



# CITY OF HOUSTON STRATEGIC PURCHASING DIVISION

Issue Date: October 16, 2009

## FORMAL INVITATION FOR BEST VALUE BID

### FURNISH & INSTALL PASSENGER LOADING BRIDGES AND SUPPORT EQUIPMENT AT GEORGE BUSH INTERNATIONAL AIRPORT, HOUSTON, TEXAS

BID NO: S48 –C23455

NIGP CODES: 035-78, 120-25

The City of Houston, Administration & Regulatory Affairs Department (ARA) invites prospective contractors to submit a sealed “**BEST VALUE**” bid to **FURNISH & INSTALL PASSENGER LOADING BRIDGES AND SUPPORT EQUIPMENT AT GEORGE BUSH INTERNATIONAL AIRPORT** for the City of Houston.

**Buyer:**

Questions regarding this solicitation should be addressed to **Irina Chong, Senior Buyer, at 832-393-8764** or e-mail to **irina.chong@cityofhouston.net**.

**Sealed bids, in duplicate, must be received at the City of Houston, City Secretary’s Office, City Hall Annex, Public Level, 900 Bagby, Houston, Texas 77002 no later than Thursday, November 5, 2009 at 10:30 A.M. No bids will be accepted after the stated deadline.** All bids will be opened and publicly read in the City Council Chambers, City Hall Annex, Public Level, 900 Bagby at 11:00 A.M. on that date for the goods and services listed herein.

**Prebid Conference:**

**A Pre-Bid Conference will be held on Wednesday, October 28, 2009 at 9:00 a.m. at Bush Intercontinental Airport/Houston (IAH), 18600 Lee Road Humble, Texas 77338, in Technical Services Conference Room 113B.**

**Site Visit:**

**Site visit for George Bush International Airport will start at 18600 Lee Road, Humble, Texas 77338 at 1:00 p.m. on Wednesday, October 28, 2009. Transportation to George Bush International Airport will be provided by the City. Bidders are required to have valid identification card for security clearance when making the site visit.**

Although the site visit is not mandatory, Bidders are responsible for obtaining the information discussed at the site visit.

All Prospective Bidders are urged to be present. It is the bidder’s responsibility to ensure that they have secured and thoroughly reviewed the solicitation documents prior to the Pre-Bid Conference. Any revisions to be incorporated into this solicitation document arising from discussions before, during and subsequent to the Pre-Bid Conference will be confirmed in writing by Letter(s) of Clarification prior to the bid due date. Verbal responses will not otherwise alter the specifications, terms and conditions as stated herein. **Bidders are strongly encouraged to forward all questions by e-mail to the responsible buyer prior to the pre-bid conference.**

**Electronic Bidding:**

A complete version of this ITB can be downloaded from the City’s website at <http://purchasing.houstontx.gov/>, or the ITB document may be obtained from ARA, Strategic Purchasing Division, Basement Level, Room B109, City Hall, 901 Bagby, Houston, Texas 77002. In order to submit a bid for the items associated with this procurement, you must fill in the pricing information on the “**PLACE BID**” page.

The place of the bid opening may be transferred in accordance with Paragraph (b), (5) of Section 15-3 of The Code of Ordinances, Houston, Texas. The bid opening meeting may be rescheduled in accordance with Paragraph (b), (6) of said Section 15-3.

**The City reserves the right to reject any or all bids or to accept any bid or combination of bids deemed advantageous to it.** City Employees are prohibited from bidding on this solicitation in accordance with the Code of Ordinances, Section 15-1.

**\*CONTENTS:**

SECTION A: OFFER  
SECTION B: SCOPE OF WORK/SPECIFICATIONS  
SECTION C: GENERAL TERMS & CONDITIONS  
SECTION D: EVALUATION MATRIX

**\*NOTE 1: Bidders must read the bid document in its entirety and comply with all the requirements set forth therein.**

**\*NOTE 2: To be considered for award please submit the electronic bid form and the forms listed in section A, including the signature page, which must be signed by a company official authorized to bind the company and a 10% Bid Bond.**

SECTION A



**FURNISH & INSTALL PASSENGER LOADING BRIDGES  
AND SUPPORT EQUIPMENT  
AT  
GEORGE BUSH INTERNATIONAL AIRPORT**

**Bid No. S48-C23455**

**NIGP Codes: 035-78, 120-25**

To The Honorable Mayor  
and City Council Members  
of the City of Houston, Texas (the "City"):

The undersigned hereby offers to **furnish and install Passenger Loading Bridges and Support Equipment**, prepaid F.O.B. destination point Houston, Texas, in accordance with the City's Specifications and General Terms & Conditions and/or samples/drawings provided herein. When issued by the City of Houston, Letters of Clarification shall automatically become part of this bid document and shall supersede any previous specifications or provisions in conflict with Letters of Clarification. It is the responsibility of the bidder to ensure that it has obtained all such letters. By submitting a bid on this project, bidder shall be deemed to have received all Letters of Clarification and to have incorporated them into the bid.

The City may accept this bid offer by issuance of a Notice of Award Letter and/or a Purchase Order at any time on or before the 120th day following the day this Official Bid Form is opened by the City. This offer shall be irrevocable for 120 days after bid opening or for 90 days after City Council awards the bid, whichever comes last, but this period may be extended by written agreement of the parties.

**The City reserves the right to INCREASE quantities during the twelve-month period following the issuance of the first purchase order subject to agreement in writing by the Contractor to honor the same bid price.**

The City reserves the option, after bids are opened, to adjust the quantities listed on the electronic bid form upward or downward, subject to the availability of funds, and/or make award (s) on a line item basis.

The magnitude of the project is between \$3,000,000 and \$5,000,000.

## SECTION A (Cont'd)

**Documents/forms must be downloaded from the City's Website**  
<https://purchasing.houstontx.gov/>

### **Additional Required Forms to be Included with this bid:**

In addition to the electronic Bid Form and the Official Signature Page, the **Forms listed in Table 1 must be completed and submitted to the Office of the City Secretary on or before the date and time the bid is due:**

<b>TABLE 1 – REQUIRED FORMS</b>
Affidavit of Ownership
Fair Campaign Ordinance
Statement of Residence
Conflict of Interest Questionnaire
<a href="#">Contractor's Questionnaires</a>
MWDBE
Pay or Play Program Acknowledgement Form
Bid Bond

Table 2 lists other documents and forms that should be viewed/downloaded from the City's website, but are not required to be submitted with the bid. The City will request these forms, as applicable, to be completed and submitted to the City by the recommended/successful bidder:

<b>Table 2</b>
Formal Instructions for Bid Terms
Drug Forms
EEOC
Construction Insurance
Construction Insurance OCP
Construction 2009 Building Construction Wage Rate
Construction 2009 Engineering Wage Rate
Pay or Play Program Requirements
Bonds for Construction
<a href="#">Construction General Conditions (0700)</a>
<a href="#">Supplementary Conditions (0800)</a>

Questions concerning the Bid should be submitted in writing to: City of Houston, Strategic Purchasing Division, 901 Bagby, Room B506, Houston, TX 77002, Attn: Irina Chong or via fax: 832-393-8755 or via email (preferred method) to [irina.chong@cityofhouston.net](mailto:irina.chong@cityofhouston.net) no later than **5:00 PM, Friday, October 30<sup>th</sup>, 2009.**

## SECTION A (Cont'd)

### **PERMITS:**

Successful Contractor shall be responsible for securing any and all permits for proposed work. Any fee charged for these permits should be the responsibility of the Contractor and not the City of Houston.

### **CITY BUILDING CODES:**

All work performed or equipment installed shall be in strict accordance with the City of Houston Building Codes. The Contractor will immediately correct any deficiencies discovered during work or after completion. Failure to correct deficiencies will result in the City having corrections made at the Contractor's expense.

### **BID BOND:**

The Contractor shall be required to provide and submit with the bid a Bid Bond in the amount of 10% of the total amount bid by the Contractor. The Bid Bond shall be in the same form as that distributed by the City, and attached hereto, all duly executed by this Bidder (as "Principal") and by a corporate surety company licensed to do business in the State of Texas, and if the amount of the bond is greater than \$100,000.00 the surety must hold a certificate of authority from the United States Secretary of the Treasury, or a Cashier's or a Certified check in a like amount. Company or personal checks are not acceptable.

### **PERFORMANCE BOND and PAYMENT BOND:**

The successful Contractor(s) shall be required to provide a Performance and Payment Bond in the total amount (100%) of the Contract if the award is in excess of \$25,000.00.

The Performance and/or Payment Bond shall be in the same form as that distributed by the City, and attached hereto, all duly executed by this bidder (as "Principal") and by an incorporated surety company licensed to do business in the State of Texas. If the amount of the bond is greater than \$100,000.00 the surety must hold a certificate of authority from the United States Secretary of the Treasury.

The Contractor(s) shall be required to provide a Performance and/or Payment Bond as outlined above, which will be delivered to the City Purchasing Agent of the City, on or before the tenth (10<sup>th</sup>) day following the day the bidder receives notice from the City.

### **MAINTENANCE BOND:**

The Contractor shall furnish a maintenance bond in the total (100%) bid amount in the form required by the City (sample attached). One bond, also referred to as the One Year Maintenance Bond, will be conditioned upon Contractor's repair, replacement or restoration of any work or any portion of the work which is found to be defective or fails in any way to comply strictly with this contract or the plans and specifications for such work within a period of one (1) year from the date of acceptance of such work by the City Council or after the date that the "CO", or his designee in writing, determines, in a written notice to the Contractor, to be the date upon which the project is both substantially complete and available for the full and beneficial occupancy or use of the City.

## SECTION A (Cont'd)

### **QUALITY AND WORKMANSHIP**

The bidder must be able to demonstrate upon request that it has performed satisfactorily, services similar to the services specified herein. The bidder will provide records of warranty and repair services performed for others upon request. The City of Houston shall be the sole judge whether the services performed are similar to the scope of services specified herein.

### **SITE INSPECTION**

The City of Houston reserves the right to inspect the bidder's current place of business to evaluate equipment condition and capabilities, staff experience, training and capabilities, and storage capabilities as they relate to the performance of this contract.

### **CONTRACTOR'S QUESTIONNAIRES**

In order to receive bid award consideration, the Bidder must **submit a Contractor's Questionnaires**, refer to Table 1 in Section A, to demonstrate that they are currently providing or have had at least one contract, as a Prime Contractor, for the Furnishing and Installation of Passenger Loading Bridges and Support Equipment at Airport Terminals that is similar in size and scope to this contract. Bidder is strongly encouraged to submit at least five (5) references documenting that it has Furnished and Installed Passenger Loading Bridges and Support Equipment at Airport Terminals of a Similar Size and Scope. If references are not included with the bid, the Bidder shall be required to provide such references to the City of Houston within 5 (five) working days from receipt of a written request from the City of Houston to do so. **Bidder's capability and experience shall be a factor in determining the Contractor's responsibility.**

**SECTION B  
SCOPE OF WORK/SPECIFICATIONS**

**GENERAL**

**1.01 SECTION INCLUDES**

- A. The Contractor shall provide a **turnkey** bid for all services, management, supervision, labor, parts, equipment, materials, tools, instruments, supplies, expendable items, incidentals, and transportation required to remove and replace the existing Passenger Loading Bridges, and furnish, install, test, and warrant new Passenger Boarding Bridges and associated equipment at George Bush Intercontinental Airport (IAH).

By submitting a Bid, the Contractor certifies that the Equipment/Systems it shall provide shall perform all functions required by the specification and that all components are properly sized for the overall satisfactory performance of the equipment/system for its intended purpose and shall be complete and ready for operation at the time of occupancy by the Owner.

**1.02 RELATED SECTIONS**

- A. Section 02050 – Demolition
- B. Section 09900 – Protective Coatings
- C. Section 13041 – Apron Drive Aircraft Passenger Loading Bridges.
- D. Section 13371 - PCA Air Handling Equipment.
- E. Section 13390 – Preconditioned Air Testing, Adjusting and Balancing
- F. Section 16801 – 180KVA/28VDC 400 Hz Gate Equipment
- G. Section 16820 – 60 Hz Electrical Requirements
- H. Section 16830 – Electrical Identification
- I. Section 16840 – Supporting Devices

**1.03 WORK NOT INCLUDED IN THIS DIVISION**

- A. The following related Work is specified in other Sections of the Specifications:

- (1) Civil, Structural, Architectural Work

## SECTION B – General (Cont'd)

### 1.04 DEFINITIONS

A. Specific items of terminology, as used herein, shall have the following meanings:

- (1) WORK: Shall mean to include but is not limited to all materials, labor, equipment, tools, parts, supplies expendables, transportation, services, management and supervision, training, and incidentals required for a complete and operable installation.
- (2) PIPING: Shall mean pipe, fittings, flanges, valves, controls, hangers, traps, drains, insulation, vents, and any other items customarily required in connection with the transfer of fluids and pneumatics.
- (3) FURNISH: Shall mean purchase and deliver to the project site indicated equipment and/or materials complete with every necessary appurtenance and support.
- (5) INSTALL: Shall mean unload at delivery point of site; store in a safe protected location at site and perform every operation necessary to establish secure mounting and correct operation at proper location in the project. Include necessary connections to required services.
- (6) PROVIDE: Shall mean FURNISH and INSTALL.
- (7) CONTRACTOR: Shall mean the party with whom the OWNER has entered into an agreement and is the primary party responsible for all work including but not limited to the manufacture, shipping, demolition, installation, and warranty of the passenger loading bridges.
- (8) CITY ENGINEER: Shall mean the City of Houston, Houston Airport System, Assistant Director of Design and Construction and his authorized representative(s)
- (9) OWNER: Shall mean the City of Houston

B. Except where modified by specific notation to the contrary, it shall be understood that indication and/or description of any item, in drawings or specifications or both, carries with it the instruction to furnish and install item, regardless of whether or not this instruction is explicitly stated as part of indication or description.

### 1.05 QUALITY ASSURANCE

A. General: It is the intent of the drawings and specifications to obtain a complete, operable and satisfactory installation. All materials shall be new, be properly labeled and/or identified, and be in full compliance with the contract documents. All work shall comply with applicable Codes and Standards.

B. Installer's Qualifications:

- (1) The Contractor and all of its subcontractors performing work under any section of this Specification shall be a licensed firm regularly engaged in providing similar work specified in these sections.

## SECTION B – General (Cont'd)

- (2) Contractor shall be able to provide, upon request, a list of at least five similar jobs it has completed in the last five (5) to ten (10) years.

### C. Drawings and Specifications:

- (1) Drawings are diagrammatic but shall be followed as closely as actual construction of the project and the work of other trades will permit.
- (2) The specifications and drawings are complementary and are to be taken together for a complete interpretation of the work. Exceptions are those notes on drawings which refer to an individual element of work. These notes take precedence over the specifications when they conflict.
- (3) The separate divisional drawings and specifications shall not relieve the contractor from the responsibility to provide the work which is indicated on any of the drawings or division of the specifications.
- (4) The drawings by necessity utilize symbols and schematic diagrams to indicate various items of work. Therefore, no interpretation shall be made from the limitations of such symbols and diagrams that any elements of work necessary for a complete installation are excluded.
- (5) Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the indicated work.
- (6) Examine all drawings and specifications prior to submitting bid.
- (7) The City Engineer shall be notified of any discrepancies, omissions, conflicts or interferences which occur between drawings and specifications. If such notification is received in adequate time and prior to the bid due date, additional data or changes will be issued by Letter of Clarification to all bidders.
- (8) In general, plans and diagrams of all mechanical, plumbing, structural and electrical work are schematic only and should not be scaled. It shall be the sole responsibility of the Contractor to coordinate all work so as not to conflict in location with any other mechanical, plumbing, electrical, or structural work. If conflicts do arise, it shall be the responsibility of the Contractor to resolve and pay for the changes.
- (9) In the event that extra work is authorized, and performed by these trades, work shown on drawings depicting such work, and/or described by Letter of Clarification or Change Order is subject to this specification in all respects.

## SECTION B – General (Cont'd)

### D. Standards:

- (1) Certain materials and installation procedures are described by reference to industry standards. These standards are as follows:

ASA	American Standards Association
ASTM	American Society for Testing Materials
ASME	American Society for Mechanical Engineers
NFPA	National Fire Protection Association
NEMA	National Electrical Manufacturers Association
UL	Underwriter's Laboratories
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
SMACNA	Sheet Metal and Air Conditioning Contractor's National Association
AMCA	Air Movement and Control Association
ARI	Air Conditioning and Refrigeration Institute
AWS	American Welding Society
ASSE	American Society of Sanitary Engineering

- (2) For additional standards see other sections of the Specifications.
- (3) Whenever a reference is made to a standard, installation and materials shall comply with the latest Published edition of the standard at the time project is bid unless otherwise specified herein.

### E. Codes and Rules

- (1) All material furnished and all work installed shall comply with the following codes as they apply to this Project:

State Fire Marshal Rules and Regulations (NFPA)  
Occupational Safety and Health Agency Standards (OSHA).  
Life Safety Code NFPA 101  
National Electrical Code NFPA 70  
Local Building Codes

- (2) Applicable codes shall be those adopted by the authority having jurisdiction at the time project is bid.
- (3) The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus and drawings required to comply with all applicable laws, ordinances, rules and regulations.
- (4) The Contractor shall inform the City Engineer of any work or materials which conflict with any of the applicable codes, standards, laws and regulations before submitting his bid.

## 1.06 PERMITS, FEES AND INSPECTIONS

- A. The Contractor shall give the necessary notices, obtain all permits and pay all government fees, sales taxes and other costs, including utility connections or extensions, in connection with this work. File all permit applications required by all governmental departments having jurisdiction.

## **SECTION B - General (Cont'd)**

- B. Obtain all required certificates of inspection for work and deliver them to the City Engineer before requesting acceptance and final payment for the Work.

### **PART 2 - PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Materials or products specified herein and/or indicated on drawings by trade name, manufacturer's name and/or catalog number shall be provided as specified. Changes in the work will not be permitted except as described herein and in the Supplementary and General Conditions.
- B. The Contractor shall verify all dimensions, performance data, etc. for each piece of equipment submitted to assure compliance with the intent of the drawings and specifications.
- C. A list of all materials and equipment which the Contractor proposes to furnish shall be submitted to the City Engineer for approval within then (10) days after the contract has been awarded. Data shall be complete in all respects.

#### **2.02 SHOP DRAWING SUBMITTALS AND ERECTION DRAWINGS AND SAMPLES**

- A. Submit 6 copies of required and/or requested fabrication and installation drawings, for review by City Engineer before ordering or installing any equipment or material. Equipment or material ordered or installed before City Engineer review may not be accepted and will have to be removed from the project.
- B. Shop drawings shall consist of manufacturer's scale drawings, cuts or catalogs, including descriptive literature which shall clearly indicate the construction, material, physical dimensions, wiring diagrams and complete operating data clearly marked for each item. Data of general nature will not be accepted.
- C. Minimum 1/4" = 1'-0" scaled erection drawings shall be provided for all material and equipment to be installed, including foundations in plan and elevation. Provide drawings for other areas requested by the City Engineers.
- D. All these drawings shall be provided using Autocad Version 2008 or higher and shall become part of the final as built records.
- E. When requested submit samples for review. The samples shall be properly tagged and shall be in the City Engineer's possession until final acceptance of the work.
- F. The City Engineer's review does not relieve the Contractor of his responsibility to comply with all requirements of this specification.

## **SECTION B- General (Cont'd)**

### **PART 3 - EXECUTION**

#### **3.01 ORGANIZATION OF THE WORK**

- A. Proceed with work as fast as possible to meet all construction schedules. At all times keep a competent superintendent in charge of the work. Such superintendent shall be replaced if unsatisfactory to the Owner.
- B. Maintain a complete file of all contract and shop drawings at the site available for inspection by Owner's representatives and the City Engineer.
- C. Upon installation of equipment, shop drawings shall be initialed and dated. This procedure will serve to ensure proper scheduling and enable Owner's representatives to check the work in progress.

#### **3.02 (NOT USED)**

#### **3.03 CUTTING AND PATCHING**

- A. The cutting and patching of walls, partitions, ceilings and floors necessary for reception of this trade's work caused by the failure to provide or properly locate sleeves, forms and inserts, or caused by incorrect location of this work shall be this Contractor's responsibility.
- B. When it becomes necessary to cut finished materials, submit for the City Engineer's approval, drawings showing the work required and obtain approval before doing such cutting.
- C. Chases and openings in walls/roofs and floors may be provided under the work of other sections. Furnish exact dimensions and locations of these openings to suit the apparatus to be used to the City Engineer before such walls are built.
- D. No structural members shall be cut without the previous written approval of the City Engineer or the structural engineer for the PLB's.

#### **3.04 WATERPROOFING**

- A. Where any work pierces waterproofing, including waterproof concrete, the method of installation shall be as approved by the City Engineer before work is done.
- B. Provide all necessary sleeves, caulking and flashing required to make openings absolutely watertight. Waterproof flashing materials shall be compatible with base materials.

#### **3.05 ACCEPTANCE INSPECTION**

- A. The Contractor and manufacturer's representatives for major components shall be present at time of acceptance inspections and shall furnish required mechanics, tools and ladders to assist in the inspection.

## SECTION B - General (Cont'd)

- B. As a precedent to requesting a final inspection, the following steps shall be met by the Contractor:
- (1) Complete all work under this Division of the Specifications.
  - (2) Have each system balanced to assure design performance. Provide copies of Test and Balance Report to the City Engineer.
  - (3) Furnish the City Engineer with a letter from an authorized representative of the controls manufacturer certifying that all controls have been checked for operation and calibration and that the systems are operating as intended.
  - (4) Replace all temporary filter medias at each PC Air unit with the clean final filters as specified.
  - (5) Clean all dirty coils that may have accumulated dirt during construction.
- C. A list of items to be corrected as a result of acceptance inspection will be furnished by the City Engineer to the Contractor. Notify the City Engineer in writing of any items appearing on the list of corrections that are disputed by Contractor. When ready, request in writing a re-inspection of work.
- D. In the event that additional site visits by the City Engineer are required beyond the substantial and final inspections due to the Contractor's failure to complete all listed deficiencies, these additional inspections will be paid by Contractor at a rate of \$140.00 per hour plus travel, lodging, meals and rental car expenses to the City Engineer whose item is involved.

