment" and assemblies shall be acceptable for installation only if labeled and listed by a nationally recognized testing laboratory, such as UL, and if accepted by DIA Maintenance and Engineering Department.
- E. All major equipment components shall have the manufacturer's name, address, model number, and serial number permanently attached in a conspicuous location.

### **2.02 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 and 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.

### **2.03 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 prior to bid for any manufacturer not specifically named with supporting documentation.
- 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.

### **2.04 SUBSTITUTIONS**

- A. Refer to DIVISION 1 - GENERAL REQUIREMENTS, Section 01630 Substitutions.

### **2.05 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 any longer period specifically noted elsewhere in these specifications, from date of final acceptance.

### **PART 3 - EXECUTION**

#### **3.01 WORKMANSHIP**

- A. Only quality workmanship will be accepted. Use the NECA Standard of Installation as a minimum for installation of equipment. Poor workmanship, improper layout of work and lack of coordination of work, as determined by the Project Manager, is not acceptable and shall be corrected at the contractors cost.
- B. Contractor shall include no more than one apprentice per Journeyman Electrician. Apprentices shall be under the direct supervision of a licensed electrician at all times.
- 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 Project Manager. 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 tested, checked, correctly adjusted, and left ready for intended use or operation. All work shall be thoroughly cleaned and all residues shall be removed from surfaces. Exterior surfaces of all material and equipment shall be left in a perfect, unblemished condition.
- F. Contractor shall provide a complete installation, including all required labor, material, cartage, testing, insurance, permits, and taxes.

#### **3.02 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 DIA Project Manager. 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 shall be pre-approved by the Project Manager.
- B. All openings made in fire-rated walls, floors, or ceilings shall be sealed and made tight in a manner to conform to the fire rating for the barrier penetrated.
- C. All penetrations required through completed concrete construction shall be core drilled at minimum size required. All penetrations in concrete require an x-ray or ground penetrating radar to determine if the location is clear of reinforcing steel and embedded systems. Precautions shall be taken when drilling to prevent damage to structural concrete. The Contractor shall provide an interpretation of the x-rays or radar shot and obtain written acceptance from the Project Manager before proceeding with drilling.

### **3.03 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 sites will permit. Any cost resulting from defective or ill-timed work performed under this Division shall be borne by the Contractor.

### **3.04 ELECTRICAL COMPLETION**

- A. 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. Clean all electrical equipment, such as switchboards, panelboards, luminaries etc. of construction dirt, dust, etc. and touch-up or repaint all scratches, blemishes, rust spots etc. to its original condition. Any costs to the Owner for clean up of the site will be charged against the Contractor.
- B. Acceptance Demonstration: Upon completion of the work, at a time to be designated by the Project Manager, the Contractor shall demonstrate for the Owner the operation of the entire installation, including all systems provided or modified under this contract.
- C. 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.

## **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 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 Lump Sum Contract price.

**END OF SECTION 16010**





**SECTION 16015**  
**ELECTRICAL DEMOLITION**

**PART 1 – GENERAL**

**1.01 DESCRIPTION**

- A. The work specified in this section consists of performing electrical demolition.

**1.02 RELATED DOCUMENTS**

- A. Drawings, General and Special Conditions, Division 1 - General Requirements and other applicable technical specifications apply to work of this Section.

**1.03 RELATED SECTIONS**

- A. Division 16 - All sections.

**1.04 REFERENCE STANDARDS**

- A. Comply with the requirements of the reference standards noted herein and in Section 16010 except where more stringent requirements are listed herein or otherwise required by the Contract Documents

**PART 2 - PRODUCTS**

**2.01 PRODUCT**

- A. Provide construction tools, equipment materials and supplies of the type and quantities that will facilitate the timely execution of the work.

**PART 3 - EXECUTION**

**3.01 PROCEDURES**

- A. Existing electrical systems shall not be abandoned in place except as authorized in writing by the Project Manager or as shown on the drawings.
- B. No area; new, remodeled, or existing shall be without a fully operational electrical system, except for scheduled outages.
- C. The contractor shall remove, relocate or replace any electrical equipment or systems as required for installation of any structural, mechanical or plumbing equipment,
- D. Maintain all existing electrical, control, communication and signaling systems to the extent required by the owner.
- E. Methods for maintaining the existing system in operation and for providing temporary systems shall be designed to assure complete safety. Requirements for protection, support and in-service maintenance of these systems shall be the sole responsibility of the contractor

- F. Where remodel or demolition interferes with circuits outside of the work area, schedule outages to rework the circuits as required.
  
- G. All items that are removed and not designated by the Project Manager to be used or turned over to the owner shall be removed from the airport.

#### **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 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 Lump Sum Contract price.

**END OF SECTION 16015**

**SECTION 16110**  
**RACEWAYS AND FITTINGS**

**PART 1 – GENERAL**

**1.01 SUMMARY**

- A. Rigid metal conduit and fittings.
- B. Intermediate metal conduit - Not Acceptable.
- C. Electrical metallic tubing and fittings.
- D. Flexible steel conduit and fittings.
- E. Liquid-tight flexible steel conduit and fittings.
- F. Non-metallic rigid conduit and fittings.
- G. Innerduct

**1.02 RELATED DOCUMENTS**

- A. Drawings, General and Special Conditions, Division 1 – General Requirements and other applicable technical specifications apply to work of this Section.

**1.03 RELATED SECTIONS**

- A. Division 1 – Cutting and Patching.
- B. Division 16 – All sections.

**1.04 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.
  - 1. ANSI C80.1 – Rigid Steel Conduit, Zinc-Coated.
  - 2. ANSI C80.3 – Electrical Metallic Tubing, Zinc-Coated.
  - 3. ANSI/NEMA FB 1 – Fittings and Supports for Conduit and Cable Assemblies.
  - 4. FS WW-C-566 – Specification for Flexible Metal Conduit.
  - 5. NEMA RN 1 – PVC Externally-Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing
  - 6. NEMA TC-3 PVC fittings for use with rigid PVC conduits.
  - 7. NEMA TC 15 PVC Fiber Optic Innerduct.
  - 8. All equipment furnished under this section shall carry a listing from an independent testing lab such as UL or an equivalent.

**PART 2 - PRODUCTS**

## **2.01 RIGID METAL CONDUIT AND FITTINGS**

- A. Rigid Steel Conduit
- B. PVC Externally Coated Conduit: rigid steel conduit with external 40 mil PVC coating and internal galvanized surface.
- C. Fittings and Conduit Bodies: threaded type, steel or malleable iron. PVC coated fittings and conduit bodies.

## **2.02 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS**

- A. EMT: galvanized tubing.
- B. Fittings, Conduit Bodies, couplings, and connectors: steel or malleable iron

## **2.03 FLEXIBLE STEEL CONDUIT AND FITTINGS**

- A. Conduit: steel.
- B. Fittings and Conduit Bodies: steel or malleable iron.

## **2.04 LIQUID-TIGHT FLEXIBLE CONDUIT AND FITTINGS**

- A. Conduit: Flexible steel conduit with PVC jacket.
- B. Fittings and Conduit Bodies: steel or malleable iron.

## **2.05 NON METALLIC RIGID CONDUIT AND FITTINGS**

- A. Conduit: Schedule 40 PVC.
- B. Fittings and Conduit Bodies

## **2.06 CONDUIT SUPPORTS**

- A. Conduit Clamps, Straps, and Supports: Steel or malleable iron. In accordance with Section 16190

## **2.07 INNERDUCT**

- A. Inner duct, meeting or exceeding the following requirements, shall be used to partition conduit
  1. Melting point: 260° F., minimum.
  2. Tensile yield strength: 3600 psi/sq. in., minimum
  3. Brittleness temperature, maximum: -140° F.
  4. Heat distortion temperature: 170° F minimum.

## **2.08 PROHIBITED MATERIALS**

- A. Intermediate conduits
- B. Aluminum conduit, Zinc Die Cast boxes and fittings

- C. Power poles.
- D. Non metallic flexible conduit.

### **PART 3 - EXECUTION**

#### **3.01 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT**

- A. Size conduit for conductor type installed or for Type THHN conductors, whichever is larger; 3/4-inch minimum size, 1/2" minimum size for all tenant work. For communication 1 inch is the minimum
- B. Arrange conduit to maintain headroom and present a neat appearance. Refer to Section 16010 for coordination requirements.
- C. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.
- D. Maintain a minimum of six inches (6") between conduit and other piping. Maintain twelve inches (12") clearance between conduit and a heat source such as heating pipes, exhaust flues and heating appliances.
- E. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.
- F. Do not support conduit from cable tray or cable tray supports.
- G. Support conduit at a maximum of 8 feet on center, within two feet of a box or fitting, and at each change of direction.
- H. All vibrating equipment such as motors, transformers, and generators shall be connected with flexible steel conduit, not to exceed six feet in length.
- I. Flexible conduit shall not be less than one-half (1/2) inch except when supplied with lighting fixtures.
- J. When anchoring to a dual sheet metal pan deck and concrete, anchors of any type when placed from below the deck shall be placed only in the lower pan form. No anchors shall be installed in the upper (high) pan.
- K. X-ray or ground penetrating radar studies shall be made of concrete floors, walls or CMU walls.