### 3.06 GUARANTEES AND CERTIFICATIONS

- A. All work shall be guaranteed to be free from leaks or defects. Any defective materials or workmanship as well as damage to the work of all trades resulting from same, shall be replaced or repaired as directed any time for the duration of the guarantee periods. The Contractor shall maintain primary responsibility for all warranties. The Contractor will not be allowed to transfer, reassign, or abrogate his responsibility to repair defective equipment, material, or workmanship through the warranty period.
- C. The Contractor will warrant all parts and materials for the passenger loading bridges against defects in material and workmanship for a period of one (1) year from the date of acceptance of each PLB by the owner's designated representatives, unless otherwise noted. In addition, the Contractor will provide an optional one (1) year extended warranty against all defects in material and workmanship the passenger loading bridge.

Note: The Prime/Contractor will warrant all parts and materials for the PCA air handling equipment and the 400 Hz/ 28 VDC equipment against defects in material and workmanship for a period of two (2) years from the date of acceptance of each PLB by the owner's designated representative.

- C. The date of acceptance shall be the date of acceptance for each passenger loading bridge.

### 3.07 RECORD DRAWINGS

- A. During the course of construction the Contractor shall keep a set of mark-up (redline) prints indicating all deviations and changes from the work indicated on the contract drawings. As-built redline drawings shall be available onsite for the City Engineer and/or Owner to review at all times throughout the project construction.

## **SECTION B - General (Cont'd)**

- B. Prepare one set of as-built drawings in Autocad Version 2008 or higher format as a record of all construction revisions and changes from the contract drawings. Include all revisions to equipment schedules.
- C. Upon completion of the work and within 30 days after acceptance by the Owner, furnish to the Owner and the City Engineer a revised and final set of electronic drawings showing all work as installed.

### **3.08 OPERATIONS/MAINTENANCE MANUALS**

- A. Complete maintenance manual shall be prepared and submitted to City Engineer for approval along with or prior to request for final acceptance inspection.
- B. Subsequent to approval, furnish ten (10) copies of manufacturer's operating and maintenance manuals, including wiring diagrams, operating procedures and parts list for each piece of equipment or systems.

### **3.09 EQUIPMENT TRAINING AND OPERATING INSTRUCTIONS**

- A. Provide on site instruction to representatives of the Owner in operation and maintenance of all installed systems and equipment. Provide a minimum of two (2) days of such instruction, more if required. In addition, provide factory training for six (6) Owner technicians covering how to diagnose, maintain and program the passenger loading bridges. The training should be the same as that provided to distributors or factory technicians and should be conducted by factory certified individuals. The individuals attending this training will receive certificate of completion. Air/travel, hotel and per diem expenses shall be included in the contract price.
- B. Provide maintenance manuals and acquaint the Owner's representative with their contents during instruction.
- C. Furnish a letter naming the Owner's personnel receiving instruction and dates when instruction was given.
- D. Provide name, address and telephone number of the manufacturer's representative and Service Company, for each piece of equipment so that service or spare parts can be readily obtained.

### **3.10 Deliverables**

- A. In addition to the specified passenger loading bridge equipment, the Contractor shall submit the following deliverables:
  - 1. Shop drawings for passenger loading bridges, PC Air systems, 60Hz-400 Hz power equipment, including all components and accessories.
  - 2. As-built plans for passenger loading bridges, PC Air, 60 Hz – 400 Hz power equipment, including all components and accessories.
  - 3. PC Air testing procedures.
  - 4. Test report on PC air system and 60- Hz- 400 Hz power equipment.

## **SECTION B - General (Cont'd)**

5. Operations and maintenance manuals on passenger loading bridges, PC Air equipment, 60 Hz – 400 Hz power equipment, and components and accessories
6. Recommended spare parts list for passenger loading bridge, PC air system, and 60 Hz – 400 Hz power equipment.

## SECTION B (Cont'd)

### SCOPE OF WORK/SPECIFICATIONS

#### TECHNICAL SPECIFICATIONS

### SECTION 02050 - DEMOLITION

#### PART I - GENERAL

##### 1.01 DESCRIPTION

- A. The work in this section addresses the removal and disposal of existing Passenger Loading Bridges (PLB), including but not limited to rotunda corridor, rotunda and column support column, telescoping tunnels, cab, drive column, and appurtenances. Existing PLB foundations are to be reused and shall remain. The existing PLB and all support equipment to become the property of the Contractor and properly disposed.

The existing PLB at Gate D4B is Stearns Model No. 80005-90 and the existing PLB's at Gates D7, D8, D9, D10, D11, and D12 are Stearns Model No. 8022-90.

The existing PLB's are served by a centralized preconditioned air system and 400 Hz power. Both systems must remain operational during and subsequent to removal of the existing PLB's and installation of the new PLB's.

##### 1.02 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: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner for reuse.
- c Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- d Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

##### 1.03 PREINSTALLATION MEETING

- A. Pre-Demolition Conference
- 1 Inspect and discuss condition of construction to be selectively demolished.
  - 2 Review construction logistics with HAS and HAS Operations.
  - 3 Review planned utility interruptions
  - 4 Review impact on Airport operations

## **SECTION 02050 – DEMOLITION (Cont'd)**

### **1.04 SUBMITTALS**

- A. Submit detailed sequence for removal work including proposed methods, equipment, materials and sequence of operations for demolition of structures. Describe coordination for shutting off, capping, and removing temporary utilities. Plan construction to minimize temporary disruption of utilities to existing facilities or adjacent property.
- B. Submit proposed demolition and removal schedule for approval. Notify City Engineer in writing at least 48 hours before starting demolition.

### **1.05 OWNERSHIP OF MATERIAL AND EQUIPMENT**

- C. All demolished materials and equipment shall become the property of the Contractor.

### **1.06 STORAGE AND HANDLING**

- A. Store and protect materials and equipment until time of installation.
- B. Remove equipment and materials not designated for reuse or salvage and all waste and debris resulting from demolition from site. Remove material as work progresses to avoid clutter.

### **1.07 ENVIRONMENTAL CONTROLS**

- A. Minimize spread of dust and flying particles. If required by governing regulations, use temporary enclosures and other suitable methods to prevent the spread of dust, dirt and debris. Demolished material will not be allowed to accumulate on-site. Demolished material is to be removed daily. Remove and transport debris in a manner to prevent spillage onto adjacent areas. Any debris deemed to pose a potential impact on Airport Operations will be immediately removed.
- B. Use appropriate controls to limit noise from demolition to levels designated in City ordinances.
- C. Do not use water where it can create dangerous or objectionable conditions, such as localized flooding, erosion, or sedimentation of nearby ditches or streams.
- D. Stop demolition and notify the City Engineer if underground fuel storage tanks, asbestos, PCB's, contaminated soils, or other hazardous materials are encountered that is not otherwise shown or indicated on the plans.
- E. Dispose of removed equipment, materials, waste and debris in a manner conforming to applicable laws and regulations.
- F. Coordinate removal work with utility companies.
- G. Refrigerant: Remove refrigerant (if any) from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.
- H. Centralized PCA Coolant: Prior to disconnecting the glycol/water coolant lines for the central PCA system, the Contractor shall drain the lines and collect the glycol/water coolant and dispose properly. Any spilled glycol/water will be contained and collected to prevent discharge into the public drainage system. Immediately report spills to Ellery Stevenson, IAH Environmental Investigator at (281) 233-1684.

## **SECTION 02050 – DEMOLITION (Cont'd)**

### **PART 2 - PRODUCTS**

#### **2.01 EQUIPMENT AND MATERIALS FOR DEMOLITION**

- A. Use equipment and materials approved under Paragraph 1.04, Submittals.
- B. Fires are not permitted.
- C. Use of explosives is prohibited.
- D. Do not use a "drop hammer" in the vicinity of fuel lines and pits or where the potential exists for damage to underground facilities, structures, adjacent improvements, or existing facilities to remain.

### **PART 3 - EXECUTION**

#### **3.01 EXAMINATION AND PREPARATION**

- A. Prior to demolition, make an inspection with City Engineer to determine the condition of existing structures and features adjacent to items designated for demolition.
- B. City Engineer will mark or list existing equipment to remain the property of the City.
- C. Do not proceed with demolition or removal operations until after the joint inspection and subsequent authorization by City Engineer.
- D. Obtain advance approval from City Engineer for dimensions and limits of removal work.
- E. Identify known utilities below grade. Stake and flag locations.

#### **3.02 PROTECTION OF PERSONS AND PROPERTY**

- A. Provide safe working conditions for employees throughout demolition and removal operations. Observe safety requirements for work below grade.
- B. Maintain safe access to adjacent property and buildings. Do not obstruct roadways, sidewalks or passageways adjacent to the work.
- C. Perform demolition in a manner to prevent damage to adjacent property. Repair damage to City property or adjacent property and facilities.
- D. The Contractor shall be responsible for safety and integrity of adjacent structures and shall be liable for any damage due to movement or settlement. Provide proper framing and shoring necessary for support. Cease operations if an adjacent structure appears to be endangered. Resume demolition only after proper protective measures have been taken.
- E. Erect and maintain enclosures, barriers, warning lights, and other required protective devices.
- F. Protect utilities that remain from damage.

## SECTION 02050 – DEMOLITION (Cont'd)

- G. Protect bench marks, monuments, and existing structures designated to remain, from damage or displacement.

### 3.03 UTILITY SERVICES

- A. Follow rules and regulations of authorities or companies having jurisdiction over communications, pipelines, and electrical distribution services.
- B. Notify and coordinate with utility company and adjacent building occupants when temporary interruption of utility service is necessary.

### 3.04 DISPOSAL

- A. Remove from the site all items not designated for reuse or salvage.
- B. Follow method of disposal as required by regulatory agencies.

### 3.05 ELECTRICAL WORK ITEMS

- A. Provide temporary circuits and jumpers to maintain necessary circuit continuity throughout execution of the work.
- C. Coordinate electrical removals with the City Engineer, as necessary. Verify that power is properly de-energized and disconnected.
- D. Where shown or otherwise required, remove wiring in underground duct systems. Verify function of wiring before disconnecting and removing.
- E. Changes to electrical systems shall conform to applicable codes.

### 3.06 PLB Salvage Credit

The Contractor shall provide the amount of the salvage credit for each of the existing PLB's. The amount of the salvage credit will be a deductive price. The salvage credit price shall not include the cost for removal, transport, and disposal of the PLB.

## PART 4– MEASUREMENT AND PAYMENT

### 4.01 MEASUREMENT

- A. Measurement of the demolition of the existing PLB's will be measured per each for each location of the existing PLB.
- B. Measurement of the salvage credit for the existing PLB's will be measured per each for each PLB.

## SECTION 02050 – DEMOLITION (Cont'd)

### 4.02 PAYMENT

- A. Payment for demolition of the existing PLB's shall be at the contract unit price per lump sum for each PLB removed at each location. The lumpsum price shall be full compensation to disconnect, remove, transport, and dispose of the PLB, including all costs for tools, equipment, labor, and incidental necessary to complete the work.
- B. The amount of the salvage credit will be per each for each PLB. The salvage credit shall be deductive pricing.

Item 02050-1	Demolition of Existing PLB D4 - per each
Item 02050-2	Demolition of Existing PLB D7 - per each
Item 02050-3	Demolition of Existing PLB D8 - per each
Item 02050-4	Demolition of Existing PLB D9 - per each
Item 02050-5	Demolition of Existing PLB D10 - per each
Item 02050-6	Demolition of Existing PLB D11 - per each
Item 02050-7	Demolition of Existing PLB D12 - per each
Item 02050-8	Deductive Pricing for Salvage Credit on Existing PLB D4 - per each
Item 02050-9	Deductive Pricing for Salvage Credit on Existing PLB D7 - per each
Item 02050-10	Deductive Pricing for Salvage Credit on Existing PLB D8 - per each
Item 02050-11	Deductive Pricing for Salvage Credit on Existing PLB D9 - per each
Item 02050-12	Deductive Pricing for Salvage Credit on Existing PLB D10 - per each
Item 02050-13	Deductive Pricing for Salvage Credit on Existing PLB D11 - per each
Item 02050-14	Deductive Pricing for Salvage Credit on Existing PLB D12 - per each

## SECTION 09900 - PROTECTIVE COATINGS

### PART 1 – GENERAL

#### 1.01 GENERAL REQUIREMENTS

A. This section includes coating of exterior hanger and support, piping and electrical conduit surfaces throughout the Project with systems specified on “coating system” sheets.

B. Coating systems include surface preparation, first coat finish coat, inspection, cleaning, and touch-up of surfaces and equipment. Shop preparation, prime coat, and finish coats to be shop-applied, may be specified elsewhere or referenced to this Section so that a complete system is specified and coordinated.

- (1) Where surface preparation and first (prime) coat are specified in other Sections to be shop-applied, such as for structural steel, hollow metal doors or equipment, only the touch-up and finish coats are a part of field painting. Surface preparation is the required degree of preparation prior to application of first (prime) coat regardless if done in shop or field.
- (2) If materials are provided without shop primer such as miscellaneous steel or sheet metal, then surface preparation, first, second, and third coats are a part of field painting
- (3) Concealed surfaces are generally not required to have finish-coats unless otherwise specified, but prime coat should be applied and touched up prior to concealment.
- (4) Where Equipment and Materials are provided with shop-applied finished coating system, only touch-up is a part of field painting.
- (5) Refer to applicable Sections to determine whether surface preparation and first coat, or complete coating system, is to be shop-applied.

C. Related Work Specified Elsewhere.

- (1) Shop painting and coatings. All applicable Divisions.
- (2) Factory prefinished items. All applicable Divisions.

D. Colors. Colors to match associated equipment PLB, PCA and 400 Hz equipment. Contractor to provide color samples to the City Engineer for review and approval.

#### 1.02 SUBMITTALS

A. Include, but not limited to, the following.

- (1) Schedule of products and paint systems to be used. Schedule shall include the following information.
  - (a) Surfaces to be coated.
  - (b) Product manufacturer, name, and number.
  - (c) Method of application.
- (2) Color charts for selection and acceptance.
- (3) Technical and material safety data sheets.

## **SECTION 09900 - PROTECTIVE COATINGS (Cont'd)**

- (4) Certification by coating manufacturer(s) that all coatings are suitable for service intended as stated on each coating system sheet. If manufacturer has an equivalent product as that specified, but it is not suitable for the intended purpose, Contractor shall submit the recommended product for approval at no increase in cost, and state reasons for substitution.

### **1.03 QUALITY ASSURANCE**

A. Include on label of container.

- (1) Manufacturer's name, product name, and number.
- (2) Type of paint and generic name.
- (3) Color name and number.
- (4) Storage and temperature limits.
- (5) Mixing and application instructions, including requirements for precautions which must be taken.
- (6) Drying, recoat, or curing time.

### **1.04 DELIVERY, STORAGE, AND HANDLING**

A. Delivery of Materials.

- (1) Deliver in sealed containers with labels and information legible and in tact. Containers shall also have correct labels with required information.

B. Storage of Materials.

- (1) Store only acceptable materials on Project Site.
- (2) Provide separate area and suitable containers for storage of coatings and related coating equipment.
- (3) Dispose of used or leftover containers, thinners, rags, brushes, and rollers in accordance with applicable regulations.

### **1.05 REGULATORY REQUIREMENTS**

A. In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local and regional jurisdiction. Notify Owner's Representative of any coating specified herein that fails to conform to the requirements for the location of the Project or location of application.

B. Lead Content. Use only coatings that are totally lead free.

C. Chromate Content. Do not use coatings containing zinc-chromate or strontium chromate.

D. Mercury Content. Materials shall not contain mercury or mercury compounds.

## SECTION 09900 - PROTECTIVE COATINGS (Cont'd)

### PART 2 – PRODUCTS

#### 2.01 ACCEPTABLE MANUFACTURERS

A. Propriety names and product numbers are specified in most systems for material identification from these manufacturers.

- (1) Ameron Protective Coatings Systems Group, Ameron Corp.
- (2) Carboline Company, Inc.
- (3) Devoe Coating Company, Division of ICL.
- (4) International Protective Coatings.
- (5) Tnemec Company, Inc.

#### 2.02 GENERAL

A. Materials furnished for each coating system must be compatible to the substrate.

B. When unprimed surfaces are to be coated, entire coating system shall be by the same coating manufacturer to assure compatibility of coatings.

C. When shop-painted surfaces are to be coated, ascertain whether finish materials will be compatible with shop coating. Inform Owner's Representative of any unsuitable substrate or coating conditions.

**2.03 COATING SYSTEMS.** Specified on the "Coating System" sheets at the end of this Section.

#### 2.04 SURFACES TO BE COATED

A. System EU1.

- (1) Exposed pipe and electrical conduit.
- (2) Exterior equipment not factory finished.
- (3) Exterior brackets, hardware and supports.
- (4) Factory finished equipment.

#### 2.05 COLOR CODING PHYSICAL HAZARDS

A. Preconditioned Air Units.

- (1) Paint a yellow and black stripe along the bottom of all preconditioned air handling units. Stripe shall be made of 2 inches wide and shall extend around the very bottom of the outer vertical sides of the air handling unit.

## SECTION 09900 - PROTECTIVE COATINGS (Cont'd)

### 2.06 SURFACE PREPARATION

A. Prepare surfaces for each coating system conforming to Society for Protective Coatings (SPC) surface preparations specifications listed.

(1) If grease or oils are present, SPC-SP1 shall precede any other method specified.

(2) Remove surface irregularities such as weld splatter, burrs, or sharp edges, prior to specified surface preparation.

B. Depth of profile will be as specified for each system, but in no instance shall it exceed one-third of the total dry film thickness of complete system.

C. Prepare only those areas which will receive the first coat of the system on the same day.

### 2.07 APPLICATION

A. Apply coatings in accordance with coating manufacturer's recommendations.

B. Use properly designed brushes, rollers, and spray equipment for all applications.

C. On unprimed surfaces apply first coat of the system the same day as surface preparation.

D. Dry film thickness of each system shall meet the minimum specified, however manufacturer's stated recommended dry film thickness shall be met if greater than the minimum specified. Maximum dry film thickness shall not exceed the minimum more than 20% or coating manufacturer's requirements if less. Where a dry film thickness range is specified, the range shall not be less than or exceeded.

E. Shop and field painting shall remain 3 inches away from unprepared surface of any substrate such as areas to be welded or bolted.

F. Environmental Conditions.

(1) Atmospheric temperature must be 50 degrees Fahrenheit (F) or higher during application, unless otherwise approved by coating manufacturer. Do not apply coatings when inclement weather or freezing temperature may occur within coating time requirements.

(2) Wind velocities for exterior applications shall be at a minimum to prevent overspray or fallout and not greater than coating manufacturer's limits.

(3) Relative humidity must be less than 85 percent and the temperature of the surface to be painted must be less than 5 degrees F above the dew point.

(4) Provide adequate ventilation in all areas of application to ensue that at no time does the content of air exceed the Threshold Limit Value given on the manufacturer's Material Safety Data Sheets for the specific coatings being applied.

G. Recoat Time. In the event a coating, such as an epoxy, has exceeded its recoat time limit, prepare the applied coating in accordance with manufacturer's recommendations.

## SECTION 09900 - PROTECTIVE COATINGS (Cont'd)

### H. Protection.

- (1) Cover or otherwise protect surfaces not to be painted. Remove protective materials when appropriate.
- (2) Mask, remove, or otherwise protect finish hardware, machined surfaces, grilles, lighting fixtures, and prefinished units as necessary.
- (3) Provide cover or shields to prevent surface preparation media and coatings from entering orifices in electrical or mechanical Equipment. Where ventilation systems must be kept in operation at time of surface preparation, take precautions to shield intakes and exhausts to prevent materials from entering system or being dispersed.
- (4) Provide signs to indicate fresh paint areas.
- (5) Provide daily cleanup of both storage and working areas and removal of all paint refuse, trash, rags, and thinners. Dispose of leftover containers, thinners, rags, brushes, and rollers which cannot be reused in accordance with applicable regulations.
- (6) Do not remove or paint over equipment data plates, code stamps on piping, or UL fire-rating labels.

### 2.08 INSPECTION

- A. Contractor shall provide and use a wet film gauge to check each application approximately every 15 minutes in order to immediately correct film thickness under or over that specified.
- B. Contractor shall provide and use a dry film gauge to check each coat mil thickness when dry, and the total system mil thickness when completed.
- C. Use a sling psychrometer and perform periodic checks on both relative humidity and temperature limits.
- D. Check temperature of the substrate at regular intervals to be certain service is 5 degrees F or more above the dew point.

### 2.09 CLEANING AND REPAIRS

- A. Remove spilled, dripped, or splattered paint from surfaces. Touch up and restore damaged finishes to original condition. This includes surface preparation and application of coatings specified.

### 2.10 REFERENCES

#### A. Applicable Standards.

- (1) American National Standards Institute (ANSI).
  - (a) Z53.1 – Safety Color Code for Marking Physical Hazards.
- (2) SPC Surface Preparation Specifications.
  - (a) SP1 – Solvent Cleaning. Removes oil, grease, soil, drawing and cutting compounds, and

and other soluble contaminants.

### **SECTION 09900 - PROTECTIVE COATINGS (Cont'd)**

- (b) SP2 – Hand Tool Cleaning. Remove loose material. Not intended to remove all scale and rust.
- (c) SP3 – Power Tool Cleaning. Removes loose material. Not intended to remove all scale or rust.

**SECTION 13041 - APRON DRIVE  
AIRCRAFT PASSENGER LOADING BRIDGES**

**PART 1 – GENERAL**

**1.01 GENERAL REQUIREMENTS**

A. The aircraft passenger loading bridge covered by these specifications shall be designed to extend from the terminal departure lounge doorway or from a fixed walkway to the aircraft loading door so that passengers can walk between the two, completely protected from inclement weather, aircraft engine blast, and blown dust. The bridge shall provide a simple, convenient, safe, and controlled method for passenger loading. The complete assembly shall be weatherproof, both when sealed to the aircraft and when parked with the cab weather door closed. Particular attention shall be given to the safety of the passengers.

Note: The observer shall be positioned with his/her back to the Terminal end and facing the aircraft end of the PLB when referring to left or right.

B. The bridge shall consist of the following components:

1. Fixed Walkway (where specified on the drawings)
2. Rotunda Entry Corridor
3. Rotunda
4. Telescoping Tunnels (3 as specified)
5. Vertical and Horizontal Drive Column Assembly
6. Rotating Aircraft Cab with Operator Control Console
7. Automatic Leveling Device
8. Service Door, Landing, Service Stair and Baggage Chute
9. Canopy Closure to Aircraft
10. Electrical Distribution Systems and Components

**1.02 APPLICATION**

A. The apron drive loading bridge must be capable of reaching all specified aircraft park positions. The bridge cab shall have sufficient flexibility to enable it to mate with the aircraft passenger loading door when the aircraft is parked at the gate. The bridge shall have sufficient vertical travel to accommodate all aircraft specified on the aircraft parking layout drawings. The bridge shall have a minimum of 1'-0" additional extended travel beyond the outer most aircraft operational requirement and 5'-0" additional retract travel from the closest aircraft operational requirement.

**1.03 SAFETY PROVISIONS**

A. The bridge shall be designed with safety as the first priority for protection of aircraft passengers, crew, operators, and maintenance personnel. The bridge shall conform to all current Federal, State and Local Occupational Health and Safety Codes, along with standards developed and adopted by the passenger loading bridge industry.

1. All elements of the bridge shall be designed to be fail-safe in operation.
2. Operating controls and maintenance features shall be designed so that errors in the operation and maintenance of the bridge cannot cause structural damage to any of its elements.

**SECTION 13041 - APRON DRIVE  
AIRCRAFT PASSENGER LOADING BRIDGES (Cont'd)**

3. All operating mechanisms shall be designed so that the drive mechanism is locked when power fails or is turned off. Hydraulic lift columns shall be equipped with a safety pilot-operated-check-valve to prevent the bridge from falling in the event of a failure in the hydraulic system. Electrical-Mechanical lift columns shall be equipped with a fault detector to sense differential motion of the ball screw assemblies. The detector shall disconnect electrical power from the vertical drive motors if a fault is detected.
4. Limit switches and/or Positive mechanical stops shall be provided to prevent hazardous over-travel where any component might become disengaged from its guiding or restraining component.
5. The operator's position in the cab shall be arranged to permit the operator to operate the loading bridge with the cab weather door closed.
6. Transition ramps shall have yellow chamfered edges and be equipped with brushed aluminum handrails on both sides. Transition ramps shall have ribbed rubber floor covering, with the ribs running perpendicular to the bridge centerline.
7. Sheared or sharp metal edges must be debarred or broken and all exposed metal corners are to be rounded. All critical fasteners are to incorporate suitable locking devices.
8. The loading bridge shall conform to the requirements of the latest National Fire Protection Association (NFPA) "Standards of Construction and Protection of Aircraft Loading Walkways", NFPA-415, latest edition. Certified documentation to be provided upon request.
9. "A" Tunnels to include brushed aluminum handrails on both sides.
10. Provide emergency lighting with 90 minute battery back-up complete with self contained charger and automatic on-off control. Emergency lighting may be incorporated into normal lighting fixtures.

**1.04 CODES, REGULATIONS AND REFERENCES**

A. The bridge shall be designed to conform to all applicable Federal, State and Airport Authority codes and regulations which apply to the installation site. The design of all parts and subassemblies shall be in accordance with good commercial practices to assure safe, efficient, and practical designs in keeping with standards which have been adopted by the passenger loading bridge industry. Applicable documents include, but are not limited to, the following:

B. Codes and Regulations:

1. American Institute of Steel Construction (AISC)
2. Society of Automotive Engineers (SAE) Standards
3. American Society of Mechanical Engineers (ASME) Standards
4. National Fire Protection Association (NFPA-415)
5. Steel Structures Painting Council (SSPC)
6. National Electrical Code (NEC)
7. National Electrical Manufacturers Association (NEMA) Standards
8. Occupational Safety and Health Administration (OSHA)
9. American Welding Society (AWS) Standards

C. Material Specifications

1. Structural Steel ASTM-A36
2. Structural Steel Shapes ASTM-500
3. Steel Pipe ASTM-A53
4. Steel Sheet ASTM-A570
5. T-1 Steel ASTM-A514 & A517
6. Hinge Pins ASTM - A 311 Grade 1018 & Grade 1144

**SECTION 13041 - APRON DRIVE  
AIRCRAFT PASSENGER LOADING BRIDGES (Cont'd)**

- 7. Bolts - Standard ASTM-A307
- 8. Bolts - High Strength SEA-J429 Grade 5 and 8

**1.05 TECHNICAL AND PERFORMANCE REQUIREMENTS**

A. The loading bridge shall be designed to accommodate all imposed loads collectively. In the worst operating configuration, structural margins of safety as recommended by AISC specifications for the design and erection of steel structures shall be maintained.

B. All mechanisms for actuating, restraining, and guiding the bridge and its components shall be designed so that no noise, sway, or sense of insecurity will be apparent to the passengers. No operating vibration or loads are to be transmitted to the terminal building.

C. The passenger loading bridge submitted shall be designed not to exceed 1 in 12 (8.33%) tunnel slope when servicing any aircraft.

D. The bridge floor structure shall be designed to accommodate 40 pounds per square foot over the total floor area.

E. The roof shall accommodate snow loads of 25 pounds per square foot over the total roof area.

F. The bridge, when in use at any extended length, shall accommodate a wind load of 12.5 pounds per square foot without loss of stability or control. The new loading bridges shall reuse the existing hurricane tie down straps and anchors.

G. The bridge, when retracted to the stowed position, shall accommodate a wind load of 25 pounds per square foot.

H. The bridge shall be able to accommodate the added electrical loads of 400 Hertz ground power equipment and preconditioned air equipment. The Contractor is responsible for coordinating the proper installation of the PCA equipment and 400 Hz/28VDC power equipment. Additional electrical loads from the PCA equipment and the 400 hz/28VDC equipment may be applied in total or in part, singularly or simultaneously. Contractor is responsible to provide structural support mounting and mounting provisions. Mounting brackets are to be provided by the 400hz/28VDC, PC Air, and auxiliary equipment suppliers. Contractor is responsible for all engineering for the mounting and coordination of the PCA equipment and 400 Hz/28 VDC power equipment, air and power delivery systems and their associated accessory equipment.

I. The bridge design, with adequate maintenance, shall provide a useful service life of 20 years minimum.

**1.06 ENVIRONMENTAL CONSIDERATIONS**

A. The bridge assembly shall be designed to provide a clean, structurally sound, comfortable, and functional transition between the aircraft and terminal building.

**SECTION 13041 - APRON DRIVE  
AIRCRAFT PASSENGER LOADING BRIDGES (Cont'd)**

- B. Interior and exterior designs are to be aesthetically pleasing, and in keeping with contemporary trends meeting all latest NFPA 415 requirements.
- C. The bridge shall operate satisfactorily under ambient temperatures from -25 degrees F. to 125 degrees F. with winds up to 60 miles per hour on wet, ice-covered, or snow laden apron surfaces.
- D. The entire bridge is to be weatherproof.
- E. Equipment and controls that are exposed to the weather are to be of a weatherproof type or housed in weatherproof boxes.(NEMA)
- F. Externally mounted electrical control panels and/or cabinets shall be equipped with space heaters to control condensation.

**1.07 MAINTAINABILITY**

- A. The bridge shall be designed to emphasize simplicity, ruggedness, and ease of maintenance. There shall be no special tools required for routine maintenance.
  - 1. Attention shall be given to the design of each component and assembly to minimize the number of routine maintenance items on the bridge.
  - 2. Components shall be selected and assemblies shall be designed to facilitate troubleshooting and to minimize repair or replacement time.
  - 3. Access panels enclosing areas requiring maintenance shall be large enough to permit accomplishment of the task required.
  - 4. Where practical, components shall be built in subassemblies for ease of replacement and shall be designed to be installed or removed by one person.
  - 5. Where the weight of a component requires mechanical assistance, the component shall be provided with lifting eyes or other suitable hoisting arrangement.
  - 6. Contractor shall provide one maintenance jack stand (A-frames) and tow bar.

**1.08 (NOT USED)**

**1.09 ROTUNDA CORRIDOR**

- A. The design of the rotunda entry corridor shall accommodate a terminal door size of 3 feet, 6 inches wide by 6'-8" high.
- B. The threshold plate with a non-slip surface shall bridge the gap between the terminal building and the adjacent fixed walkway (where required) and the rotunda corridor.
- C. Interior and exterior flashing shall be installed between the terminal building and/or fixed walkway (where required) and the rotunda corridor to effect a weather-tight connection.

**SECTION 13041 - APRON DRIVE  
AIRCRAFT PASSENGER LOADING BRIDGES (Cont'd)**

**1.10 ROTUNDA**

- A. The rotunda is to be supported on an independent support column. It shall allow the telescoping tunnels to swing through an arc of 175 degrees (87.5 degrees clockwise and 87.5 degrees counter clockwise from the corridor centerline).
- B. The rotunda support column shall not be anchored or secured to the terminal building, nor shall it transmit any live or dead loads or vibrations to the terminal building.
- C. The rotunda shall be equipped with adjustable limit switches to control the swing angles of the bridge tunnels. If the limit switch is activated by the bridge, all power shall be disconnected, preventing the bridge from traveling further.
- D. The opening between the rotunda and the hinged telescoping tunnels shall have a complete weatherproof seal.
- E. The side coiling curtain barrel assemblies shall be covered to protect them from the weather.
- F. The rotunda floor shall remain level regardless of the movements of the bridge tunnels.
- G. All avenues must be pursued in the design of the rotunda to deter nesting of birds in the area between the ceiling and roof.

**1.11 TELESCOPING TUNNELS**

- A. The telescoping tunnels shall be rectangular in cross section and hinged for vertical motion at the rotunda. The tunnels with the largest cross section shall be closest to the aircraft. The tunnel walls shall be either galvanized steel panels or 14 gauge steel corrugated plate.
  - 1. The telescoping tunnels shall permit servicing of all commercial jet aircraft as required by the aircraft parking layout such that the slope of the tunnels does not exceed 1 in 12 (8.33%), with the exception of the transition ramps.
  - 2. The minimum inside width of the tunnels shall be 4 feet, 10 inches and the minimum inside height shall be 6 feet 11 inches.
  - 3. Flexible seals are to be used between the tunnel sections to provide a weather-tight seal preventing entry of blowing dust, rain, or snow.
  - 4. Where the telescoping sections overlap, ramps shall be provided to accommodate the difference in elevation. The ramps shall have yellow chamfered edges and handrails on both sides. Ramps shall have ribbed rubber floor covering, with the ribs installed perpendicular to the bridge centerline.
  - 5. The telescoping tunnels shall be equipped with either an exterior side mounted electrical cable conveyance system or an exterior under-the-bridge mounted electrical cable conveyance system. This system shall be accessible to maintenance personnel for inspection or cable additions at all bridge positions and operating conditions. Access to the cable conveyance system shall not impede passenger traffic or bridge operation. The cable conveyance system shall be capable of supporting a combination of cables and hoses totaling 12 lbs/sf.

**SECTION 13041 - APRON DRIVE  
AIRCRAFT PASSENGER LOADING BRIDGES (Cont'd)**

**1.12 DRIVE COLUMN**

- A. The drive column assembly shall provide the force to swing, extend or retract, and raise or lower the bridge. These systems shall be either hydraulic and/or electrical-mechanical.
- B. The motors and mechanisms for vertical, horizontal and radial motion shall be integral parts of the drive and lift column assembly and operate in a smooth and quiet manner.
- C. The system shall be designed to permit simultaneous vertical travel, horizontal travel and steering, to permit expeditious movement to the aircraft.
- D. Horizontal Drive - Hydraulic
  - 1. A hydraulic drive system shall provide the extend, retract, swing and steer capabilities at variable speeds up to 90 feet per minute. This two-wheeled system shall operate on pneumatic tires. Both wheels shall be independently driven by hydraulic motors.
  - 2. The wheel motors shall be equipped with an automatic brake that locks the undercarriage when the power is "off". In case of a power outage, the brakes shall be manually released so the bridge can be towed. Tow bar lugs are to be included on the undercarriage.
- E. Vertical Drive - Hydraulic
  - 1. The lift mechanism shall consist of two (2) extra capacity hydraulic rams. Each assembly shall be independent of the other and capable of supporting the bridge under full design load. An adjustable flow control valve shall provide a lift speed of approximately 2 feet, 6 inches per minute measured at the aircraft cab bumper.
  - 2. The lift cylinders shall be equipped with internally mounted pilot operated check valves that prevent the bridge from descending in the event of fluid loss or other system failure. The hydraulic circuit shall be designed so that the bridge can be lowered manually in case of a power failure.
  - 3. Mechanical stops in the cylinders shall be provided to prevent over-travel of the lift column. The system shall not be damaged if the bridge is raised or lowered into the cylinder stops.
  - 4. The vertical movement can be operated at the same time as horizontal drive.
- F. Fluid – Hydraulic
  - 1. The petroleum base hydraulic fluid shall allow satisfactory operation of the drive column under ambient temperatures of - 25 degrees F. to 125 degrees F. with winds up to 60 miles per hour and meet the requirements of MIL-H-5606, latest edition. The hydraulic reservoir (tank) shall have the capability of being electrically heated during severe weather conditions.
- G. Horizontal Drive - Electrical Mechanical

A variable speed, electro-mechanical drive system shall provide horizontal travel.

  - 1. The tires used on the horizontal drive system shall be solid tires.
  - 2. The AC horizontal drive system shall use AC gear motors with integral brakes. The AC motors shall be driven by solid state, variable frequency motor controllers. The AC drive system shall provide high efficiency, smooth performance, and good component availability. The controller shall provide a variable frequency signal to provide adjustable speeds from 0 to 90 feet per minute. The controller can be adjusted to provide optimum responsiveness to the horizontal controls. The controller shall provide built in diagnostics to assist with trouble shooting.

**SECTION 13041 - APRON DRIVE  
AIRCRAFT PASSENGER LOADING BRIDGES (Cont'd)**

3. A steer angle of 180° shall be possible in place and in motion. Steering speed shall be a minimum of 7° per second.
4. A regenerative braking system shall be used allowing the PLB to come to smooth controlled stops. Integral spring-applied, electrically-released brakes shall be provided with each drive motor. The brakes lock the PLB in place when electrical power is disconnected. This shall occur when the joystick is in the neutral position or when normal operating power shall be discontinued.
5. The horizontal drive motors shall be equipped with manual brake releases. These allow the PLB to be towed in the event of power failure. Tow lugs shall be a component of the lower wheel frame.
6. A wheel position sensor(s) shall monitor rotational alignment with the bridge and provide operational wheel bogey limits. Wheel bogie position shall be indicated on the HMI.

H. Vertical Drive - Electrical Mechanical

1. The lift mechanism shall consist of two (2) recirculating ball bearing screw assemblies. Each assembly shall be independent of the other, with individual motors, and be capable of supporting the bridge under full design load and raising and lowering the bridge at an approximate speed of 3 feet, 6 inches per minute measured at the cab bumper. The ball nut of this assembly shall be equipped with wiper brushes to remove grit or dirt from screw threads and a self-locking acme type thread to prevent unit collapse in the event of a ball nut failure.
2. The vertical drive motors shall be AC induction motors with integral reducer and fitted with spring applied brakes which release only when electric power is applied and vertical motion, up or down, is signaled from the operator's console or the auto-leveler system.
3. The brakes shall hold securely at all elevations, without creeping, whether the bridge is in operation or not.
4. The fault detector circuit shall shut down the electrical power to the vertical drive motors and set the brakes independently of the operator. This shall occur if the bridge is in the vertical-operate mode and there is differential motion at the ball screws.

**1.13 AIRCRAFT CAB WITH OPERATOR'S STATION**

- A. The aircraft cab with operator's station shall be designed to rotate a minimum of 125 degrees, a minimum of 92.5 degrees counter clockwise and 32.5 degrees clockwise on bridges with right-side service stairs and a minimum of 92.5 degrees clockwise and 32.5 degrees counter clockwise on bridges with left-side service stairs from the tunnel centerline to facilitate alignment with multiple aircraft parking configurations. The rotation speed shall be between 2 and 2.5 degrees per second. The cab shall be enclosed to provide maximum security and protection from the outside environment throughout the docking and passenger loading operation.
- B. The operator's station shall be located on the left-hand side of the cab and shall be protected from the outside environment as well as passenger interference. It shall consist of a forward facing control console positioned behind a safety glass window. This window shall be of sufficient size to allow the operator to operate the bridge with full view of the aircraft contact area during normal operation, including the auto-leveler, without opening the weather door.

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AIRCRAFT PASSENGER LOADING BRIDGES (Cont'd)**

- C. The cab shall have sufficient windows to allow the operator to view the ramp area during operation. Also, a rear view mirror shall be provided on the left side of the cab to allow the operator full view of the horizontal drive wheels (wheel bogie) during operation.
- D. The cab side coiling curtain slats shall be equipped with view panels to allow the operator maximum visibility of the aircraft and ramp during operation.
- E. The side coiling curtain barrel assemblies shall be covered to protect them from the weather. Covers shall be hinged to allow easy access to curtain assemblies.
- F. The cab shall have a weather door to protect the interior of the bridge when it is not in operation. This door shall be located to the right of the operator's station and have the capability of being locked. This door shall be either a roll-up door or double swinging weather doors. The opening shall have a clear width of 44 inches and a minimum clear height of 7 feet 6 inches. If double swinging doors are used, they shall be equipped with 12 inch wide by 32 inch high safety glass windows to enhance visibility.
- G. The aircraft end of the cab floor shall be equipped with a full width aircraft spacer (bumper). The spacer shall be of a material that will retain its flexibility during constant usage regardless of the temperature and must be non-abrasive to prevent scratching or other damage to the aircraft fuselage. The spacer material shall comply with NFPA 415 requirements.
- H. A cab floor de-icer with thermostat, with a manual ON/OFF switch on the operator control console, shall be provided exterior of the cab weather door. (applicable for ambient weather patterns of 40 degrees F and above) The ON/OFF switch shall be accessible by service personnel only.
- I. The outer most end of the cab shall be equipped with an adjustable floor. The floor shall be individually actuated and independently adjustable to adapt to all aircraft doorsills. This floor must be designed to be automatic with a manual override. Include safety railings for floor extension to Regional Jet aircraft.
- J. Provide an illuminated, gate sign mounted on the top of the passenger boarding bridge cab identifying the appropriate gate number. The sign lens shall be a minimum of 2'-5" high x 4'-3" long and shall have 2'-0" tall gate number characters. The character font shall be SWIS 721 HEAVY BT. The sign configuration type and font color shall be as specified by the Airport Authority. The sign shall be mounted on a pivot bracket mounted to the rooftop of the bridge cab. During installation, rotate the gate sign to the desired final position before tightening cap screws on pivot bracket. Sign housing shall be painted to match bridge color. The sign shall house a 400W metal halide bulb as manufactured by General Electric Model MPR400-VBU-XHOPA or equal. Provide all electrical conduit, wire and connections required for a complete and operable installation.

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AIRCRAFT PASSENGER LOADING BRIDGES (Cont'd)**

**1.14. CONTROLS AND INDICATORS**

**A. Controls**

1. The operator's control console shall be designed to allow easy operation by personnel possessing no special skills and with minimum training.
  - a. A placard outlining the bridge operating instructions shall be displayed in a prominent location in the cab of each bridge so as to be easily visible to the Operator.
2. All controls necessary for the operation and control of the loading bridge are to be located on the control console and grouped on control console faceplate in functional groups. The following controls shall be located on the control console:
  - a. A three position key switch with positions marked "Auto-level", "Off" and "Operate". The key shall be removed only in the "Off" or "Auto" positions. The auto-leveler arm will extend when the switch is put in the "Auto" position.
  - b. A "Power On" push-to-start button.
  - c. An "Emergency Stop" push/pull button.
  - d. A 4-way "joystick" controls forward, reverse and steering motions of the horizontal drive systems. As the joystick is moved progressively forward or back, PLB speed ramps proportionally through 3 preset speeds. Steering may be accomplished independently or at the same time by moving the joystick to the left or right.
  - e. Two individual push-buttons marked "Raise" and "Lower" for controlling the vertical travel of the bridge.
  - f. Two individual push-buttons marked "Rotate Left" and "Rotate Right" for rotating the cab.
  - g. Push-button(s) to independently control the adjustment of the left and right side of the bellows-type aircraft closure.
  - h. A switch to control the floodlights that illuminate the ramp area under the aircraft and drive column undercarriage.
  - i. A switch to control the cab floor de-icer. (if applicable)
  - j. A switch to control the light in the cab.
  - k. A switch to change the adjustable cab floor operation from automatic or manual. The current mode of operation must be visually obvious.
  - l. A push-button switch to control the adjustable cab floor while in the manual mode.

**C. Indicators**

The control console shall have indicators that display the current PLB status. The PLB status indicators are as follows:

1. An HMI (Human Machine Interface) message center graphic display panel shall be provided. This includes a programmable color display that provides critical operator information, fault status notification, maintenance and troubleshooting information, operational timers and set points, and programmable push-buttons for optional customer equipment. The Contractor shall ensure the manufacturer supplies the HMI data sheets and a complete list of their HMI's messages, functions, and features during the submittal process.
2. A cab floor height indicator shall show when the cab floor elevation is at the proper height (theoretically correct) for each aircraft to be serviced.

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AIRCRAFT PASSENGER LOADING BRIDGES (Cont'd)**

3. A wheel position indicator shall show the orientation of the wheels along with the true tunnel centerline, regardless of the cab's rotational position.
4. An amber light to indicate that the auto level function is energized and operating.
5. An auto level malfunction shall be indicated with a red light and shall be accompanied by an audible warning.
6. A swing limit reached shall be indicated on the HMI, or with a red light on the console
7. A red light shall indicate when the aircraft closure is in the down position (aircraft closure must be retracted before the bridge can be moved).
8. For electro-mechanical vertical drive systems, a red light shall indicate a lift column malfunction has occurred.
9. A light shall indicate if the cab floor de-icer is on or off. (if applicable)
10. If a pushbutton type switch is used, a light shall indicate if the adjustable cab floor is in the automatic or manual mode.

The bridge rotunda shall have a visual fault indicator/audible alarm to notify the gate agent on any bridge console alarm fault.

**D. Interlocks**

For 400hz, cable hoist, and PC Air units installed to serve the passenger loading bridge, the units shall be interlocked with the bridge control circuit so that the bridge cannot be moved away from the aircraft while these units are in operation and the cable hoist is not in the full UP position. Alarms shall be activated in the area of the loading bridge operator console, in the event that the bridge motion controls are activated if either of the above mentioned conditions exist. The Contractor shall assure the compatibility of all bridge controls to be monitored via the Houston Airport System's Building Management System (BMS). The Contractor shall ensure that the PLB manufacturer coordinate s with the PCA and 400hz power equipment to monitor all vital functions of operations for each piece of equipment and integrate into the BMS. Recommended monitoring points will be submitted for review and consideration – Note the airport reserves the right to change and or modify each point for monitoring.