#### **3.02 CONDUIT INSTALLATION**

- A. Use only factory cast hubs for fastening conduit to cast boxes, and use steel or malleable iron hubs for fastening conduit to sheet metal boxes or equipment in damp or wet locations.
- B. All exposed and concealed conduit runs shall be squared with the building lines. Use conduit bodies to make changes in direction around beams or columns.
- C. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.

- D. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture during construction.
- E. Provide a 200 lb. Nylon measuring pull string in all empty conduits.
- F. Use PVC-coated rigid steel factory elbows for bends greater than 45 degrees in plastic conduit runs.
- G. Exposed conduits to be rigid steel to 8'-0" above floor, deck or grating except in electrical, communications and mechanical rooms.
- H. Conduit stubbed up shall be two inches above slab or house keeping pad and the empty conduits shall be capped. Under freestanding equipment conduits with conductors shall be sealed with duct seal.
- I. Flexible steel conduit runs shall not exceed 3' in length when connecting equipment, 6' in length when connecting light fixtures or when fished in hollow spaces with written approval by Project Manager and shall contain a grounding conductor.
- J. Raceways shall not be installed in stairways or on the exterior of any building.
- K. Electrical installations in hollow spaces, vertical shafts, and ventilation or air-handling ducts shall be so made that the possible spread of fire or products of combustion will not be substantially increased. Openings around electrical penetrations through fire-resistant-rated walls, partitions, floors or ceilings shall be fire stopped using UL approved, classified, listed or labeled material and/or methods to maintain the fire resistant rating.

### **3.03 CONDUIT INSTALLATION SCHEDULE**

- A. Underground Installations More Than Five Feet From Foundation Wall: Polyvinyl Chloride (PVC) conduit Schedule 40. All bends greater than 45 degrees in non-metallic conduit shall be galvanized rigid steel conduit with a factory coating of polyvinyl chloride (PVC).
- B. Installation In Concrete Slab: Not allowed.
- C. In Slab Above Grade: Not allowed.
- D. Wet Interior Locations: Rigid steel.
- E. Concealed Dry Interior Locations: Electrical metallic tubing.

## **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 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 Lump Sum Contract price.

**END OF SECTION 16110**





**SECTION 16120**  
**WIRES AND CABLES**

**PART 1 – GENERAL**

**1.01 SUMMARY**

- A. Building wire.
- B. Cable.
- C. Wiring connections and terminations.

**1.02 RELATED DOCUMENTS**

- A. Drawings, General and Special Conditions, Division 1 - General Requirements and other applicable technical specifications apply to work of this Section.

**1.03 RELATED SECTIONS**

- A. Division 16 - All Sections.

**1.04 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.

**1.05 SUBMITTALS (REFER TO SECTIONS 01300 AND 01340)**

- A. Submit shop drawings and product data under the provisions of Division 1.

**1.06 PROJECT CONDITIONS**

- A. Verify that field measurements are as shown on Drawings.
- B. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required by field verification.

**1.07 COORDINATION**

- A. Coordinate Work under provisions of Section 16010.
- B. Determine required separation between wiring and other work.
- C. Determine routing to avoid interference with other work.

**PART 2 - PRODUCTS**

**2.01 BUILDING WIRE**

- A. All conductors shall be copper.

- B. All building wire and cable shall be installed in an approved raceway.

## 2.02 REMOTE CONTROL AND SIGNAL CABLE

- A. Control Cable for Class 1 Remote Control and Signal Circuits: Copper conductor, 600 volt insulation, 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, individual conductors twisted together, shielded, and covered with a PVC jacket; UL listed.
- C. All power, control, data, communication and signal wire or cable shall be installed in an approved raceway.

## PART 3 - EXECUTION

### 3.01 GENERAL WIRING METHODS

- A. Minimum wire size shall be based on the over current protection device and as governed by the NEC.
- B. Size circuit conductor for 20 ampere, 120- volt and 277-volt branch circuit home runs for a maximum of 3% voltage drop.
- C. Place an equal number of conductors for each phase in the same raceway or cable.
- D. Neatly train and lace wiring inside boxes, equipment, and panel boards. Make temporary connections to panel board devices with sufficient slack conductor to facilitate reconnections required for balancing loads between phases.
- E. Where harmonic currents exist on circuits, that supply electric discharge lighting, data processing or similar equipment, a full size neutral conductor shall be provided for each single-phase circuit.
- F. Verify raceways are open, continuous and clear of debris before installing cables.