**1.15 AIRCRAFT CANOPY**

- A. The outermost end of the cab is to be equipped with an accordion type bellows closure. Both sides of the closure shall be independently adjustable to provide a weather-tight seal against the most critical aircraft contours. When fitted against the aircraft fuselage, the closure shall enclose both the open aircraft door and doorway. A means shall be provided to prevent excessive pressure on the skin of the aircraft. The aircraft contact point of the closure shall be a soft material to prevent scratching or damage of any kind. The closure is to be non-abrasive, highly tear resistant, weather resistant, remain elastic and flexible in extreme cold down to -31° F. and hot climates up to 127° F., have replaceable front pads, and meets the requirements of NFPA-415, latest edition. Closure must be capable of mating with all aircraft (A300 compatible). The aircraft removable pads must be tethered/secured in to the cab so when they are removed for narrow bodied aircraft they remain in the vicinity of the bridge.

**1.16 AUTO LEVELER**

- A. The loading bridge shall be equipped with a wheel type automatic leveling system which will allow the floor of the cab to automatically follow small changes in the aircraft floor sill elevation as the aircraft loading varies. It shall function with equal reliability for all aircraft, regardless of door location or fuselage contour.

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AIRCRAFT PASSENGER LOADING BRIDGES (Cont'd)**

- B. The wheel type leveling sensor shall be located on the right side of the cab area within full view of the operator. The rotary sensor shall be deployed when the "Auto" position is selected on the Master Key switch. "DANGER DO NOT TOUCH" shall be printed in red letters on the wheel hub.
- C. The system shall be designed to stop vertical travel and sound an alarm in the event the system does not neutralize within either a pre-set adjustable distance (1 inch to 6 inches) or of a certain time limit (6 seconds maximum).

**1.17 SERVICE DOOR, LANDING, STAIR, and BAGGAGE CHUTE**

- A. A ramp service door, landing, and service stair shall be provided at the aircraft end of the bridge for apron access by authorized personnel. These shall be positioned on the right-hand side of the cab bubble unless otherwise indicated.
  - 1. The service door shall be a minimum 2 feet, 8 inches wide by 6 feet, 8 inches high, half wire-glass hollow core, steel door, with a 45 minute fire rating. The door shall open outward on the landing and be equipped with a heavy duty door closure. The door shall include a 30 inch stainless steel kick plate to cover the lower inside portion of the door along with weather stripping on the jambs and header and a vertically adjustable bottom weather strip. The door shall be equipped with a heavy duty keyless lockset. Lockset to Kaba Ilco Corp., EE100 Series, Model No. EE21B/21B-26D-41 (no substitution will be allowed). Lockset finish to be satin chrome.
  - 2. The service stairs shall have equally spaced, self-adjusting risers with open mesh non-skid type treads. All steps have equal rise with a minimum tread width of 28 inches, and depth of 9-1/2 inches. The bottom of the service stair shall be supported by casters with rubber tired cast iron wheels to roll on the apron. Both sides of the stairs shall be equipped with tubular steel handrails of proper height to meet OSHA . Stair Landing shall include an up to date airline late bag slide/drop – PLB manufacturer may choose and submit for owner approval.
  - 3. The service landing shall be made of an open mesh, non-skid grating and be completely surrounded by tubular steel handrails of the proper height to meet applicable codes. The landing shall be level with the cab floor and be illuminated by a 100 watt light actuated from within the bridge. A photocell shall also be provided under the cab to automatically turn off the light during daytime operation
  - 4. A maintenance access ladder (with safety cage) shall be provided. A roof safety railing/guardrail system shall be provided on the outermost tunnel where electro-mechanical vertical drive columns are present.
  - 5. Supply and install on exterior ramp stairs a fiberglass baggage chute with a protective end stop to prevent damage of baggage.

**1.18 ELECTRICAL SYSTEM AND COMPONENTS**

- A. The existing three (3) phase 480/277 Volt, 225 Amp service shall be used for operation of the PLB along with a 120 Ton PC Air handling unit. The new 180 KVA 400 Hz/28vt DC Combo gate box unit shall be powered by the 400 Hz central plant. The 225A service panel is mounted on the bridge rotunda support column. There shall be individual fuses or breakers for the PLB

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and PC Air equipment, and any other bridge-mounted auxiliary equipment. All distribution systems to provide power across the bridge for all accessory equipment not limited to PCA and 400hz is the responsibility of the Contractor.

- B. All standard lighting, duplex receptacles, operator controls, and fractional HP motors shall operate on 120 volt, single phase, 60 Hz power.
- C. All electrical components, which are exposed to the weather, shall be of a weatherproof type or housed in weather-tight NEMA 3 enclosures, except for main power disconnect, which shall be a NEMA 4 enclosure. Where indicated by the environment, electrical control enclosures shall be equipped with heaters to control condensation.
- D. All electrical equipment and methods of installation shall conform to the requirements and recommendations of the American Insurance Association (AIA), the National Electrical Manufacturers Association (NEMA), and the National Electrical Code (NEC).
- E. All electrical components utilized shall be recognized by Underwriters Laboratories (UL) or an approved equal testing laboratory in all cases where UL maintains a listing category for the devices installed.
- F. Wiring and installation shall be in accordance with National Electric Code and applicable local electrical codes.
  - 1. Both ends of all conductors shall be color coded or identified. Particular attention shall be given to separating circuits of different voltages, emergency lighting, and telephone lines.
  - 2. Three (3) unswitched, 120 volt, 1 phase, 60 Hz, 15 Amp three-conductor duplex receptacles shall be provided; one located near the operator's console, one in the Rotunda, and one weatherproof outlet at the wheel undercarriage near one of the lift columns.
  - 3. The bridge shall contain provisions for customer installed communications equipment. The provisions shall include a flush mounted "J" box containing 12 pair communication cable near the operator's position for installation of a wall mounted telephone. The cable must have sufficient length at the rotunda end of the bridge to allow connection to the terminal building communications J-box located on the building face near the passenger loading door.
- G. The bridge shall be designed with safety as the first priority; the following control features, interlocks, warning devices and communication systems shall be included in the bridge:
  - 1. With the Operator Key Switch in the "Off" position, all controls shall be inoperative.
  - 2. Spring-loaded wheel brake(s) shall be automatically set whenever controls for horizontal travel are not actuated by the operator. The drive system shall have provisions to manually release the brakes to permit towing of the unit in the event of a power failure.
  - 3. The vertical lift column safety stops are to be automatically engaged whenever controls for vertical travel are not actuated by the operator.
  - 4. With the Operator Key Switch in the "Auto-Level" position, all manual motion controls shall be inoperative. In this mode, vertical travel shall be regulated by the automatic leveling system.

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5. With the Operator Key Switch in the "Operate" position, the Auto-Leveler shall be retracted and become inoperative.
  6. The control circuits shall be designed and wired so that it is impossible to select opposite motions simultaneously, e.g., extend and retract or raise and lower travel.
  7. Two limit switches, one for slow and one for stop, shall slow to half speed and then halt forward or reverse travel of the bridge when the tunnel extension or retraction limits have been reached.
  8. Limit switches shall prevent movement of the bridge beyond specified Rotunda operating parameters.
  9. A minimum 6 inch diameter, 94 decibel alarm bell located on the crossmember shall sound continuously whenever the bridge is in drive mode of operation.
  10. An amber colored rotating or flashing beacon located under the aircraft cab shall illuminate when the key switch is in the "Operate" position.
  11. Adjustable slope limit switches shall prevent movement of the bridge beyond acceptable operating slopes.
  11. Vertical travel limits switches shall be provided to prevent travel of the vertical lift columns into the mechanical stops.
  12. Cab rotation limit switches shall prevent over rotation (left or right) of the cab into mechanical stops.
  13. Two amber flashing beacons shall be located on the ends of the crossmember. They shall be active and flashing whenever the bridge is in drive mode.
  14. Provide a telephone and mounting plate on the left side cab wall adjacent to the cab operator's control console. Telephone communication wiring shall be installed on the bridge routed from the cab mounted telephone to the underside of the rotunda to a communication junction box for tie-in to the building telephone communication system. Provide six pair (twelve conductor) wire and outlets for the telephone equipment.
- H. The operator shall be able to pre-position the bridge to the approximate height of the aircraft serviced by reading the vertical height indicator while raising or lowering the bridge in the manual mode.
- I. The following interior and exterior lights shall be provided:
1. Interior lighting shall include the lighting in the cab/bubble area. The level of illumination shall be adequate with the weather door closed.
  2. Tunnel lighting shall be provided by recessed fluorescent panel fixtures with diffusers. The fixtures shall be 4 feet long and shall be positioned perpendicular to the tunnel centerline on a maximum of 8 foot centers. The lights shall be controlled by two 3-way switches. One shall be located in the control cab and one in the rotunda corridor adjacent to the terminal door.
  3. Two exterior floodlights shall be provided under the tunnel to illuminate the apron area ahead of the bridge. An additional floodlight shall be provided to illuminate the area around the drive column.
  4. A sealed exterior type one-tube fluorescent fixture shall illuminate the cab area forward of the overhead roll-up door.
  5. A weatherproof exterior light fixture with a fluorescent lamp shall be installed over the service door to illuminate the service stairs and landing. It shall be controlled by a switch located on the inside wall of the tunnel adjacent to the door.

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6. Provide emergency lighting with 90 minutes battery back up complete with self contained charger and automatic on-off control. Emergency lighting may be incorporated into the normal lighting fixtures.
7. Install a motion detector in the cab to control the cab lighting for energy savings purposes.
8. Provide a triangular illuminated gate sign on the top of the cab of the bridge identifying the appropriate gate number. The sign configuration and type, font size and color shall be as specified by Houston Airport System (HAS).

**1.19 FINISHES AND MATERIALS**

**A. INTERIOR**

1. All interior surfaces of the structure shall be cleaned in accordance with SSPC-SP3 or sand/grit-blasted in accordance with SSPC-SP6, as appropriate, and shall be coated with primer applied to a minimum 3 mil total dry thickness over the average measured blast profile. Exposed interior surfaces shall be coated with an additional 3 mils of finish coat.
2. Interior wall treatment shall consist of floor to ceiling 4 foot wide laminated phenolic plastic panels, with aluminum trim and recessed black accent strips. Color to be selected by Architect. Paint all exposed interior metal surfaces to match interior wall panel
3. Ceiling shall be an 8 inch wide aluminum plank-type ceiling painted (color to be supplied by owner) with a 1/2 inch insulation blanket on top with an exposed, black backing, or pre-painted galvanealed sheet metal panels.
4. The fixed walkways, rotunda, and tunnel floors shall be manufactured with galvanized steel able to sustain the load specifications with carpet. Carpet to be supplied and installed by bridge manufacturer. Carpet color & style selected by Architect from the bridge manufacturer's available options.
5. The cab floor shall be galvanized steel and one-quarter inch ribbed, fire-resistant, black rubber installed on the floor from the aircraft end of the bridge to the terminal side of the service door and on the tunnel transition ramps.

**B. EXTERIOR**

1. All exterior surfaces, including support columns and base plates, shall be sand/grit blasted in accordance with specification SSPC-SP6 to a 1-1/2 mil minimum to 3 mil maximum profile.
  - a. The exterior shall be coated with primer applied to a minimum of 2 mil total dry thickness over the average measured blast profile followed by a finish coat of 5-1/2 mils thickness. Paint bridge using a radiant barrier, low e application. Color to be supplied by owner.
  - b. Anodized aluminum, galvanized or stainless steel trim items, roll-up doors, and cab curtains shall be supplied in their original unpainted bright finish. Machined surfaces shall not be painted unless they are exposed after assembly.

**1.20 AUXILIARY SYSTEMS COORDINATION AND PROVISIONS**

**A. 400 Hertz System:**

1. The Contractor shall provide all necessary mounting provisions (i.e. drilled holes and any necessary reinforcement) for the 400 Hz gate box unit, 28volt gate box and cable hoists.

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2. The Contractor shall coordinate mounting provisions for the 400 Hz power equipment and insure the required mounting provisions are factory installed and finished prior to delivery of the PLB.
3. The 400hz gate box unit size will be rated at 180kva and /28VDC Unit.
4. The Contractor shall provide structural mechanism and all electrical cables to support and operate 400hz/28volt DC units on this side of the loading bridge, C Tunnel

**B. Preconditioned Air System (PCA)**

1. The Contractor shall provide all required mounting provisions (i.e. drilled holes and any necessary reinforcement) for the PCA air handling unit, air duct, hose basket, bridge pre-conditioning grilles and duct, thermostats, and switches and provide a 3000 cfm rooftop mounted exhaust fan mounted on the roof of the rotunda. The PC Air unit shall be bridge-mounted on a support frame hung from the underside of Tunnel "A", outboard of the rotunda column.
2. Control wires from a terminal box under the cab near the lift column to a terminal box on the face of the rotunda rigid frame shall be factory installed. Control wires shall include two (2), twisted shielded pairs, #18 AWG and 20 #18 insulated conductors suitable for 24V AC or DC, all rated and routed as Class II control wiring.
3. The cabin temperature sensor wall plate in the bridge cab shall be factory installed.
4. Mounting provisions for all PCA equipment shall factory installed and finished prior to delivery of the PLB.
5. The PC Air unit size will be rated at 580 lb/m at 35 deg. F. at the aircraft inlet air nozzle.
6. The Contractor shall provide structural mechanism and all electrical cables to support and operate PCA units under the bridge adjacent to the rotunda column.

**C. Potable Water Cabinets**

1. A potable water cabinet shall be installed for each passenger loading bridge . The mounting configuration shall be welded on a structural member welded to the stair landing.
2. Cabinet Material: Stainless steel, type 304, 16 gauge, #4 brush polish interior and exterior welded double wall construction throughout, including bottom and stainless steel double doors with 1" polystyrene insulation on all sides of the cabinet. Provide doors with two-point recessed locking handle, and full length stainless steel piano hinge with top mounted door stops.
3. Bottom to be provided with a 1-1/2" NPS fitting for drain at the center of the cabinet.
4. All components mounted within the cabinet shall be UL recognized, weatherproof in accordance with the National Board of Fire Underwriters, suitable for service at 120 volts. All parts to be grounded.
5. Light: 100 watt, weatherproof-vapor proof, with guard and on-off switch.
6. Heaters: Four (4) 750 watt, single-phase heat pads with temperature limit switch, located behind removable side panels. Provide two (2) thermostats set at 50 F with positive on-off switch.
7. All wiring enclosed in flexible Sealtite conduit or rigid galvanized conduit. Provide three (3) 115 Volt, 1-Phase circuits for each cabinet. Heaters to be on two (2) 20 AMP circuits, and the motor, light, on one (1) 20 AMP circuit.

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AIRCRAFT PASSENGER LOADING BRIDGES (Cont'd)**

8. Hose Reel: Hannay Model EPBA6028-25-26 RT, 1" bronze swing joint, bronze internal piping, automotive quality coated drum, disks, and frame with silver finish. Reel includes 1.2 HP 115 volt, explosion-proof motor, electric rewind motor with HP rated push button control. Chain sprocket to be chrome plated. Auxiliary hand rewind crank to be provided. Adjustable reel drag brake. Reel mounted to back wall of cabinet.
9. Manufacturer: Phoenix Industries or INET

**1.21 ACCEPTABLE MANUFACTURERS**

Passenger Loading Bridge manufacturers shall submit a list of 5 similar projects performed in the last five (5) to ten (10) years, complete with an airport or airline contact person and up to date contact information. Acceptable manufacturers for this project are:

- A. JBT AeroTech
- B. Thyssen-Krupp

**1.22 MANUALS AND TRAINING**

Included in the manuals shall be preventative maintenance requirements, problem solving procedures, repair procedures and illustrated parts drawings.

- A. Technical manuals, prepared in accordance with Air Transport Association Specification 101, shall be provided with each passenger loading bridge. The number of manuals required to be delivered to the Owner's Representative is ten (10) manuals and ten (10) CD's.
- B. A minimum of 40 hours of operator training and 40 hours of maintenance training shall be provided on site at a time convenient to the Owner's designated representatives, but no later than two weeks prior to the operational date of the first bridge.
- C. In addition to the training listed above, provide factory training for six (6) OWNER technicians covering how to diagnose, maintain and program the passenger loading bridges. The training should be the same as that provided to distributors or factory technicians and should be conducted by factory certified individuals. Training shall be provided at a time that is mutually convenient to the OWNER and the PLB Manufacturer but it shall be provided prior to delivery of the first bridge. The individuals attending this training will receive certificate of completion. Air/travel, hotel and per diem expenses shall be included in the contract price.

**1.23 WARRANTY**

- A. All parts and materials shall be warranted against defects in material and workmanship for a period of one (1) year from the date of acceptance of each PLB by the owner's designated representatives.
- B. Contractor shall warrant in writing, that the equipment and all components and accessories furnished in connection therewith, shall comply fully with contract documents; be free of any defect in design, material, or workmanship; be new and of good quality; and free and clear from any liens, encumbrances, and title defects.

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- C. The Contractor shall also provide an pricing information on an optional additional 1 year warranty period beyond the warranty period required in 1.23.A. All parts and materials shall be warranted against defects in material and workmanship for an additional 1 year period from the date of expiration of the warranty required by 13041-1.23.a

**1.24 SUBMITTALS**

- A. The Contractor shall submit six (6) copies each of Shop Drawings, technical specifications, and descriptive product data to the City Engineer for review and approval. The exterior and interior designs shall be aesthetically pleasing and in harmony with contemporary PLB design trends. Where necessary to meet these requirements, and in conflict with maintainability standards.
1. An index prepared in chronological order listing drawings, sketches, details, and material submitted shall be provided.
- B. Drawings, sketches, details, and materials shall be submitted in the English language, with United States Units, including dimensions, volumes, weights and forces. The use of the metric or SI units is not acceptable.
- C. No manufacturing of the PLB components shall begin until the Shop Drawings for such components have been reviewed and approved by the owner's representative.
- D. Critical design items related to the human factors including operation and maintenance shall be addressed with Shop Drawing and shall include, but not be limited to:
1. General:
    - a. General Arrangement drawings to include dimensions
    - b. General Erections drawings to include dimensions
  2. Interior Finishes:
    - a. Interior scheme of each type
    - b. Transition details
    - c. Wall finish attachment
    - d. Light fixture details and layout
    - e. Joint details
    - f. Interior Finishes
    - g. Carpet edging details, including, lines of demarcation between carpeted and hard surfaced floor at wall areas and treatment at doors and thresholds
  3. Exterior Configurations:
    - a. General bridge layout
    - b. Exterior sketch of each type
    - c. Graphics
    - d. Paint finishes
    - e. Handrails
    - f. Flashing (terminal to PLB)
    - g. Flashing (terminal to fixed walkway if required)
    - h. Flashing (fixed walkway to PLB if required)
    - i. Flashing (bridge segments)
    - j. Cab door seal
    - k. Ramp Service Stairway

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4. Cab:
  - a. Operator's cone of visibility
  - b. Control panel location and functional layout
  - c. View panels
  - d. Interface with aircraft
  - e. Designs necessary for appropriate mating with required aircraft types (including auto-leveling devices)
  - f. Operator protection while bridge is in motion with weather door open
  - g. Operator instruction placard.
  
5. Safety Markings:
  - a. All safety decals

**1.25 PRODUCT SUPPORT**

**A. Spare Parts**

1. The Contractor shall ensure the manufacturer maintains an adequate inventory of all proprietary or vendor fabricated or modified parts, especially the long lead time items considered as insurance, for routine maintenance of the unit. All stock shall be maintained, whether or not the unit is in current production, for a minimum of ten (10) years from the date of the last unit manufactured.
2. The Contractor shall ensure the manufacturer provides recommended spare parts list for items, which should be maintained on site. This list and their associated costs are to be provided with bid proposal.

**B. Field Support Services**

1. The Contractor shall ensure the manufacturer provides qualified supervisory and service personnel during the installation of the loading bridge to assure proper installation.
2. The Contractor shall ensure the manufacturer provides the owner's representative with all appropriate Service Bulletins.
3. The Contractor shall ensure the manufacturer provides a maintenance jack stand (A Frames) and (1) tow bar.

**PART 2 – MEASUREMENT AND PAYMENT**

**2.01 MEASUREMENT**

- A. Aircraft passenger loading bridges shall be measured per each kind of aircraft passenger loading bridge of the operating range designated.

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AIRCRAFT PASSENGER LOADING BRIDGES (Cont'd)**

**2.02 PAYMENT**

A. The accepted quantities of aircraft passenger loading bridges will be paid at the lump sum price per each for each kind of aircraft passenger loading bridge of the operating range designated. These prices shall fully compensate the Contractor for removal and disposal of the existing PLB and furnishing and installation of the complete new assembly of the aircraft passenger loading bridge including, but not limited to the rotunda, telescoping tunnels, drive column, aircraft cab with operator's station, controls and indicator, aircraft canopy, auto leveler, service door, landing, stair and baggage chute, electrical system and components, preconditioned air system, 400Hz/28VDC gate equipment, finishes and materials, auxiliary systems coordination and provisions, manuals and training submittals, product support, warranty, spare parts, and delivery; and for all labor, equipment, tools, and incidentals necessary to complete the item.

C. Payment will be made under:

Item 13041-1	Aircraft Passenger Loading Bridge No. 1, Operating Range $\pm$ 60-ft to 126-ft, complete in place – per lump sum
Item 13041-2	Aircraft Passenger Loading Bridge No. 2, Operating Range $\pm$ 60-ft to 126-ft, complete in place – per lump sum
Item 13041-3	Aircraft Passenger Loading Bridge No. 3, Operating Range $\pm$ 60-ft to 126-ft, complete in place – per lump sum
Item 13041-4	Aircraft Passenger Loading Bridge No. 4, Operating Range $\pm$ 60-ft to 126-ft, complete in place – per lump sum
Item 13041-5	Aircraft Passenger Loading Bridge No. 5, Operating Range $\pm$ 60-ft to 126-ft, complete in place – per lump sum
Item 13041-6	Aircraft Passenger Loading Bridge for No. 6, Operating Range $\pm$ 60-ft to 126-ft, complete in place – per lump sum
Item 13041-7	Aircraft Passenger Loading Bridge no. 7, Operating Range $\pm$ 60-ft to 126-ft, complete in place – per lump sum

**NOTES for Bidders:**

Contractor must field verify all conditions including but not limited to existing foundation, electrical services, sill heights and aircraft parking dimensions prior to bid. The Contractor shall be responsible for all installation components to be without change of conditions in order for a safe and operational bridge install. The owner will not accept any changes due to miscalculations and or field conditions if not verified and approved prior to bid by both parties.

Pricing must be based on all three components – PLB, PCA and 400hz criteria and must meet with no deviations to the intent of specifications.

**SECTION 13041 - APRON DRIVE  
AIRCRAFT PASSENGER LOADING BRIDGES (Cont'd)**

Field site conditions must be in conjunction with all local airport rules and regulations. PLB installation must be coordinated with HAS Operations and may not interfere with adjacent gate operations. HAS has submitted FAA Form 7460 for approval of the installed PLB's. The Contractor is required to submit FAA Form 7460 on the use of crane equipment. Work shall not commence without approval.

All work must be completed in a timely manner. The Contractor will have access to the construction site 24 hours a day. The construction site must be regulated for safety and FOD monitoring; all welding must comply with local regulations via the fire marshal. The Contractor must provide on site supervision throughout the installation and must report on a daily basis to the designated Airport project personnel during the install process.

Delivery of PLB must be coordinated with HAS Airport Operations personnel and all field conditions must be researched and confirmed prior to bid and installation of the equipment to assure timely completion of the work and resumption of normal airport operations. An unsecured storage area on Airport property will be provided for delivery and staging of PLB components. Security of the equipment while in the storage area will be the responsibility of the Contractor.

Passenger Loading Bridges will be installed along with all accessory equipment to be considered a complete installation gate by gate, all punch list items will be noted accordingly and a schedule for completion will be issued upon commissioning of each PLB and accessories.

## **SECTION 13355 - RAMP SERVICES MOTORS**

### **PART 1 - GENERAL**

#### **1.01 DESCRIPTION**

A. This Section includes basic requirements for factory installed and field installed motors.

B. Related Work Specified Elsewhere.

- (1) Application of motors and reference to specific motor requirements for motor driven equipment.  
DIVISION 15

#### **1.02 SUBMITTALS**

A. General. Submit the following in accordance with SECTION 01340 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

- (1) Product Data. Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding terminal lugs, conduit entry, and grounding lug; and coatings.
- (2) Factory Test Reports. For specified tests.
- (3) Field Test Reports. Indicate and interpret test results for compliance with performance requirements.

#### **1.03 QUALITY ASSURANCE**

A. Comply with NFPA 70.

B. Listing and Labeling. Provide motors specified in this Section that are listed and labeled.

- (1) Terms "Listed and Labeled." As defined in the National Electrical Code, Article 100.

### **PART 2 - PRODUCTS**

#### **2.01 MANUFACTURERS**

A. Basic requirements apply to mechanical equipment motors, unless otherwise indicated.

B. Motors ½ Horse Power (HP) and Larger. Polyphase.

C. Motors Smaller than ½ HP. Single phase.

D. Frequency Rating. 60 Hertz (Hz).

E. Voltage Rating. Determined by voltage of circuit to which motor is connected.

F. Service Factor. According to NEMA MG 1, unless otherwise indicated.

G. Capacity and Torque Characteristics. Rated for continuous duty and sufficient to start, accelerate, and operate connected loads at designated speeds, in indicated environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

H. Enclosure. Open drip-proof, unless otherwise indicated.

## SECTION 13355 - RAMP SERVICES MOTORS (Cont'd)

### 2.02 POLYPHASE MOTORS

A. Description. NEMA MG 1, medium indicator motor.

- (1) Design Characteristics. NEMA MG 1, Design B, unless otherwise indicated.
- (2) Energy Sufficient Design. Where indicated.
- (3) Stator. Copper windings, unless otherwise indicated. Multispeed motors have separate winding for each speed.
- (4) Rotor. Squirrel cage, unless otherwise indicated.
- (5) Bearings. Double shielded, pre-lubricated ball bearings suitable for radial and thrust loading.
- (6) Temperature Rise. Match insulation rating, unless otherwise indicated.
- (7) Insulation. Class F, unless otherwise indicated.

B. Motors Used with Reduced Inrush Controllers. Match wiring connection requirements for indicated controller, with required motor leads brought to motor terminal box to suit control method.

C. Motors Used with Variable Frequency Controllers. Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

- (1) Critical vibration frequencies are not within operating range of controller output.
- (2) Temperature Rise. Match rating for Class B insulation.
- (3) Insulation. Class H.
- (4) Thermal Protection. Where indicated, conform to NEMA MG 1 requirements for thermally protected motors.

D. Rugged Duty Motors. Where indicated, motors are totally enclosed with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings are insulated with non-hygroscopic material. External finish is chemical resistant paint over corrosion resistant primer.

E. Source Quality Control. Perform the following routine tests according to NEMA MG 1.

- (1) Measurement of winding resistance.
- (2) No load readings of current and speed at rated voltage and frequency.
- (3) Locked rotor current at rated frequency.
- (4) High potential test.
- (5) Alignment.

## SECTION 13355 - RAMP SERVICES MOTORS (Cont'd)

### 2.03 SINGLE PHASE MOTORS

- A. Type. As indicated or selected by manufacturer from one (1) of the following, to suit starting torque and other requirements or specific motor application.
- (1) Permanent split capacitor.
  - (2) Split phase start, capacitor run.
  - (3) Capacitor start, capacitor run.
- B. Shaded Pole Motors. Do not use, unless motors are smaller than 1/20 HP.
- C. Thermal Protection. Where indicated or required, internal protection automatically opens power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature returns to normal range, unless otherwise indicated.
- D. Bearings. Ball bearing type for belt connected motors and other motors with high radial forces on motor shaft. Sealed, pre-lubricated sleeve bearings for other single phase motors.

## PART 3 – EXECUTION

### 3.01 ADJUSTING

- A. Use adjustable motor mounting bases for belt driven motors.
- B. Align pulleys and install belts.
- C. Tension according to manufacturer's written instructions.

## PART 4 – REFERENCES

### 4.01 APPLICABLE STANDARDS.

- A. National Electrical Manufacturers Association (NEMA).
  - (1) MG1 – Motors and Generators.
- B. National Fire Protection Association (NFPA).
  - (1) 70 – National Electrical Code.

## SECTION 13371 - PCA AIR HANDLING EQUIPMENT

### PART 1 – GENERAL

#### 1.01 GENERAL DESCRIPTION

- A. This section of the specifications covers the following types of air handling units:
1. Preconditioned Air High Pressure Air Handling Units capable of cooling aircraft up to and including Airbus A380.
- B. It is the intent of the contract documents that the same equipment manufacturer, shall be used for both the bridge air handling equipment, the controls and instrumentation (PC-Air) and the 400hz ground power equipment and controls and instrumentation (GPU). Acceptable manufacturers of PCA air handling units include the following or Owner approved equal of follows:
- 1) Trilectron Industries
  - 2) INET Airport Systems
  - 3) JBT Aero Tech

#### 1.03 REFERENCES

- A. Applicable Standards:
1. Anti-Friction Bearing Manufacturers Association (AFBMA).
  2. Air-Conditioning and Refrigeration Institute (ARI):
    - a. Standard 410 - Standard for Forced-Circulation Air-Cooling and Air Heating Coils.
    - b. Standard 850 - Commercial and Industrial Filter Equipment.
  3. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
    - a. ASHRAE 52 - Method of Testing Air-Cleaning Device Used in General Ventilation for Removing Particulate Matter.
  4. National Fire Protection Association (NFPA):
    - a. ASHRAE 70 - National Electrical Code.
  5. National Electrical Manufacturer's Association (NEMA).
  6. Occupational Safety and Health Act (OSHA).
  7. Underwriters Laboratories (UL).
  8. Local Building Code.

#### 1.04 SUBMITTALS

- A. General:
1. The Contractor shall submit product data for selected models, including specialties, accessories, and the following:
    - a. AHU performance curves with system operating conditions indicated.
    - b. Motor ratings and electrical characteristics plus motor and fan accessories.
    - c. Materials, gages and finishes.
    - d. FVD, including housings, linkages, and operators.
    - e. Submit air filter manufacturer's technical product data including dimensions, weights, required clearances and access, flow capacity including initial and final pressure drop at rated air flow, efficiency and test method, fire classification, and installation instructions.
    - f. Unit air flow control, capacity control and defrost control.
    - g. Flexible hoses.

## **SECTION 13371 - PCA AIR HANDLING EQUIPMENT (Cont'd)**

- h. Hose storage basket
  - i. Telescoping Bridge air ducts.
  - j. Loading bridge interface with bridge air handlers: Installation details, field measurements, support details, etc.
- 2. Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.
  - 3. Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer-installed wiring and field installed wiring.
  - 4. Maintenance data for air-handling units and filters, for inclusion in Operating and Maintenance Manual.

### **1.05 QUALITY ASSURANCE**

- A. ARI Compliance: Air filter equipment shall comply with ARI 850.
- B. ASHRAE Compliance: Air filters shall comply with ASHRAE Standard 52 for method of testing, and for recording and calculating air flow rates.
- C. NFPA Compliance: Comply with applicable portions of NFPA 70, for components and installation of air handling units.
- D. NEMA Compliance: Motors, enclosures and electrical accessories shall comply with NEMA standards.
- E. UL Compliance: Air Handler Units shall be UL-listed and labeled.
- F. Comply with the all applicable Local Building Codes.
- G. Previous Experience Qualifications
  - 1. Equipment supplier of both types of systems (Bridge air handling equipment and controls and instrumentation (PC-Air)) shall have past experience in the furnishing, design, installing, programming, testing, system start-up and training.
  - 2. Supplier of Air Handler Unit and Controls shall have a minimum of five (5) prior similar installations of a minimum of 20 gates servicing jumbo aircraft within the previous 3 years at other airports utilizing subfreezing temperature (20°F) EG/W mixture of a size and complexity similar to the proposed project. The supplier shall also have been responsible for all phases of the project, including supplying equipment, installing, testing and responsibility for ultimate finished systems performance to the Owner.
  - 3. The supplier shall supply and integrate the total control systems of the PC-Air equipment with system chillers, boilers, pumps and computer programs.

### **1.06 DELIVERY, STORAGE AND HANDLING**

- A. Lift and support units with the manufacturer's designated lifting or supporting points.

## SECTION 13371 - PCA AIR HANDLING EQUIPMENT (Cont'd)

- B. Provide units which do not require any disassembly and reassembly for movement into the final location following manufacturer's written instructions.
- C. Deliver units as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.
- D. Store all equipment and material in suitable facilities until delivery and acceptance by the Owner.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. The Contractor shall ensure that all manufacturers comply with the requirements of these specifications. Due to the complexity of PCA system no deviations will be acceptable and the specifications must be adhered to from the submittal process, to factory testing and field commissioning.

#### 2.02 GENERAL DESCRIPTION

- A. Provide a compact, light-weight, and low-noise insulated, glycol air handling unit that can be mounted on the passenger loading bridge, such that the operational characteristics are as follows:

Unit Model No.:	PAC-40
Supply Air Flow:	580 lbs/min
Outlet Pressure at Max Air Flow:	40 in. water
Outlet Air Temp. at Max Air Flow:	25 deg. F.
Blower Speed:	3450 rpm
HP Rating:	100 HP
Blower Type:	Centrifugal
Max. EG/W Flow Rate:	90 gpm
Max. EG/W Pressure Drop:	65 psi
Electrical Characteristics:	480V/3-phase/60 Hz
Input Current at Max. Air:	115 Amps
Unit Dimensions:	140"x94"x44"
Operating Weight:	3300 lbs.

The bridge operational characteristics shall be unrestricted and the bridge's structural integrity shall be uncompromised by the PC-Air unit assembly. Acceptable location for mounting underneath the bridge is at the bridge rotunda. Refer to drawings for specific mounting locations.

- B. The air handling unit at each gate shall have a minimum of two distinct assemblies:
  - 1. A control assembly which contains the low voltage (Class II) logic and control circuits.
  - 2. A blower/coil unit containing a blower, VFD drive, cooling coil, heating coil, complete motor starting equipment, outlet plenum and condensate drain pan to provide the required cooled, ventilated or heated air to maintain the aircraft cabin temperature specified.

## SECTION 13371 - PCA AIR HANDLING EQUIPMENT (Cont'd)

- C. The air handling unit(s) shall have the capacity required to sufficiently cool the largest designed aircraft parked at each gate, as designed on the drawings.
- D. The blower shall be centrifugal type and sized for the appropriate constant volume airflow requirements. The unit size shall be selected so that the fan brake horsepower does not exceed the maximum required over the design operating range of the unit at the total static pressure.
- E. Unit external static pressure shall be defined as the gauge pressure measured at the outlet of the air handling unit. The Contractor shall present the gauge pressure his air handling unit can produce at the outlet of the air handling unit and at the aircraft connection through 65 feet of hose and with an aircraft adapter nozzle in his submittal.
- F. Horsepower shall be selected based on the Contractor's choice of equipment which affects the external resistance of the system. The minimum horsepower requirements for the air handling unit shall be as indicated in paragraph 2.02.A. Contractor shall furnish the fan motor and unit size adequate for final total static pressure and maximum brake horsepower requirements.
- G. Passenger Bridge cooling shall be furnished as follows:
  - 1. Each gate PCA system shall contain additional air ducts and a bridge/walkway access as required at the end of the bridge to supply preconditioned air from the specified air duct to the bridge tunnel. The bridge air shall operate to utilize the circulated air feature to allow manual selection of a pre-cool/heat mode in which the air handler operates to deliver air to the cab end of the bridge prior to aircraft arrival. This will serve to precondition the bridge from possible soaked conditions to enhance de-planning passenger comfort. It is the responsibility of the PCA supplier to coordinate with the PLB manufacturer for a complete system for proper cooling of the bridge and walkway if applicable.
  - 2. The bridge preconditioning shall be activated by an ON push-button located just inside the terminal/bridge door, which shall energize the bridge AHU in the predetermined operating mode. The air will circulate through the bridge to the bridge exhaust fan (provided by the loading bridge manufacturer complete with starter) and continue until one of the following occurs:
    - A. The OFF button is depressed at the terminal/bridge door.
    - B. An automatic shut off by the controller elapses time.
- H. During bridge pre-conditioned air operations, the AHU controller shall automatically provide cooled air to walkway and or bridge.
- I. The construction of the unit shall be of a material sufficient to provide adequate structural rigidity of frame and enclosure; of a non-corrosive nature; and provided with thermal insulation for conditions encountered in normal usage. Equipment exterior shall be primed and painted to match bridge color. Equipment interior shall be manufacturer's standard.
- J. The maximum sound level for the air handling units at maximum cooling shall not exceed 91 DBA at a distance of 15 feet from the unit. Sound power level radiated by the unit outlet and at the unit inlet when the unit is operated at the designated capacity shall be furnished with the submittal.
- K. No dirty filter indications shall be required. However, Contractor shall include in the O & M manual provisions for schedules, routine filter cleaning or replacement.
- L. Capacity control and defrost control shall be identified and explained in the submittal.

## SECTION 13371 - PCA AIR HANDLING EQUIPMENT (Cont'd)

- M. Provide hinged access doors for each air handler unit to provide access to the internal components that require routine maintenance and repair. Locate as required for proper access to the following:
1. Blower
  2. Filters.
  3. Coils.
  4. VFD
- N. A condensate pump and drain pan shall be provided for each air handling unit. The condensate pump shall be lightweight, self-priming, and capable of running dry. Minimum pump rating shall be 3 gpm, 40-foot head, or as required by the specific bridge configuration. Position the drain pan under the coil section. Drain pan shall be stainless steel or aluminum.
- O. All air handling units shall be prepared with all necessary rails and mounting assemblies to be hung from the underside of the bridges.
- P. All air handling units shall be provided with smoke detectors located in such a manner to sense the presence of smoke in the inlet air plenum.

### 2.03 AHU CONTROL ASSEMBLY (GEC):

The AHU controller assembly or gate equipment controller (GEC) shall be designed for mounting directly onto the blower/coil unit or for mounting remote from the blower/coil unit.

- A. The controller shall contain the following field interface connection points.
1. Connections for remote on/off pushbutton, aircraft type selector switch, cabin temperature sensor, bridge air damper and 400 Hz service cabinet wiring from passenger loading bridge furnished control wiring across the bridge.
  2. Connections for remote monitoring and control system (See Specification Section 15900 for definition) The communication protocol shall be LON based.
  3. Connection for loading bridge exhaust fan. Start/stop control and operating status.
- B. A remote control station shall be provided for operator control of the AHU. The control station enclosure shall be rated NEMA 4X and shall contain the following operators:
1. Lighted ON push button.
  2. Off push button.
- C. The air handler controller shall utilize direct digital control (DDC) using microprocessor technology for all control, regulation, modulation, alarm shut-down, and response to/from remote signals.
- D. The controller shall automatically control the AHU outlet air temperature in response to the cabin temperature as sensed by the companion cabin temperature sensor. In addition to the sequences listed below, the PCA manufacturer shall submit a Sequence of Operation for the AHU Controller to the Engineer of Record (EOR) for approval. The EOR may require the PCA unit manufacturer to modify the Sequence of Operation at no additional cost to the project.

1. Narrow body aircraft:
  - a. Narrow body selected or unit off: inlet air damper at minimum air flow.

## SECTION 13371 - PCA AIR HANDLING EQUIPMENT (Cont'd)

2. Wide body aircraft:
    - a. Wide body selected or unit off: inlet air damper to modulate airflow in order to control and meet both airflow and GG/W Flow requirements.
  3. Jumbo aircraft:
    - a. Wide body selected or unit off: inlet air damper to modulate airflow in order to control and meet both airflow and GG/W Flow.
  4. A380 aircraft:
    - a. Wide body selected or unit off: inlet air damper at maximum airflow in order to control and meet both airflow and GG/W Flow.
- E. The controller shall automatically sense a failure of the cabin temperature sensor and automatically begin outlet air temperature control based upon sensed inlet ambient temperature. During this backup mode of automatic temperature control, the remote monitoring system shall be applied with a signal indicating the failure of the cabin temperature sensor.
- F. The controller or operator panel with Alpha numeric display shall, in addition to the above functions, provide for local data display and program updates with laptop computer connected directly to the controller. This local connection to the gate controller shall also provide for operator connection to the entire PCA system acting as a remote host computer. In addition, the controller shall provide full networking capabilities and built-in control and monitoring communication means with remote devices including, as a minimum, the following points:
1. Air handler ON and OFF status and SUMMARY ALARM.
  2. Designation of each alarm condition, by type. (blower overload, smoke detected, over-temperature).
  3. Air outlet and ambient temperatures.
  4. Position of gate EG/W modulating valve.
  5. Position of air inlet damper or alternately, motor speed as % of full rated speed if VFD is used.
  6. Totalized AHU running time.
  7. Readout of, and control of, both cabin temperature set points in heating and cooling modes.
  8. Readout of actual cabin temperature as measured by cabin temperature probe used by the controller logic.
  9. Readout of, and control of, mode changeover points and slope versus ambient temperature (backup temperature control in event of cabin temperature sensor failure).
  10. Nighttime cabin temperature set-up mode control including on/off control, set-up temperature set point, mode automatic start and stop times and remote override capabilities to adjust start and stop times.
- G. The AHU controller shall contain an internal real-time clock.
- H. The controller shall be capable of stand-alone automatic operation in the event of failure of the data/control network.

## SECTION 13371 - PCA AIR HANDLING EQUIPMENT (Cont'd)

- I. The controller assembly shall be housed in NEMA 12 gasketed enclosure and be suitable for direct mounting on the blower/coil unit or remote mounted.

### 2.04 CABIN TEMPERATURE CONTROL

- A. Each AHU Controller shall automatically maintain the set cabin temperature within  $\pm 20^{\circ}$  F. at the sensing point. This shall be by use of a small temperature probe connected to the system by way of a small cable and jack in the bridge cab.
- B. The PCA Cabin Temperature Sensor assembly shall consist of a cord mounted sensor element mounted in a Delrin plastic housing and mating wall receptacle design for mounting in the cab of a passenger loading bridge.
  1. The sensor element shall be rated for ambient temperatures of  $-40^{\circ}$  F, be an thermistor or solid state element type and be fully compatible with the specified AHU controller.
  2. The sensor shall be housed in the delrin plastic housing and provide full sealing of the sensor against all weather conditions. The upper end of the housing shall provide openings sufficient to provide necessary air flow across the sensor element while protecting the element from damage when in use or being stored. The sensor shall be connected to a neoprene retractable cable, 0.2" diameter, with three 2.3 AWC conductors. The cable length shall be approximately four feet retracted and twenty feet extended and be retained to the sensor housing by a screw-on type waterproof strain relief with O-ring seat. The receptacle mating end of the cable shall be terminated with a  $90^{\circ}$  angle, waterproof type plug with a screw cap for securing to the wall receptacle. The mating receptacle shall be mounted on a stainless steel cover plate. A bracket shall be provided in the bridge cap next to the cover plate for easy storage of the sensor assembly when not in use.

### 2.05 PCA AIR HANDLING UNITS – PERFORMANCE

- A. All air handling units shall be capable of a one-hour pull down for their respective heat soaked aircraft.

### 2.06 BLOWER/COIL UNIT COMPONENTS

- A. Casing: Manufacturer's standard casing construction, having corrosion protection coating, and exterior finish. Where the air handler unit is provided as a utilized enclosure construction, casings shall have removable panels or access doors for inspection and access to internal parts, a minimum of 1-inch-thick thermal insulation, knockouts for electrical and exterior condensate drain connection, and lifting lugs.
- B. Blower:
  1. General: Provide blower that is factory fabricated and assembled, factory tested, and factory finished, with required capacities and characteristics.
  2. Blower and Shafts: Statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower. Blower Shaft: Turned, ground, and polished steel designed to operate at no more than 70% of the first critical speed at the top of the speed range of the fan's class.
  3. Shaft Bearings: Provide bearings having a median life Rating Life (AFBMA L50) of 200,000 calculated in accordance with AFBMA 9 for ball bearings or AFBMA 11 for roller bearings.