### 3.02 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Use a 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.
- D. Conductors shall not be pulled in concrete encased conduits before concrete is placed.

### 3.03 CABLE INSTALLATION

- A. Provide protection for exposed cables where subject to damage.
- B. Use suitable cable fittings and connectors.
- C. All cable shall be racked and supported in manholes.

- D. Pulling winches and other necessary pulling equipment shall be of adequate capacity to ensure a continuous pull on the cable. Strain gages shall be used to monitor the cable pulling tension.
- E. Cable and Wire pulling lubricants that are non-corrosive and harmless to hands and clothes shall be used. Lubricants shall be compatible with cable jackets and insulation.

**3.04 WIRING CONNECTION AND TERMINATIONS**

- A. Splice only in accessible junction and outlet boxes.
- B. For No. 8 AWG and smaller, use insulated spring wire connectors with plastic caps.
- C. Use irreversible compression 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 – protect edges from wear.
- D. Thoroughly clean wires before installing lugs and connectors.
- E. All control cable and conductor splices shall be made on numbered terminal strips. Wire nuts are not acceptable for control cable and conductor splices.

**3.05 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 conductor connections and terminations to manufacturer's recommended values.
- D. Perform continuity test on all feeder and branch circuit conductors. Verify proper phasing connections.
- E. Verify cables are colored coded and labeled according to contract documents.
- F. Prior to energizing, all building service cables, feeders to and/or from transformers, switchboards and panel boards are to be tested with a 500-volt insulation megohm meter to determine insulation resistance levels. All field test data is to be recorded, corrected to a baseline temperature and furnished to the DIA Project Manager. A 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. Insulation test values shall meet or exceed the values given below.

Conductor Size (AWG or k CMIL)	Resistance (Megohms-1,000 ft)
12-8	200-MOhms
6-2/0	100-MOhms
3/0-750	100-MOhms

**3.06 WIRE AND CABLE INSTALLATION SCHEDULE**

- A. Concealed Interior Locations: in approved raceways.
- B. Exposed Interior Locations: in approved raceways.

- C. Above Accessible Ceilings: in approved raceways.
- D. Wet or Damp Interior Locations: in approved raceway.
- E. Exterior Locations: in approved raceways.
- F. Underground Locations: in approved raceways.
- G. Control data, Communication and signal cable (less than 48 volt): raceway and/or cabletray.
- H. MC cable, AC cable and Modular wiring are not permitted unless indicated otherwise in the contract documents or as approved by the Project Manager..

### 3.07 WIRE AND CABLE COLOR CODING

- A. Wire No. 6 AWG and smaller shall be factory color-coded. Wire No. 4 AWG and larger shall be color-coded by color taping of 6 inch length of exposed ends.

120/208 Volts		277/480 Volts	
A =	Black	A =	Brown
B =	Red	B =	Orange
C =	Blue	C =	Yellow
Neutral =	White	Neutral =	Gray
Ground =	Green	Ground =	Green
Isolated Ground = Green with a yellow tracer			

- B. Fire Alarm wire and color coding: Reference Specification Section 16721.

## 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 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 Lump Sum Contract price.

**END OF SECTION 16120**

## SECTION 16142

### ELECTRICAL CONNECTIONS FOR EQUIPMENT

#### PART 1 – GENERAL

##### 1.01 SUMMARY

- A. Electrical connections to equipment specified under other Sections or furnish by the Owner

##### 1.02 RELATED DOCUMENTS

- A. Drawings, General and Special Conditions, Division 1 – General Requirements and other applicable technical specifications apply to work of this Section.

##### 1.03 RELATED SECTIONS

- A. Division 1 - General Requirements.
- B. Division 15 – Mechanical Equipment.
- C. Division 16 – All Sections.