## SECTION 13371 - PCA AIR HANDLING EQUIPMENT (Cont'd)

4. Factory Finish:
    - a. Exterior Sheet Metal Parts: Prime coating prior to final assembly. Final color to match bridge color, color chip to be provided to the manufacturer by the Owner.
    - b. Interior Surfaces: Manufacturer's standard finish is acceptable.
  5. Blower: Forward-curved, centrifugal, direct-drive fans; and permanently lubricated motor bearings where bearings are not more accessible for greasing
- C. Coils: Cooling/Heat
1. Aluminum plate fins and seamless copper tube type, minimum 5/8 inch O.D. Fins shall have collars drawn, belled and firmly bonded to the tubes by means of mechanical or hydraulic-expansion of the tubes. No soldering or tinning shall be used in the bonding process. Coils shall have a galvanized steel casing. Fin spacing shall be 12 fins/inch on the first stage and 8 fins/inch on the second stage. Coils shall be mounted on the coil casing with same end connections accessible for service. Coils shall be removable from the unit. Coil section shall be completely insulated.
  2. The number of tubes and fin spacing shall be submitted on coil selections made. Coils shall be constructed and tested in general accordance with ASHRAE 15 and ARI 410.
  3. Coils shall be proof 400 psig and leak 250 psig tested with air pressure under water.
  4. Heating coil to be selected by manufacturer to meet performance design criteria for the local ambient conditions.
  5. Coils shall be warranted for a period of 10 years from all defects.
- D. Airflow Control: Airflow control by a variable frequency drive (VFD). Contractor shall describe proposed airflow control in shop drawing submittal.
- E. Inlet Air Filters: Provide medium efficiency pleated disposable air filters suitable for installation in holding frames; two inch thick minimum narrow body units, four inch thick minimum for jumbo units; constructed of non-woven cotton fabric type. The enclosing frame shall be constructed of rigid, heavy duty, high wet-strength beverage board to the filter pack material. The filter media internal support shall have welded wire grid. Holding frames shall be fabricated metal construction complete. For all units, provide filters with rated face velocity of 500 fpm, initial resistance of not greater than 0.30 inches water gauge, final rated resistance of 0.50 inches water gauge and average resistance of 80%. The holding frame and filters shall be sized such that the rated face velocity of the filters is not exceeded at specified AHU mass flow and design inlet ambient temperature conditions.
- F. Each AHU unit shall be provided with a single stage electric strip heater with associated plenum over-temperature safeties. The rating of the electric heat shall be calculated by PCA manufacturer to meet the ASHRAE design day temperature for Houston, Texas. All calculations shall be submitted to the EOR for review and approval prior to fabrication of the PCA equipment. Electric heating shall be used and controlled by the AHU controller and will be specified in the PCA manufacturer provided sequence of operation. Heat level control shall be by PWM. Heating shall be capable of maintaining the aircraft at 68°F. on a winter design day temperature.

## SECTION 13371 - PCA AIR HANDLING EQUIPMENT (Cont'd)

### 2.07 AIR DELIVERY EQUIPMENT

- A. All gates shall be provided with dual air delivery hoses of sufficient length for connection from the telescoping air duct to the aircraft type(s) scheduled to be served at each gate. Each hose end shall be provided with an 8" aircraft PCA connection nozzle.
- B. Air flexible hoses shall be of the lightweight insulated type, maximum thermal conductance of 1.28 BTU/Hr./Ft./°F., pressure rated for 50 inches of water maximum. Hose shall be flat when not in use, and 14 inch diameter flat type. Hose is to be supplied in sections of no more than 25 feet in length, connected by a closed nylon zipper device, or Velcro connectors with a 14 inch to 8 inch diameter reducing adaptor on the end section.
- C. A dual compartment hose storage basket (wheel type) shall be provided and installed at the location shown on the drawings at the end of each bridge, of sufficient size to easily store the required hose lengths. The basket shall be constructed of steel frame with rounded top edges and corners, with sheet steel or expanded steel sides and an open framework or expanded steel bottom. The top front edge (toward hose deployment direction) shall have a minimum radius of 1 inch. On apron drive bridges, the basket shall be mounted to the bridge support mechanism, as directed by the engineer accessible on the air side. The basket shall be galvanized. The basket connection shall be constructed such that it can be readily removed and reconnected. All gates shall be equipped with dual compartment hose baskets for storage of dual hoses as required. Hose baskets shall be adequately sized for storage of all hose assemblies required for servicing the gate, including MD80 extension hoses.  
*Alternate: As an alternate to the dual hose storage basket, the PCA bidder may provide an "alligator" flexible hose support mechanism. The support mechanism shall include trays mounted in a spring-loaded, scissor formation and the trays shall be supported on caster wheels.*
- D. Provide unit mounted or rotunda mounted disconnect switch at the engineer's discretion.
- E. Telescoping Rigid Insulated Air Duct (TAD) - For Transporting Preconditioned Air Across the Sections of 3-Tunnel Passenger Loading Bridges:
1. General: The telescoping air duct shall be a complete assembly of rigid insulated tubing sections, air seals or gaskets, guide bearings, brackets and other mounting and alignment devices. It shall be designed to extend and retract during the full range of motion of a telescoping passenger loading bridge to which it is attached. It shall be extensively proven in service to withstand thousands of bridge motion cycles while carrying air at the specified conditions from a fixed-mounted air handler at the terminal end of a loading bridge to a connection of flexible duct at the aircraft-end of the bridge.
  2. Manufacturer Experience: The telescoping air duct shall be the regular product of a company who has designed, manufactured, and installed no less than 300 units that are currently in service as specified herein, with at least 100 currently-installed units of this same design in continuous service on passenger loading bridges for a minimum of 10 years. The full-retract and full-extend lengths shall be as required to install on the loading bridges as defined in the bid documents or other bridge definition documents.
  3. Ratings: The TAD shall be rated to carry pressurized air at up to 1,000 mm column of H<sub>2</sub>O at temperatures between -5°C and +65°C. In order to accommodate the required airflows within acceptable pressure drop limits, the inner diameter of the smallest section of duct shall be at least 350mm.

## SECTION 13371 - PCA AIR HANDLING EQUIPMENT (Cont'd)

In addition, the construction shall allow extension and retraction of the duct assembly while mounted on the bridge, for a minimum of 50,000 full cycles or ten years, without requiring inspection or any scheduled maintenance. This shall be proven in practice by a minimum of 100 previously-installed units.

### 4. Materials and Construction:

Telescoping air duct shall be rigid cross-bridge, shall be foam core fiber glass with minimum 1/8" inner and outer fiberglass layer for rigid construction. Polyurethane insulation core shall be flame retardant.

Fireproof and smoke proof, as tested and demonstrated according to approved NFPA procedures, with records of such successful testing on existing products previously installed to be submitted as requested by the Owner. Telescoping section shall have Teflon bearings and foam seals to minimize air leaks. Seals shall be provided as necessary to limit air leakage during operation to less than 1% under the above rated air pressure conditions. The number of telescoping sections shall match the number of tunnels of the passenger loading bridge at each gate. Provide no hindrance or resistance to bridge retraction or extension in excess of 50kg of force opposing the bridge motion. Cause no limitation of bridge retraction or extension limits be reason of its mounting method beyond a small amount which may be approved by the Owner. The telescoping air duct shall be of the type and design proven at similar airport installations at a minimum of 100 gates. Furnish telescoping duct with all brackets and supports as recommended by the manufacturer's installation requirements (where required). TAD to be designed to maximize airflow and minimize heat gains when utilizing subfreezing air flow.

5. Mounting: Each telescoping duct assembly shall be provided with a full set of mounting clamps and brackets to attach to the bridge in a manner as coordinated with the bridge manufacturer during the project design process. It is the responsibility of the PLB manufacturer to mount TAD brackets under the supervision of the PCA supplier.
6. Shipping: Each telescoping duct assembly shall be shipped complete, as an assembly, with all two or three sections retracted into one another. Each assembly shall be marked on the outside of its wrapping with bridge or gate number ID, along with its mounting bracket kit, as established during the project coordination process.
7. Drawings and coordination: The manufacturer shall provide mounting installation guide and adequate information to the coordination process with the bridge manufacturer. Following complete coordination, the manufacturer shall provide full set of installation drawings and process description, matched gate-by-gate for each appropriate bridge.

## 2.09 AHU LIQUID-SIDE EQUIPMENT

- A. EG/W Hoses: Flexible hoses shall be furnished from the building EG/W piping to the AHU supply and return connections. The hoses shall be of commercial quality, designed to handle EG/W fluid, and manufacturer by Goodyear Petroleum Flexwing or similar approved quality. The EG/W hoses shall be provided with barbed male brass couplings attached to both ends. The couplings shall be double banded and rated to 150 psi. All fittings shall be of brass construction with clamps of stainless steel construction. The hoses shall be routed and supported in such a manner to allow for full bridge rotation without stress at the AHU connections. The flexible hoses shall be insulated with flexible foam-type expanded close-cell insulation and protective coating as specified in Section 15250, "Thermal Insulation."

## SECTION 13371 - PCA AIR HANDLING EQUIPMENT (Cont'd)

- B. EG/W Control Valves: EG/W control valves shall be furnished for each AHU. The valves shall be controlled by the AHU controller as required by the sequence of operation and sized as required for AHU outlet temperature control. Valve actuators shall be suitable for outdoor operation in both Summer and Winter design conditions. Control valve location shall be as indicated on the drawings.
- C. Condensate Drain Hoses: A hose shall be provided to carry condensation produced by the AHU to a drain located as indicated on the drawings. The hose shall be 1/2" ID, reinforced PVC tubing and be constructed and routed to function under the design operating conditions. The PVC tubing shall transition to 1/2" copper pipe routed to a ramp drain as indicated on the drawings. All condensate piping shall be insulated with flexible foam-type expanded close-cell insulation and protective coating.

### 2.10 BRIDGE PRECONDITIONING. Each gate system shall provide the necessary controls, equipment and hardware to provide PLB preconditioning prior to aircraft arrival.

A. Function. Bridge preconditioning shall function to operate the PCA unit in a reduced operating mode to automatically heat or cool the PLB when the Bridge Air push-button is activated at the bridge control console.

B. Passenger Loading Bridge Interface. The PC Air Contractor shall supervise and the PLB manufacturer is responsible for the install and supply of the following components on bridge for interface with the bridge preconditioning equipment and PCA unit.

- (1) Bridge air control push buttons, ON & OFF, located on the bridge control console and on the inside wall of the bridge "A" tunnel 5'-0" from the terminal door opening. Each button will contain two N.O. contacts and will be terminated at a terminal block within the console.
- (2) Control wiring from a control console terminal block to the exhaust fan starter for PCA unit automatic control and status monitoring.
- (3) A bridge air side wall cutout in the right side of the outer tunnel between the lift column and stair landing, one foot below the bridge tunnel finished ceiling. The cutout provided will be 8 ½ inches wide by 73 inches high and include an interior air grill.
- (4) Bridge air plenum, on the side wall of the outer tunnel from the inlet to the bottom of the bridge with an 8 inch diameter collar at the bottom for connection of bridge air hose from the PCA unit's bridge air damper.

C. Bridge Air Components. The following bridge air components shall be supplied and installed by the PCAir Contractor.

- (1) Bridge Air Damper. A bridge air damper shall be provided to divert PCA unit outlet air from the aircraft air delivery hose to the bridge air ducting. The damper shall be under the control of the PCA unit controller. The damper shall be integrally installed in the PCA unit discharge air plenum. The damper shall be rated for the air delivery pressure of the PCA unit during aircraft air operations.
- (2) The damper with its actuator shall be a spring-return type.
- (3) Bridge Air Flexible Ducting. Flexible insulated air duct shall be extended from bridge air damper to the air plenum provided by the bridge Contractor on the side of the bridge.

(a) The flexible air ducting shall be factory insulated. Flex duct shall be tested to maintain its

## SECTION 13371 - PCA AIR HANDLING EQUIPMENT (Cont'd)

integrity at the supply fan discharge pressures. Insulation shall achieve a minimum thermal conductance rating of  $K = 0.5$  and must be completely shielded from the air stream at all times. Where the flexible duct joins the fixed ductwork, install with sealer and worm screw drive adjustable bands to make joint secure and airtight.

- (b) The flexible air duct shall be routed and supported under the bridge in such manner to prevent excessive drooping or sagging and to prevent interference with bridge operating mechanisms as specified in SECTION 13375 – PRECONDITIONED AIR DUCTWORK AND ACCESSORIES.

### D. Bridge Air Sequence of Operation.

- (1) If the PCA unit is off, bridge preconditioning shall be activated by pressing the “Bridge Air ON” push-button at the bridge control console. This action shall start the PCA unit in a pre-set reduced operating mode, open the bridge air damper to divert supply air to the bridge tunnel and start the bridge exhaust fan. The PCA unit reduced operating mode shall be such that the aircraft air delivery hose is maintained in its storage basket while still providing approximately 1400 CFM supply air to the bridge.
- (2) Air will circulate through the bridge to the exhaust fan and continue until one of the following occurs.
  - (a) The Bridge Air OFF button is depressed.
  - (b) The aircraft arrives and ground crew depresses the standard Aircraft Air ON button, at which point the delivery system returns to standard operation.
  - (c) An automatic 0 to 20 minute timer elapses its preset time. The timer shall be controlled by the PCA unit DDC controller.
- (3) Exhaust fan status and Bridge Air ON or Aircraft Air ON status shall be available for remote display on the remote monitoring system via the PCA unit DDC controller.

## 2.11 PASSENGER LOADING BRIDGE COORDINATION

- A. The Contractor will be responsible for the PCA air handling equipment specified in this section and passenger loading bridges requirements specified in Section 13041 – Apron Drive Aircraft Passenger Loading Bridges. The Contractor is responsible for coordination of detailed shop drawings for PCA air handling equipment and the equipment specified in Specification 13041. It is the responsibility of the Contractor to supply all bridge components for the pre-cooling of bridge along with the installation of components as follows:
  - 1. Bridge air inlet cutout with interior decorative grill. See paragraph 2.10.B.3 for size and location.
  - 2. Rotunda mounted exhaust fan with rotunda column mounted starter, starter to include provision for remote N.O. contact starting from the AHU controller when the starter H-0-A switch is in the AUTO position.
  - 3. All required stair landing extensions where required for any right-side mounted telescoping air duct.

## SECTION 13371 - PCA AIR HANDLING EQUIPMENT (Cont'd)

4. Lighted "Bridge Air On" and "Bridge Air Off" pushbuttons to be located in the bridge rotunda area near the terminal door. Each pushbutton shall provide a single N.O. momentary contact. The indicator light shall be suitable for operation at 24V, AC or DC.
5. Factory installed control wires from a terminal box under the cab near the lift column to a terminal box on the face of the rotunda rigid frame. Control wires shall include two, twisted shielded pairs, #18 AWG and 20 #18 insulated conductors suitable for 24V AC or DC, all rated and routed as Class II control wiring.
6. Factory installed cabin temperature sensor wall plate in the bridge cab.
7. Rotunda Column Supports.
8. Mounting of Hose Storage Baskets.

### 2.12 FIELD CABLING

#### A. AHU Input Power

Furnish flexible power cable, type S.O. with ground conductor, from a fixed wiring point near the rotunda to the rotunda mounted AHU. Flexible cabling shall only be allowed where required for bridge movement and shall not be used for extending to the AHU disconnect switch where the disconnect is mounted on the building wall. Route and support flexible cable in such a manner to allow for full bridge rotation and elevating movement without interference or snagging with bridge equipment. Input power cable shall be sized for AHU input power requirements, Winter design. Furnish weather sealing hubs as required for connection to the AHU and at transition from fixed to flexible service.

Provide a separate raceway (fixed wiring), such as rigid galvanized steel conduit or as allowed by local code, across any walkways from the AHU disconnect switch to the rotunda area, extending AHU input power wiring with the same size and type used for the input to the AHU disconnect switch and terminating in a junction box.

#### B. Pushbutton Station

Control cabling to the lift column-mounted pushbutton shall be of the size, type and number of conductors required for the selected control system, suitable for outdoor service and of the flexibility required for routing and supporting to the bridge scissors. Furnish weather sealing hubs for cable entry into the station, bottom entry only allowed.

#### C. Network Cabling

PCA system network cabling shall extend from the building mounted network terminal box and shall be of the same size and type used for the system network. The cabling shall be continuous from the building terminal box to the AHU controller. Provide a separate raceway across any fixed walkways from the building terminal box to the rotunda and where required for the type of cable selected with flexible service from fixed wiring points to the rotunda mounted AHU. Furnish weather sealing hubs of the size and type required for network cabling connection to the AHU controller.

## SECTION 13371 - PCA AIR HANDLING EQUIPMENT (Cont'd)

### D. Exhaust Fan, Valve and Bridge Wiring Connection Cabling

Furnish flexible control cabling from the AHU controller to the exhaust fan starter and EG/W valve actuator. Each cable shall be a single jacketed type with the number and size of conductors required and suitable for outdoor service and sunlight resistant. Connections to each device or terminal box shall be made with weather sealing hubs of the size and type required, bottom entry only.

## PART 3 - EXECUTION

### 3.01 FACTORY TEST

- A. A factory test report shall be furnished for each PCA unit including test results, instrument used, test procedures, and final conclusions. Each test report shall be dated and signed by authorized personnel and shall be neat, readily legible and self-explanatory. The Contractor shall include the cost for three (3) trips Owner's representative to witness testing at the factory. Cost shall include travel and lodging for the duration of the test.

### 3.02 EXAMINATION

- A. The Prime contractor and the Owner's representative will examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of air handling units.
- B. Do not proceed until unsatisfactory conditions have been corrected.

### 3.03 INSTALLATION, GENERAL

- A. PCA air handling units shall be mounted under the loading bridge to the rotunda, as indicated on the drawings.
- B. Arrange installation of units to provide access space around air handling units for service and maintenance.
- C. Furnish all necessary supports, brackets, guard posts, safety rails, etc., for properly installing all air-handling units.
- D. All air-handling units shall be properly aligned, adjusted and lubricated before final acceptance.
- E. Perform water and air system testing and balancing as specified in Section 13990, PRECONDITIONED AIR TESTING, BALANCING AND COMMISSIONING MECHANICAL SYSTEMS.

### 3.04 CONNECTIONS

- A. Duct installations and connections are specified in other sections. Make final air duct connections with flexible connections.

## SECTION 13371 - PCA AIR HANDLING EQUIPMENT (Cont'd)

B. Electrical Connections: The following requirements apply:

1. Electrical power wiring as specified.
2. Temperature control wiring as specified.
3. Grounding: Connect unit components to ground in accordance with the National Electrical Code.

### 3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Inspection: Arrange and pay for a factory authorized service representative to perform the following:

1. Inspect the field assembly of components and installation of air handling units including ductwork and electrical connections.
2. Prepare a written report on findings and recommended corrective actions. The Contractor shall repair all recommended corrective actions at his own expense.

### 3.06 ADJUSTING, CLEANING, AND PROTECTING

- A. Check variable inlet damper (or inlet butterfly damper) for proper damper operation.
- B. Clean unit cabinet interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheel and cabinet.

### 3.07 COMMISSIONING

A. Final Checks Before Start-Up: Perform the following operations and checks before start-up:

1. Remove shipping, blocking, and bracing.
2. Verify unit is secure on mountings and supporting devices and that connections for piping, ductwork, and electrical wiring are complete. Verify proper thermal overload protection is installed in motors, starters, and disconnects.
3. Perform cleaning and adjusting as specified.
4. Lubricate bearings and other moving parts with factory-recommended lubricants.
5. Verify manual and automatic volume control.
6. Disable automatic temperature control operators.

B. Starting Procedures for Blowers:

1. Energize motor; verify proper operation of motor, drive system, and blower wheel. Replace blower and motor as required to achieve design conditions.
2. Measure and record motor electrical values for voltage and amperage.

## SECTION 13371 - PCA AIR HANDLING EQUIPMENT (Cont'd)

- C. Refer to Section 13990 – PRECONDITIONED AIR TESTING, BALANCING AND COMMISSIONING MECHANICAL SYSTEMS for procedures for air handling system testing, adjusting, and balancing.

### 3.08 DEMONSTRATION

- A. Demonstration Services: Contractor shall arrange and pay for a factory-authorized service representative to train Owner's maintenance personnel on the following:
  - 1. Procedures and schedules related to start-up and shutdown, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
  - 2. Familiarization with contents of Operating and Maintenance Manuals specified in SECTION B GENERAL REQUIREMENTS.
- B. Schedule training with at least seven days advance notice.

### 3.09 OPERATION AND MAINTENANCE MANUALS

- A. Technical manuals, prepared in accordance with Air Transport Association Specification 101, Revision 4 shall be provided in a protective binder or cover at least 10 days prior to site acceptance. Manuals shall be provided to the Owner's representative as indicated in SECTION B GENERAL REQUIREMENTS.
- B. As a minimum, the manuals shall consist of the following.
  - (1) One section defining the overall operation of the system, start-up and shut-down and adjustment procedures, overall preventative maintenance charts, flow charts and a listing of major system components, with a guide to finding detailed information on these components in other sections.
  - (2) One section containing maintenance and operating details of the air handlers, with theory of operation, control diagrams, schematics, troubleshooting charts, complete alignment instructions, preventive maintenance details, parts lists, all in the general format and intent of ATA-101 as adapted for fixed facility equipment.
  - (3) One or more sections containing the standard vendor's operating and maintenance manuals of all functional assemblies, including pumps, control valves, coils, etc., with catalog cuts of all devices.
  - (4) One section detailing system controls: operation, theory, control and ladder diagrams, program parameter adjustments, manual override techniques, parts lists.
  - (5) Cross reference parts list, indicating Contractor's part numbers as they appear in the manuals with corresponding original manufacturer's part numbers (if different than Contractor).
  - (6) Capacity information, curves, etc., same as provided for submittals.

### 3.10 AS-BUILTS

- A. As built drawings for the air handling equipment shall be coordinated and submitted with the as built design for the passenger loading bridges.

## SECTION 13371 - PCA AIR HANDLING EQUIPMENT (Cont'd)

### 3.11 SPARES PARTS

Upon acceptance of the system provide the following spare parts:

1. Two AHU controllers properly configured.
2. Two complete sets of AHU fuses.
3. One of each type of control Transformer.
4. Two of each type of starter and heater contactor.
5. One of each type of pushbutton, lighted pushbutton assembly.
6. Two of each type of pushbutton contact blocks.
7. Two inlet air damper/valve actuators.
8. One of each type of temperature sensor.
9. Two aircraft connectors.
10. Two complete sets of the air delivery hoses with all separate hose sections and reducers. These may be stored in OEM boxes in the storage area.
11. Provide and install at the time of Owner's acceptance of the system, new air filters in all air handling units, and clean strainers in EG/W piping at each air handling unit.