##### 1.04 REFERENCED 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.

##### 1.05 WORK INCLUDED

- A. Applications of electrical power, control and monitoring connections specified in this section include the following:
  - 1. From electrical source to motor starters
  - 2. From motor starters to motors
  - 3. To lighting fixtures and wiring devices
  - 4. To converters, rectifiers, transformers, inverters, switchgear, switchboards, panel boards, generators and similar equipment
  - 5. To grounds including ground electrode connections.
  - 6. Equipment furnished in other Divisions (unless indicated otherwise).
  - 7. Electrical connections for equipment, that are not furnished as integral part of equipment, are specified in Division 15 and other Division 16 sections, and are criteria of this section.
  - 8. Refer to Division 15 sections for motor starters and controllers furnished integrally with equipment; not criteria of this section.
  - 9. Refer to Division 15 sections for control system wiring, not criteria of this section.
  - 10. Junction boxes and disconnect switches required for connecting motors and other electrical units of equipment are specified in applicable Division 16 sections, and are criteria of this section.

## 1.06 QUALITY ASSURANCE

- A. Products, materials, equipment and systems shall comply with the following Codes and Standards:
1. NFPA Compliance: NFPA 70, "National Electrical Code (NEC)" as adopted and amended by the Denver Building Code and as applicable to products used and the installation of electrical power connections (terminals and splices), junction boxes, motor starters and disconnect switches.
  2. IEEE Compliance: Std. 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to connections and terminations.
  3. ANSI Compliance: Applicable requirements of ANSI/NEMA and ANSI/EIA standards pertaining to products and installation of electrical connections for equipment.
  4. UL Compliance: UL Std. 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors" including, but not limited to, tightening of electrical connectors to torque values indicated. Electrical connection products and materials are to be UL-listed and labeled.

## 1.07 SUBMITTALS

- A. The following data shall be submitted in accordance with Sections 01300 – Approved Submittals required prior to starting installation:
1. Product Data: Manufacturer's data on electrical connections for equipment products and materials.
  2. Complete wiring diagrams and/or shop drawings for installation purposes shall be furnished under the Mechanical or other Divisions, as applicable to DIA Project Manager prior to installation.

## PART 2 - PRODUCTS

### 2.01 MATERIALS AND COMPONENTS

- A. Products shall be as specified in other Sections of this Division.
- B. General: Each electrical connection shall be a complete assembly of materials, including but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, stress cones, splice kits, termination kits, solder less wire nuts, and other items and accessories as needed to complete splices and terminations as required.
1. Connectors and Terminals: Electrical connectors and terminals shall mate and match, including sizes and ratings, with equipment terminals that are recommended by equipment manufacturer for intended applications.
  2. Electrical Connection Accessories: Electrical insulating tape, heat-shrinkable insulating tubing and boots, stress cones, splice kits, termination kits, wirenuts and cable ties as recommended for use by accessories manufacturers for type of services required.

### 2.02 MECHANICAL AND ELECTRICAL COORDINATION

- A. Responsibility: It is the contractor's responsibility to complete the EXHIBIT A SCHEDULE included at the end of this specification section. The Contractor shall include all costs and work associated with these items in his bid.

- B. Verify location, size and characteristics of all mechanical equipment before installation of electric service. In all cases of the installation of heating, ventilating, air conditioning, plumbing and other mechanical equipment, the contractor is responsible for all revisions, changes and modifications necessary to properly supply electric services to the equipment.

### **PART 3 - EXECUTION**

#### **3.01 INSPECTION**

- A. Verify that equipment is ready for electrical connection, wiring and energization.

#### **3.02 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.

#### **3.03 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. Length shall be six feet (6') maximum.
- C. Install pre-finished cord set where connection with attachment plug is indicated or specified, 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 as required for a complete operating system.
- F. Install disconnect switches, controllers, control stations, and control devices such as limit switches and temperature switches as required for a complete operating system. Connect with conduit and wiring as required for a complete operating system.

#### **3.04 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 electrical/mechanical coordination schedule. The contractor shall carefully coordinate with work performed under the Mechanical and other Divisions if these specifications.
- B. All line and low voltage wiring shall be installed utilizing materials and methods as specified in the Electrical Division of the specifications.
- C. Provide NEMA-rated motors and equipment suitable for operation on the voltage systems as designated below, with tolerances for the allowable voltage variations above and below the nominal:

1. Rated Motor Voltage

Service Voltage and Phase	1/3 HP and smaller Smaller 1-Phase	½ HP and Larger 3-Phase
120/208V, 3Ø 277/480V, 3Ø	115V	208V (only when 480v is not available) 460V