### 3.12 WARRANTY

- A. All parts and materials for the PCA air handling equipment shall be warranted against defects in material and workmanship for a period of two (2) years from the date of acceptance of each PLB by the owner's designated representatives.

**SECTION 13390  
PRECONDITIONED AIR TESTING, ADJUSTING, AND BALANCING**

**PART 1 – GENERAL**

**1.01 DESCRIPTION**

A. This Section specifies the requirements and procedures for total testing, adjusting, and balancing of the Preconditioned Air (PC Air) System. Requirements include measurement and establishment of the airflows and capacities of the PC Air System as required to meet design specifications, and recording and reporting the results.

B. Test, adjust, and balance the following components of the PC Air System.

- (1) Air handling units; including supply air volume and temperature, automatic and manual controls, and confirmation that condensate is flowing freely to disposal point.
- (2) Verify temperature control system operation.

C. The Contractor shall conduct all testing, adjusting, and balancing in accordance with the written Site Acceptance Test Procedure (SATP) to be provided to the contractor at the start of construction. This SATP includes but is not limited to all testing and verification of correct operation of motors, valves, dampers, controls, temperature readings and settings for the PC Air unit. The SATP for each PC Air unit shall be witnessed and approved by the Owner's Representative.

D. This Section does not include.

- (1) Specifications for materials for patching mechanical systems.
- (2) Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.
- (3) Requirements and procedures for piping and ductwork systems leakage tests.

**1.02 DEFINITIONS**

A. System testing, adjusting, and balancing is the process of checking and adjusting systems to produce the design objectives. It includes.

- (1) The balance of air, volumes, and temperatures.
- (2) Adjustment of the total system to provide design quantities.
- (3) Electrical measurement.
- (4) Verification of all performance of all equipment and automatic controls.

B. Test. To determine quantitative performance of equipment.

C. Adjust. To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).

**SECTION 13390**  
**PRECONDITIONED AIR TESTING, ADJUSTING, AND BALANCING (Cont'd)**

D. Balance. To proportion flows within the distribution system according to specified design quantities.

E. Procedure. Standardized approach and execution of sequence of Work operations to yield reproducible results.

F. Report Forms. Test data sheets arranged for collecting test data in logical order for submission and review. This data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.

G. Terminal. The point where the controlled fluid enters or leaves the distribution system. The terminals for the PC Air System are the air handling units.

**1.03 SUBMITTALS**

Submit the following information to the City Engineer:

B. Procedure and Agendas. Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for this project.

C. Maintenance Data. Submit maintenance and operating data that include how to test, adjust, and balance the PC Air System. Include this information in maintenance data.

D. Sample Forms. Submit sample forms, if other than those standard forms prepared by the NEBB are proposed.

E. Draft Reports. Upon completion of testing, adjusting, and balancing procedure, prepare typewritten draft reports. Organize and format draft reports in the same manner specified for the final reports. Submit two complete sets of draft reports. Only one complete set of draft reports will be returned.

F. Final Report. Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit two complete sets of final reports.

G. Report Format. Bind report forms complete with schematic system diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs.

- (1) General Information and Summary.
- (2) Preconditioned Air Handling Units.
- (3) Bridge Mounted Exhaust Fans.
- (4) Temperature Control Systems.

**SECTION 13390**  
**PRECONDITIONED AIR TESTING, ADJUSTING, AND BALANCING (Cont'd)**

H. Report Contents. Provide the following minimum information, forms and data.

- (1) General information and summary. Inside cover sheet to identify testing, adjusting, and balancing report, Contractor, Owner, and Project. Include addresses, and contact names and telephone numbers. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.
- (2) The remainder of the report shall contain the appropriate forms submitted by Contractor earlier for review. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.

I. Calibration Report. Submit proof that all required instrumentation has been calibrated within a period of six months prior to starting the project.

**Note: Approval and acceptance of the PCA Test report is a condition for final payment of the passenger loading bridge.**

**1.04 QUALITY ASSURANCE**

A. Codes and Standards.

- (1) NEBB. "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
- (2) ASHRAE. ASHRAE Handbook HVAC Applications, Volume, Testing, Adjusting, and Balancing.

B. Pre-Balancing Conference. Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Owner's Representative and the Contractor. The objective of the conference is final coordination and verification of PCA system operation and readiness for testing, adjusting, and balancing.

**1.05 PROJECT CONDITIONS**

A. Systems Operations. Systems shall be fully operational prior to beginning procedures.

**1.06 SEQUENCING AND SCHEDULING**

A. Test, adjust and balance the PCA air handling systems during the summer and winter seasons. Test units when the outside conditions are within 5 degrees Fahrenheit (F) wet bulb temperature of summer design condition and within 10 degrees F dry bulb temperature of winter design condition. The Contractor will have to perform two tests (one during each season) at no additional charge to the Owner.

**SECTION 13390  
PRECONDITIONED AIR TESTING, ADJUSTING, AND BALANCING (Cont'd)**

**Part 2 – PRODUCTS (NOT USED)**

**Part 3 – EXECUTION**

**3.01 MISCELLANEOUS**

- A. Obtain all necessary approvals, acceptances, and permits before commencing with testing, adjusting, and balancing.
- B. The Contractor shall furnish electrical power and operating personnel for start-up, operating and performance training.
- C. Test, adjust and balance all PCA air handling units once they are installed at each aircraft bridge.
- D. Correct all deficiencies resulting from tests.
- E. Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.
- F. Patch insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.
- G. Seal ducts and piping, and test for and repair leaks.
- H. Seal insulation to re-establish integrity of the vapor barrier.
- I. Mark equipment settings, including damper control positions, valve indicators, fan speed control levels, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.
- J. Retest, adjust, and balance the PC Air System subsequent to significant system modifications, and resubmit test results.

**3.02 HYDROSTATIC TESTS**

- A. There is no requirement to pressure test the condensate piping, however, it shall not leak. The condensate shall be observed during operation tests to assure that:
  - (1) The condensate piping is not leaking.
  - (2) Condensate is flowing freely to the potable water ramp drain discharge point.

**3.03 PERFORMANCE TESTS**

- A. Conduct a functional performance test witnessed by the Owner's Representative prior to acceptance on each gate and a check of the safety device to determine if the performance is in accordance with the

specifications and to ensure proper operation and function of the equipment furnished.

## **SECTION 13390**

### **PRECONDITIONED AIR TESTING, ADJUSTING, AND BALANCING (Cont'd)**

- B. Perform all tests recommended by the equipment manufacturers and required by the codes.
- C. Schedule performance testing with the City Engineer.
- D. The Contractor shall prepare and submit to the City Engineer a typewritten report of the performance tests and specifically list the final set points on all control devices.

#### **3.04 FLUSHING PROCEDURES**

A. Inspection.

- (1) Examine the areas and conditions under which cleaning of piping system is to be performed, and remedy and conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

(2) Cleaning.

- (a) General. Each piping system shall be cleaned after successful pressure testing prior to being placed in service and before operating tests are performed.
- (b) Condensate Piping – General. Remove sediment and debris from piping with air or water. Flush thoroughly until piping is clean.

(3) Equipment.

- (a) Remove dirt from interior and exterior of air handling units. Coils shall be cleaned per manufacturer's recommendations.

#### **3.05 SERVICE AND TEST ENGINEERS**

A. Contractor shall furnish the services of experienced factory technician/engineer as required to perform and/or supervise the erection, start up, testing and placing into successful operation all equipment of the PC Air System, and to instruct the Owner's personnel in operation of the PC Air equipment.

- (1) The Contractor shall coordinate with the City Engineer to schedule all performance and acceptance tests and ensure that all required factory service Engineers and test personnel will be present and the required test equipment and instruments will be available and calibrated.

B. Travel and lodging expenses for the service technician/engineer shall be paid by the Contractor.

C. The Contractor shall provide a qualified service technician/engineer for start-up and testing of the PC air equipment.

D. The service technician/engineer(s) shall make daily written reports to the City Engineer.

E. The service technician/engineer's performance shall be satisfactory and acceptable to the City

Engineer. Unsatisfactory performance time shall not be credited as service time.

**SECTION 13390**  
**PRECONDITIONED AIR TESTING, ADJUSTING, AND BALANCING (Cont'd)**

F. The service technician/engineer(s) shall be replaced at the request of the City Engineer.

G. Upon arriving or leaving the jobsite, all service technician/engineer(s), shall report to the City Engineer.

H. Upon completion of the installation of the PLB, the Contractor provide on-site services of the factory technician/engineer. The Contractor notify the City Engineer 5-days in advance of the factory technician/engineer's arrival. The Contractor shall submit to the City Engineer written notification containing the test schedule, test procedures, and personnel which will be present for the test.

I. The Contractor shall furnish operating personnel for start up, operating and performance testing.

J. In the event of failure of any equipment specified in this document to operate and perform as specified, or if the equipment fails to meet the performance guarantees provided for in this Contract, the Owner shall have the right to operate the system or equipment until such defects have been remedied by the Contractor, and the guarantees complied with. In the event that defects necessitate the rejection of the system or equipment, the Resident Engineer shall have the right to operate the equipment without additional cost until such time as new equipment is provided to replace the rejected equipment. Replacement of the equipment shall be coordinated and scheduled with the Owner.

K. All tests and balancing of PC Air System shall be witnessed by the City Engineer.

**3.06 PRELIMINARY PROCEDURES FOR AIR HANDLING UNIT BALANCING**

A. Prior to operating the system, the Contractor shall perform these steps.

- (1) Check filters and cleanliness.
- (2) Check dampers for correct and locked position, and temperature control for completeness of installation before starting fans.
- (3) Prepare report test sheets for each air handling unit. Obtain manufacturer's recommended procedures for testing. Prepare a summation of air handling unit air flows.
- (4) Determine best locations in PC Air ductwork for most accurate duct traverses.
- (5) Place inlet dampers in the full open position.
- (6) Prepare schematic diagrams of system as built ductwork and piping layouts to facilitate reporting.
- (7) Lubricate all motors and bearings.
- (8) Check fan rotation.
- (9) Connect air handling unit (via ductwork) to aircraft for testing.

**SECTION 13390**  
**PRECONDITIONED AIR TESTING, ADJUSTING, AND BALANCING (Cont'd)**

**3.07 MEASUREMENTS**

The Contractor shall:

- A. Provide all required instrumentation to obtain proper measurements. Instruments shall be properly maintained and protected against damage.
- B. Provide all pipeline connections, valves, temporary connections and lines as required for testing.
- C. Provide instruments meeting the specifications of the referenced standards.
- D. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.
- E. Apply instrument as recommended by the manufacturer.
- F. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.
- G. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until two (2) consecutive identical values are obtained.
- H. Take all reading with the eye at the level of the indicated value to prevent parallax.
- I. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.
- J. The measurements in the system where best suited to the task.

**3.08 PERFORMING TESTING, ADJUSTING, AND BALANCING.** Perform testing and balancing procedures on the PC Air System according to the following method.

- A. Supply Air System Adjustment (Preliminary).
  - (1) The Contractor shall furnish the labor and equipment necessary to adjust each air handling unit and the equipment apparatus connected thereto in accordance to the respective air handling unit design conditions.
  - (2) The Contractor shall furnish a fabricated test section that is 8 inches in diameter and 10 feet in length.
    - (a) The test section must be able to be attached to the 14 inch flexible PC Air duct via an aircraft adapter nozzle.
    - (b) The test section shall be mounted on feet for stability and a volume damper shall be located at the far end of the test section to adjust static pressure and airflow.
    - (c) Also provide a port at the midpoint of the test section large enough to insert a pitot tube.

**SECTION 13390**  
**PRECONDITIONED AIR TESTING, ADJUSTING, AND BALANCING (Cont'd)**

(3) All air handling units shall be tested during start up with this test section for flows, gauge pressure, and temperature.

**3.09 RECORD AND REPORT DATA**

The Contractor shall:

- A. Record all data obtained during testing, adjusting, and balancing as approved on the sample report forms.
- B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.
- C. Prepare a report conforming to NEBB guidelines using tabulation forms proposed by NEBB.

**SECTION 16801**  
**180Kva / 28VDC 400Hz GATE EQUIPMENT**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.02 SUMMARY**

- A. The work included under this Section consists of furnishing and installing the equipment for the generation and distribution of 400 Hz / 28 VDC power, including all related system and accessories as shown on the Drawings and hereinafter specified.

**PART 2 - Products**

**2.01 GATE SERVICE CABINETS AND GATE CONTROL**

- A. The gate service cabinet shall be contained in a modified NEMA 4 weatherproof ventilated enclosure designed for mounting on the bridge at the aircraft end and shall serve as the termination point for the Central System (Motor Generator) voltage 575vac, the incoming 575V, 400Hz power conductors and the outgoing 115/200V, 400Hz power and 28VDC control conductors. The continuous rating of the transformer/contactors assembly shall be 180 kVA with intermittent operation at 125% of specified rating for five minutes at 0.8 lagging power factor.

1. Transformer

- a. Power Source: The transformer shall receive input power from a branch circuit output located in the motor generator room or solid state frequency room. Distribution to the delta primary of the 400Hz step down transformer shall be by a 3-wire system at 575V nominal L-L.
- b. Turns Ratio: The L-L/L-N transformer turns ratio shall be 5:1 with a turns ratio tolerance of +0.5%. Primary shall be delta connected. Secondary shall be wye connected and grounded. With an AC input voltage of 575V applied to the primary, the open circuit secondary line to neutral voltage shall be 115V +0.1%.
- c. Temperature Rise: The maximum temperature rise shall not exceed 115°C over 40°C ambient under conditions of full rated load with rated input voltage, as measured by the resistance change method.

**SECTION 16801**  
**180Kva / 28VDC 400Hz GATE EQUIPMENT (Cont'd)**

- d. Overload: The transformer shall be capable of five minutes of operation in 40 C ambient temperature under a load of 125% of rated current, with rated voltage applied, without exceeding the temperature rating of the insulation.
- e. Short Circuit Impedance: The short circuit impedance of the transformer shall be less than 1.99% with maximum reactance of 1.88% and maximum resistance of .58% as related to the absolute value of nominal load impedance. The values are for 400Hz and measured with the secondary short circuited, and voltage applied to the primary. Values are line to neutral.
- f. Insulation: Insulation shall be class H as defined in MIL-E-917. A moisture barrier to ground shall be provided as required in MIL-E-917. The insulation system shall be capable of passing the following tests:
  - Primary High Potential Test: 4000VAC, 60HZ primary to core for one second.
  - Secondary High Potential Test: 1200VAC, 60Hz secondary to core for one second.
- g. Windings: The winding shall be of copper wire only, insulated and supported to withstand the test requirements specified herein.

2. Disconnect Device

- a. This device shall be 3-pole, 600V, non-automatic circuit breaker current rated equal to or higher than branch circuit over current protective breaker. The breaker shall be externally operated from front panel of enclosure with handle interlocked to enclosure door.

3. Line Drop Compensator

- a. Reactive line drop compensators shall be rated for 180 KVA continuous load and be capable of compensating for branch distribution inductive reactance as required by system parameters. This compensation shall compensate for inductive reactance's in the step down transformer, the 575V, 400 Hz branch circuit conductors, and the aircraft service cable that connects the 400 Hz power to the aircraft. Current rating of the line drop compensator shall match the step down transformer primary current rating and shall be capable of sustaining a 125% overload at 0.8 power factor for five minutes.
- b. Temperature rise: Magnet components shall have a maximum temperature rise of 80°C over a 40°C ambient temperature. Capacitors shall have a maximum temperature rise of 20°C over a 40°C ambient temperature.
- c. Insulation: Magnet components shall be Class H as defined in MIL-E-917. A moisture barrier to ground shall be provided.
- d. Cooling: Line drop compensators shall be convection cooled.

**SECTION 16801**  
**180Kva / 28VDC 400Hz GATE EQUIPMENT (Cont'd)**

- e. Input protection: Each branch circuit line drop compensator input shall be protected by a 3-phase, 600VAC molded case type non-automatic circuit breaker with shunt trip and manually operable through cutouts in front panel. Circuit breaker shunt trip shall be actuated by signals received from overload fault sensors at the input to the line drop compensator as well as an over-voltage device sensing the voltages at the line drop compensator capacitor terminals. Overload sensors shall provide a command signal to shunt trip circuit to open input breaker at 125% of full branch circuit load sustained for six minutes and, after 200 milliseconds at 200% of full branch circuit load. In the event of branch circuit short circuit, an over-voltage device shall be set to prevent the voltage across the line drop compensator capacitors from exceeding their maximum working voltage and shall instantaneously actuate the shunt trip of the circuit breaker to disconnect the branch circuit.
4. Contactor
    - a. Contactor shall be rated same as transformer secondary full load current and capable of reactive load switching at 0.8 lagging P.F. and fault interrupting. Contactor shall be electrically held, 3-pole, rated 250 VAC minimum at 400Hz.
5. Control Components
    - a. Input to control voltage source shall be derived from step down transformer secondary. A control voltage transformer shall supply power to rectifier and filter for 28VDC and solid state control elements. The following control functions and elements shall be provided:

Remote contactor open/close.

"E & F" interlock relay circuit 28VDC to prohibit contactor latch circuit unless aircraft plug is engaged and 28VDC signal is received from the aircraft between jumpered E/F pins and neutral.

Relay operated over current circuitry set at 125% overload for five minutes and opens load contactor.

Relay operated unbalanced load current circuitry, opens load contactor after 3 second delay whenever unbalanced current exceeds 60% of full balanced load current.

Common fault light.  
Power available light, indicates presence of 575V in cabinet.
6. Remote Control Boxes

Remote control boxes shall be provided at each gate. One control box each shall be for the 400Hz system, 28volt box system and the PC Air system. Each control box shall contain the following pushbutton switch functions.

    - a. Contactor "On" button with guard.
    - b. Contactor "Off/Reset" button with guard.
    - c. Load "On" light (contactor closed).

**SECTION 16801**  
**180Kva / 28VDC 400Hz GATE EQUIPMENT (Cont'd)**

Remote control boxes shall be mounted on or near the fixed portion of the bridge lift column and shall be of rugged, watertight construction.

7. Monitoring

The 400 Hz Gate boxes shall be designed with a LON network and transmitting data in SNVT's. All faults and status points shall also be dedicated N.O. contacts. No common input shall be allowed. The following points are to be displayed and monitored:

- Over Voltage
- Under Voltage
- Output On/Off
- Power Available
- Cable hoist Interlock (Optional)

**2.02 FINISHES**

- A. All outdoor equipment shall be finished to match the color of the nearby existing surfaces, to be approved by the Owner. All steel shall be phosphatized prior to application of primer and a minimum of two coats of exterior enamel.

Indoor equipment shall be suitably finished in the manufacturer's standard color.

**2.03 400 Hz CABLE HOISTS**

Each unit shall be supplied with the following related components.

- (1) Input power cable for connection to cable hoist input junction box. Junction box to be supplied and installed by PLB Manufacturer.
- (2) Two (2) Tunnel mounted cable hoists with brackets.
  - (a) Provide a dual cable hoist assembly to raise the two flexible aircraft cables (connected to the gate box mounted on the PLB) to a stowed position along the side of the bridge out of the path of moving vehicles. Provide operator controls via remote pushbutton to allow raising and lowering the cable to power aircraft at the gate.
  - (b) The hoists shall be designed for mounting on top of or on the side of the bridge.
  - (c) The hoist cabinets shall be welded number 10 gauge steel. The finish shall be two (2) coats of primer and one (1) coat of white polyurethane paint. The unit shall be rated NEMA 3R. The hoists shall be constructed with removable or hinged cover for ease of maintenance and access to major components.

**SECTION 16801**  
**180Kva / 28VDC 400Hz GATE EQUIPMENT (Cont'd)**

(d) Motor.

- Provide an electric open drip proof gear motor rated at ½ horsepower (HP), 480 V of alternating current (VAC), 60 Hz, 3 PH. The gear reducer shall be NEMA rated Class D.
- Provide a magnetic disc brake to prevent the wire rope drum from unwinding when the hoist is shut off.

(e) Controls.

- A 600V, 3 pole 10 A manually operated disconnect isolation switch shall be provided.
- Provide a reversing contactor and control circuitry.
- Provide a 24 V adjustable counter to control the IN and Out limits of the wire rope.
- A step down transformer shall be provided for the low voltage circuits.
- Provide a single drum with flanges to contain the wire rope.
- Provide 3/16 inch diameter nylon coated stainless steel braided wire rope of sufficient length to raise the aircraft cables level with the underside of the bridge.
- For each hoist provide two (2) cast aluminum cable saddles and clamps to attach to the aircraft cable. One (1) clamp is to be attached about 14 feet from the cable head and the second approximately 18 feet from the cable attachment on the bridge. This will allow the aircraft cable to be festooned on the side of the bridge.
- During the “down cycle”, the hoists lower the aircraft cables to a ground handling position. The operator uncouples both swivel clamps from the saddles which allow the aircraft cables to be extended and attached to the aircraft.
- The return of the aircraft requires the operator to pull the cables back to a position where the cable clamps can be reattached to the hoist wire rope. The “raise” push button on the aircraft cable head or the lift column returns the aircraft cables to the stowed position.
- The cable hoists counter disconnects power from the motor when the travel limit, “raise” or “lower”, has been reached.

(3) Remote pushbutton station for mounting on PLB lift column. Unit to include On/Off/Up/Down controls.

**SECTION 16801**  
**180Kva / 28VDC 400Hz GATE EQUIPMENT (Cont'd)**

**2.04 400 Hz AIRCRAFT CABLES**

- A. The 400 Hz Aircraft Cables shall be 60 ft. long and of a banded configuration suitable for nominal 200/115 V, 3 phase, 4 wire, 400 Hz power. Cable shall include E&F control wiring as required for aircraft applications.
- B. Cables shall include a molded head with replaceable nose section.
- C. Dual cables shall include separate On/Off and Raise/Lower pushbuttons in the cable head.
- D. Weight shall not exceed 2 lbs per foot.
- E. Acceptable Manufacturers.
  - INET
  - JBT AeroTech
  - Or proven equal
- F. All required connectors and mounting accessories required to completely install equipment and related components shall be provided.

**2.05 28VDC UNIT FEATURES**

- A. The 28 VDC ground power shall housed in a separate 28 VDC output box. A selector switch shall be provided to select either 400 Hz or 28 VDC. These additional 28VDC boxes shall be provided at ALL gates.
- B. DC Output Voltage Ripple less than 1 percent.
- C. DC Output Voltage Regulation less than 0.5 percent (0 to nominal load).
- D. DC Output Voltage Adjustment +/- 10 percent.
- E. DC overload of rated capacity.
  - (1) 150 percent for 60 seconds.
  - (2) 200 percent for 5 seconds.
  - (3) 350 percent for 3 seconds.
- F. DC Efficiency greater than 90 percent.