**3.05 INSTALLATION OF ELECTRICAL CONNECTIONS**

- A. Electrical connections shall be installed in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.
1. As a minimum: Each feeder circuit to panelboards, switchboards, motor control centers, transformers, and 480-volt (and higher) motor circuits shall have an insulated equipment ground conductor.
  2. All medium voltage splices and terminations are to be made by a certified cable splicer/terminator.
  3. Electrical service and feeders are to be maintained to occupied areas and operational facilities when temporary service is required during interruptions to existing facilities. Momentary outages for replacing existing wiring systems with new wiring systems shall be scheduled. When the "cutting-over" has been successfully accomplished, temporary wiring is to be removed.
  4. Splices shall be covered with electrical insulating material equivalent to, or of greater insulation rating, than electrical insulation rating of those conductors being spliced.
  5. Cables and wires shall be trimmed as long as practicable and routing shall be arranged to facilitate inspection, testing and maintenance.
  6. Connectors and terminals, including screws and bolts, shall be tightened in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Proper torquing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings shall be used to comply with torquing values contained in UL 496A or the manufacturer's literature.
  7. Identification markers are to be fastened to each electrical power supply wire/cable conductor in accordance with Section 16195 "Electrical Identification."
    - a. Markers are to be affixed on each terminal conductor, as close as possible to the point of connection.

**3.06 FIELD QUALITY CONTROL**

- A. The correct direction of rotation of each motor is to be verified.
- B. Provide measured torquing value checklist with witness signature to DIA Project Manager.

**PART 4 - MEASUREMENT**

**4.01 MEASUREMENT**

- A. No separate measurement will be made for the work specified in this Section.

**PART 5 - PAYMENT**



**5.01 PAYMENT**

- A. No separate payment will be made for work specified in this Section, but shall be included in the Contract Lump Sum Bid Price for Division 16 - Electrical, which price shall include all necessary and incidental material and work thereto.

**SEE NEXT PAGE FOR EXHIBIT A**

**EXHIBIT A**

It is the contractor's responsibility to complete the following schedule and include all costs associated with these items in his bid.

ITEM	FURNISHED BY *	SET/ INSTALLED BY *	POWER WIRING BY*	CONTROL WIRING BY* AND **
EQUIPMENT MOTORS AND THERMAL OVERLOADS.				
MOTOR CONTROL CENTERS, MOTOR CONTROLLERS, MAGNETIC STARTERS, VARIABLE FREQUENCY DRIVES AND OVERLOAD RELAYS.				
DISCONNECT SWITCHES (FUSED OR UNFUSED), THERMAL OVERLOAD SWITCHES AND FUSES, TIMER SWITCHES.				
PUSHBUTTON STATIONS, PILOT LIGHTS, MULTI-SPEED SWITCHES, FLOAT AND PRESSURE SWITCHES, THERMOSTATS, CONTROL TRANSFORMERS, CONTROL AND MONITOR PANELS, MOTOR OPERATED VALVES, DAMPER MOTORS OR SOLENOIDS, SOLENOID VALVES, EP AND PE SWITCHES AND INTERLOCKES.				
CONTRACTORS AND CONTROL CIRCUITS FOR CONTROL PANELS.				
AUTOMATIC AND/OR MANUAL CONTROL STATIONS, PANELS OR SYSTEMS.				
ALL WIRING INCLUDING POWER AND CONTROL RELATED TO DIRECT DIGITAL CONTROL SYSTEM.				
POWER AND CONTROL EQUIPMENT FURNISHED AS PART OF FACTORY WIRED EQUIPMENT.				
SPECIALTY MECHANICAL AND ELECTRICAL ITEMS OR SYSTEMS.				
ALARM AND MONITORING STATIONS AND PANELS.				
FIRE PROTECTION MONITORING AND CONTROL FUNCTIONS.				
FIRE AND SMOKE DUCT MOUNTED DETECTORS				
A. SAMPLE TUBE MODULE				
B. MONITOR MODULE				
FIRE AND SMOKE DETECTORS, RELAYS FOR FAN START/STOP FUNCTIONS, AS IT RELATES TO SMOKE CONTROL.				
ADDITIONAL ITEMS:				

- MC = MECHANICAL CONTRACTOR
- EC = ELECTRICAL CONTRACTOR
- MFR = EQUIPMENT MANUFACTURER
- CC = CONTROL CONTRACTOR
- FA = FIRE ALARM CONTRACTOR
- FP = FIRE PROTECTION CONTRACTOR
- TC = TEMPERATURE CONTROL CONTRACTOR
- N/A = NOT APPLICABLE

\*\* ANY CONTROL WIRING ABOVE ONE (1) VOLT.

**END OF SECTION 16142**