**SECTION 16801**  
**180Kva / 28VDC 400Hz GATE EQUIPMENT (Cont'd)**

**2.06 28VDC CABLES**

- A. A flexible aircraft cable assembly shall be of a banded configuration, suitable for the DC output of the 28VDC box. Cable shall be 60 feet long.
- B. The cable shall include a molded two (2) prong head. Sockets shall be suitable for 28 VDC connections.
- C. Weight shall not exceed 2 lbs per foot.
- D. Acceptable manufacturers include the following or Owner approved equal of follows:
  - 1) INET
  - 2) Trilectron Industries
  - 3) JBT AeroTech

**2.07 CABLE HOIST**

- A. The cable hoist for a single cable for the 28 VDC cables shall be identical to the cable hoist for 400 Hz cables.

**PART 3 - EXECUTION**

**3.01 SYSTEM INSTALLATION**

- A. The complete system installation shall be designed by, performed by, and under the direction of the Contractor as part of this contract.
- B. All installation labor shall be performed by the Contractor or subcontractors licensed in and approved by the Owner, who meets all insurance and bonding requirements. The installation includes all construction permits or other approvals required under a master permit.
- C. The central equipment room will be available to the contractor on a full time basis with no interference from other trades or contractors, in accordance with the milestones of the contract schedule.
- D. The Contractor shall be responsible for coordination and proper installation of both the 400hz and 28volt DC systems on the passenger loading bridge, including but not limited to mounting provisions, brackets, cables, junction boxes for both cable hoist and service cabinets. It is the responsibility of the Contractor to assure a smooth operating system with no changes due to owner.

**SECTION 16801**  
**180Kva / 28VDC 400Hz GATE EQUIPMENT (Cont'd)**

**3.02 FACTORY TESTS**

- A. Each functional assembly shall be inspected and tested at the factory prior to shipment. Owner or his representative shall have the right to witness these tests, for which purpose a 5 day notification shall be given to the City Engineer prior to performance. Complete test reports shall be submitted to the City Engineer.
- B. Test procedures shall be submitted by the contractor to the City Engineer at least 30 days prior to the scheduled tests for review by the Owner.
- C. It is the responsibility of the Contractor to absorb all costs for two AECOM representatives to witness factory testing for one day
- D. Acceptable manufacturers include the following or Owner approved equal of follows:
  - 1) INET Airport Systems
  - 2) Trilectron Industries

**3.03 SITE ACCEPTANCE TESTS**

- A. Following checkout and inspection by the Contractor, a complete acceptance test shall be made by the Contractor of the central system and gate subsystems. The Contractor shall provide a load bank capable of providing a 180 KVA load at 0.8 lagging power factor when connected to the plug end of the aircraft cable. Load bank shall provide incremental loads above this level to verify the overload and unbalanced load current protective circuit settings.
- B. Complete test reports shall be submitted by the Contractor to the City Engineer within 10 days of completion of the actual tests. Test reports shall contain suitable data reduction and calculation to verify the goals of the test plan and the system capacity.

**3.04 APPROVAL DRAWINGS**

- A. Ten sets of design drawings, calculations, catalog cuts, and equipment installation drawings shall be submitted to the City Engineer for approval. Detailed installation shop drawings and catalog cuts shall be available for submittal to the City Engineer. All drawings shall be approved by the City Engineer or such approval waived in writing prior to beginning construction. The purpose of the Engineer's approval is not to concur and accept the contractor's calculations or equipment selection, but to indicate that the Engineer has not discovered violations in the submittals of codes and his agreement of critical interfaces.

**3.05 AS-BUILTS**

- A. As-built drawing shall be submitted within 30 days after system acceptance.

**SECTION 16801**  
**180Kva / 28VDC 400Hz GATE EQUIPMENT (Cont'd)**

**3.06 RECOMMENDED SPARES LIST**

- A. A set of recommended spares lists shall be submitted covering all items of equipment and categorized accordingly, with current unit prices as well as recommended lot price. This list shall be submitted within 90 days after drawing approval.

### **3.07 OPERATING AND MAINTENANCE MANUALS**

- A. Ten (10) sets of complete and bound maintenance and operating manuals shall be provided at least 60 days prior to site acceptance. As a minimum, manuals shall consist of the following:
  - 1. One section defining the overall operation of the system, start-up and shut-down and adjustment procedures, overall preventative maintenance charts, flow charts, and a listing of major system components, with a guide to finding detailed information on these components in other sections.
  - 2. One section containing maintenance and operating details of the 400Hz system equipment with theory of operation, control diagrams, schematics, troubleshooting charts, complete alignment instructions, PM details, parts lists, all in the general format and intent of ATA-101 as adapted for fixed facility equipment.

### **3.08 TRAINING**

- A. During the checkout and test phases above, the appropriate Owner personnel shall be invited to witness and to receive over-the-shoulder operation/adjustment training. Immediately prior to or within one week after system acceptance tests or beneficial use of the system, whichever comes first, contractor shall conduct a one (1) day training class for up to 12 personnel. The class shall consist of 50% classroom and 50% hands-on operation. This class shall be aimed at operating and maintenance personnel for basic operation, preventative maintenance, adjustments, and initial fault response.

### **3.09 AVAILABILITY OF PARTS AND SERVICE**

- A. Contractor shall guarantee availability of parts and service for a minimum of 10 years following site acceptance. Contractor shall make available a complete maintenance contract covering all preventative and corrective maintenance, including all parts.

### **3.10 WARRANTY**

- A. All parts and materials for the 180Kva/28VDC 400 Hz gate equipment shall be warranted against defects in material and workmanship for a period of two (2) years from the date of acceptance of each PLB by the owner's designated representatives.

**SECTION 16820  
60 HZ ELECTRICAL REQUIREMENTS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. General electrical specification, description, references and requirements for the furnishing, installation, and testing of all electrical systems as shown on the Drawings and these Specifications. All systems shall be complete and ready for operation at time of occupancy by the Owner.

**1.02 SUMMARY**

A. Provide complete new electrical systems where shown on the Drawings, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to:

1. Feeder system, in conduit to branch circuit panels;
2. Branch circuit panels for power;
3. Branch circuit wiring, in conduit, for receptacles, junction boxes, equipment and motors;
4. Hangers, anchors, sleeves, chases, supports for fixtures, devices, and other electrical materials and equipment in association therewith;
5. Wiring system, in conduit, for equipment and controls provided under other Sections of these Specifications;
6. Motor starters and controls for motors provided under the contract.

B. The Drawings are diagrammatic and shall be followed as closely as actual construction of the building and the work of other trades will permit. All changes from Drawings necessary to make the work of other trades shall be performed at the Contractor's expense.

C. Unless explicitly stated to the contrary, the Contractor shall furnish and install each item of equipment or material hereinafter specified, complete with all necessary fittings, supports, trim, piping, etc., as required for a complete and operating installation.

**1.04 REFERENCES**

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C2                      1993 National Electrical Safety Code

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC. (IEEE)

IEEE 100                    1992 Dictionary of Electrical and Electronics Terms

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATIONS (NEMA)

NEMA MG 1                1993 Motors and Generators

**SECTION 16820**  
**60 HZ ELECTRICAL REQUIREMENTS (Cont'd)**

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70                    1993 National Electrical Code

NFPA 70E                1995 Electrical Safety Requirements For Employee Work Place

NFPA 101                1994 Safety To Life From Fire in Buildings and Structures

NFPA 110                1993 Emergency and Standby Power Systems

Underwriters Laboratories Inc. (U.L.)

**1.05 RELATED REQUIREMENTS**

A. This section applies to Section B General Requirements and all sections of Division 13000 and 16000 of this project specification unless specified otherwise in the individual sections.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

C. Refer to other sections of these specifications for related work which is not work of this section.

**1.06 DEFINITIONS**

A. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

B. The technical sections referred to herein are those specifications sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal types.

C. The technical paragraphs referred to here in are those paragraphs in PART 2 - PRODUCTS and PART 3 - EXECUTION of the technical sections that describe products, systems, installation procedures, equipment, and test methods.

D. The term "provide" used in this division shall include labor, materials, equipment necessary to install, complete and operate the item or system indicated. Items called for, implied, or normally part of equipment or system, as indicated on either plans or specifications, shall be provided.

**1.07 QUALITY ASSURANCE**

A. Supervisory Qualifications:

1. The electrical work on the project shall be under the direct supervision of a licensed master electrician.

**SECTION 16820**  
**60 HZ ELECTRICAL REQUIREMENTS (Cont'd)**

**B. Qualifications of Installers:**

1. For the actual fabrication, installations, and testing of work in this section, use only thoroughly trained and experienced personnel who are completely familiar with the requirements of this work and with the installation recommendations of the manufacturers of the specified items.

**1.08 ELECTRICAL COORDINATION**

The Contractor shall:

A. Coordinate with all other trades to avoid interferences and conditions which will not allow the installation of equipment, ductwork, piping, fixtures, etc., as indicated. It shall be the total responsibility of the Contractor to accomplish these installations without extra charges.

B. Provide power wiring, conduit and connections to all electrically operated equipment and provide disconnecting means, unless specifically indicated otherwise, or furnished as part of factory-packaged equipment.

C. Check that motors and equipment have proper voltage to operate this system, and that each motor has thermal overload protection, properly sized to name plate data.

D. Verify exact equipment locations with final architectural drawings. No extra compensation will be granted for adjustments to outlet location, as required.

**1.09 CODES AND INSPECTIONS**

A. The installation shall comply with all laws applicable to the electrical installations, which are enforced by the regulations of the 1996 edition of the National Electrical Code, and the latest editions of the ANSI National Electrical Safety Code and NFPA Life Safety Code.

B. Where, in any specific case, different sections of any of the aforementioned codes or these Drawings and Specifications specify different materials, methods of construction or other requirements, the most restrictive shall govern.

C. All materials shall be listed by the UL, Incorporated, as conforming to its standards, where such as standard has been established for the particular type of material in question.

D. Where the Contract Document requirements are in excess of code requirements and are permitted under the code, the Contract Documents shall govern.

**1.10 SUBMITTALS**

A. Comply with pertinent provisions of The General Specifications.

**SECTION 16820**  
**60 HZ ELECTRICAL REQUIREMENTS (Cont'd)**

B. Submittal shall be at one time in one integral group. Piece-by-piece submission of individual items within group systems will not be acceptable. City Engineer may check contents of each submittal set upon initial delivery; if not complete as set forth herein, submittal sets may be returned to Contractor without review and approval and may not be accepted until made complete.

The Contractor shall submit the following to the City Engineer:

1. Materials list of items proposed to be provided under this Section;
2. Equipment manufacturer's specifications and other data needed to prove compliance with the specified requirements;
3. Equipment manufacturer's recommended installation procedures which, when approved by the City Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.
4. Shop drawings required for the following:

Wiring Devices  
Transformers  
Motor Starters  
Branch Circuit Panels  
Safety Switches  
Conductors  
Conduits

C. Samples:

1. When requested by the City Engineer, promptly provide samples of items scheduled to be exposed in the final structure.
2. When specifically so requested by the Contractor and approved by the City Engineer, approved samples will be returned to the Contractor for installation on the Work.

D. One equipment manufacturer shall be selected for any specific classification of material, equipment or systems. For example, all panel boards, transformers, etc., shall be by one manufacturer. If more than one equipment manufacturer is submitted, the City Engineer shall select one and disapprove the others.

E. Submittals shall comply with the following additional requirements. Submittals shall include the manufacturer's name, trade name, place of manufacture, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification, and technical paragraph reference. Submittals shall also include applicable industry and technical society publication references, and years of satisfactory service, and other information necessary to establish contract compliance of each item to be provided.

F. The review of systems, equipment and shop drawings is a general review subject to the contract drawings, specifications, and verification of all measurements at the job. Review does not relieve the contractor from the responsibility of shop drawing errors. The contractor shall carefully check and correct all shop drawings prior to submission for review. Each shop drawing submittal shall bear the stamp and signature of the contractor, indicating he has checked and corrected all shop drawings.

**SECTION 16820**  
**60 HZ ELECTRICAL REQUIREMENTS (Cont'd)**

- G. Shop drawings shall be reviewed and stamped by contractor, with all items identified and all technical data included. All shop drawings shall be submitted one at a time.
- H. Shop drawings plan submittals shall be in a minimum 1/8" = 1'-0" scale.

**1.11 SUBSTITUTIONS**

A. Refer to other sections of the specifications for requirements governing substitutions.

1. Materials and equipment are specified herein by a single or by multiple manufacturers to indicate quality, material and type of construction desired. One manufacturer's product is shown on the Drawings and has been used as a basis for design; it shall be the Contractors responsibility to ascertain that alternate manufacturer's products meet the detailed specifications, and that size and arrangement of equipment is suitable for installation on this Project.
2. All requests for substitutions shall clearly and specifically indicate any and all differences or omissions between the product specified as basis of design and the product proposed for substitution.
3. Where equipment or materials are specified by the use of the name and catalog model, or style number, that manufacturer / Model No. is the Basis of Design for that equipment. The use of manufacturer's names is for the purpose of describing the standard of quality, performance and characteristics desired and is not intended to limit or restrict competition.

**1.12 PROTECTION OF MATERIALS, EQUIPMENT AND WORK**

A. Materials shall be stored so as to assure the preservation of their quality and fitness for the work. Stores materials, even though approved before storage, shall be subject to re-inspection prior to their use in the work. The Contractor shall coordinate the storage of all materials with the Owner's Authorized Representative.

B. The Contractor shall protect electrical raceway, cable, and associated support systems against damage from movement of equipment and material, welding, flame cutting, and other construction damage. Raceway and supporting structures for raceway shall not be used as access scaffolding at any time. Whenever welding or flame cutting operations occur above or near raceways or cables not shielded from such operations by concrete floor or other protective covers, the Contractor shall protect the raceways and cables from damage by means of fireproof boards or blankets. Damaged materials shall be repaired or replaced, by and at the Contractor's expense, subject to the engineer's discretion and acceptance.

C. Surfaces of most equipment, such as motor control centers are finished at the factory. Great care shall be exercised to prevent damage to this original finish during installation of the equipment and during construction work. If the factory finish is damaged during the course of construction, the entire surface of the damaged component shall be re-finished by and at the expense of the Contractor.

**SECTION 16820**  
**60 HZ ELECTRICAL REQUIREMENTS (Cont'd)**

**1.13 GUARANTEE AND SERVICE**

A. In addition to the guarantee of equipment by the manufacturer of each piece of equipment specified herein, the Contractor shall also guarantee such equipment for a period of two (2) years from the PLB Acceptance test for necessary adjustments and/or replacements of all defective equipment, materials and workmanship without expense to the Owner.

**1.14 OPERATING INSTRUCTIONS**

A. The Contractor shall provide the services of equipment manufacturer's field service technician to supervise the operation of all equipment specified herein and to instruct the Owner's operators during an 8-hour period.

B. The Contractor shall be notified in writing at least five days before each operating instruction period begins. The Contractor shall commence no instruction period until the Owner has issued his written acceptance of the starting time.

**1.15 POSTED OPERATING INSTRUCTIONS**

A. Provide for the PC Air and 400 Hz Units, operating instructions, which shall include the following:

1. Wiring diagrams, control diagrams, and control sequence for each unit. Show all feeder loads.
2. Safety precautions.
3. The procedure in the event of equipment failure.
4. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

B. Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. Operating instructions shall be secured to prevent easy removal or peeling.

**1.16 NAMEPLATES**

A. Provide laminated plastic nameplates for each switchgear, switchboard, transformer, panel board, equipment enclosure, relay, switch, and device; as specified in the technical sections or as indicated on the drawings. Each nameplate inscription shall identify the function and when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be minimum of 0.25 inch high normal block style.

**SECTION 16820**  
**60 HZ ELECTRICAL REQUIREMENTS (Cont'd)**

**1.17 RECORD DRAWINGS**

A. Provide and maintain at the site a set of prints on which shall be accurately shown the actual installation of all work under this section, indicating any variation from contract drawing, including changes in sizes, locations and dimensions. Changes in circuitry shall be clearly and completely indicated as the work progress.

B. These progress prints shall be available for inspection by the Engineer and shall be used to determine the progress of electrical work.

C. At the completion of the work, produce three sets of record drawings in AutoCAD release 12 format. AutoCAD files shall be delivered on CD to the City Engineer. Record drawings shall accurately depict the work performed, including the dimensioned location of all underground conduit.

**1.18 ACCESS TO ELECTRICAL WORK**

A. Provide access panels for concealed junction boxes, ballasts, disconnect switches, or other electrical devices where concealed, or in areas not otherwise accessible.

**1.19 PAINTING FOR ELECTRICAL WORK**

A. Raceways, conduit supports, hangers and surface raceway, where exposed, shall be painted to match mounting surface or surrounding surfaces. Panels and equipment with damaged painted surfaces shall be refinished to present a smooth continuous finish.

**1.21 SYMBOLS**

A. The contractor shall be responsible for request for clarification of unclear or unscheduled symbols prior to bid.

**1.23 CONCRETE WORK**

A. All repairs, patching, and/or restoration to existing concrete slab and wall surfaces which may be required for supporting equipment furnished under this Contract shall be the responsibility of the Contractor.

B. This Contractor shall furnish all equipment anchor bolts and shall be responsible for their proper installation and accurate location.

**1.24 MAINTENANCE MANUALS**

A. Manual: Upon completion of this portion of the work, and as a condition of its acceptance, deliver to the Architect two copies of an operation and maintenance manual compiled in accordance with the provisions of The General Specifications. Include within each manual:

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**60 HZ ELECTRICAL REQUIREMENTS (Cont'd)**

1. Copy of the approved Record Documents for this portion of the work;
2. Copy of all circuit directories;
3. Copies of all warranties and guarantees;
4. Copies of all operating and maintenance manuals for equipment supplied;

**PART 2 – PRODUCTS**

**2.01 MATERIALS**

A. Metallic Conduit:

1. Rigid galvanized steel conduit shall conform to ANSI Standard C80.1 and UL 6.
2. Galvanized steel tubing (Electrical Metallic Tubing - EMT) shall conform to ANSI Standard C80.3 and UL 797.
3. Flexible metal conduit.
4. Liquid-Tight flexible conduit shall be galvanized steel with polyvinyl jacket, liquid tight and shall conform to UL 360. Fittings shall conform to UL 514.

B. Connectors, Couplings and Fittings:

1. One coupling of the appropriate type shall be furnished with each length of conduit.
2. Rigid Conduit Fittings: Threaded, heavy steel, water and concrete tight. Grounding type nylon insulated bushings for connectors at cabinets, boxes, switchboards, gutters, panel boards, and disconnect switches.
3. Electrical Metallic Tubing Fittings: Compression type steel, water and concrete tight. Connectors with nylon insulated throats at cabinets, boxes and gutters. Indentor or set screw type fittings will not be allowed.
4. Flexible Metal Conduit Fittings: Squeeze or clamp type galvanized steel with nylon insulated throats. Set screw type will not be allowed.
5. Liquid tight Flexible Conduit Fittings: Galvanized steel with watertight gaskets, "O" ring and retainer and nylon insulated throats.
6. Condulet Fittings: Exposed conduit fittings shall be Ferris Condulet (cast metal) type for sharp turns, tees, and similar conditions.
7. Expansion Fittings: Expansion Fittings, properly bonded, shall be installed in each conduit run that crosses a expansion joint, or where conduit is subjected to expansion/deflection.
8. Die-cast fittings are not permitted.
9. Watertight Fittings: Ferrous cast metal with flanges and glands to properly seal conduit wall penetration from water passage.

**2.02 CONDUCTORS**

- A. All conductors shall be copper of 98% conductivity with 600-volt insulation.

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**60 HZ ELECTRICAL REQUIREMENTS (Cont'd)**

- B. Conductor sizes specified are AWG up to 4/0, and circular mils above 4/0.
- C. Conductors used for secondary distribution shall be as follows:
  - 1. Conductors No. 10 and smaller shall be solid, No. 8 and larger, stranded.
  - 2. Conductors shall be NEC standard type, "THWN", "XHHW" or "THHN" and UL Labeled.
  - 3. Provide equipment grounding conductors with green type insulation.

**2.03 JUNCTION AND PULL BOXES**

A. Boxes shall be sized in accordance with requirements of the National Electric Code with covers accessible at all times. All junction and pull boxes shall be fabricated of galvanized steel with removable face plates located for easy access of removal.

**2.04 MOTOR STARTERS**

A. Where required, motor starters shall be full voltage across-the-line magnetic motor starter, rated as required for equipment served, with 120 volt coil (unless otherwise indicated), hand-off-automatic selector switch in cover (unless otherwise indicated), push-button operated "start"- "stop"- "reset" button in cover (unless otherwise indicated), and general purpose NEMA-1 (indoor) enclosure. The starters shall be equipped with thermal overloads in each ungrounded conductor. Thermal overloads shall be sized in accordance with nameplate rating of motor supplied. Motor starters shall be as manufactured by General Electric Company, Square "D" Company, or Westinghouse Electric Corporation.

**2.05 MOTOR AND CIRCUIT DISCONNECT SWITCHES**

A. All motor and circuit disconnect switches shall be 600 volts, unless noted otherwise, in heavy duty NEMA-1 (indoor) or rain-tight NEMA-3R (outdoor) enclosures, and fusible in rating as required for equipment served. Disconnect switches shall be of the heavy duty type as manufactured by General Electric Company, Square D Company, or Westinghouse.

B. All fused or non-fused safety switches which may be required shall be furnished and installed under this section of the work; no switches of any kind or type will be provided under other sections of the specifications. All switches shall be heavy duty type and of the appropriate ampere rating. Those employed for motors and their feeders shall be horsepower rated switches. Switches for outdoor installation shall be provided with weather-tight cabinets, those utilized for service entrance duty shall bear the UL label of approval for such service. Provide rejection type fuse holders in all fusible switches.

**2.06 CIRCUIT BREAKERS**

1. All circuit breakers shall be UL labeled and shall be thermal and magnetic, molded case type, quick-make and quick-break both on manual and on automatic operation and shall be bolted to the panel bus. Breakers shall be the over-the-center toggle operating type with the handle going to a position between "On" and "Off" to indicate automatic tripping. All multi-pole breakers shall be internal common trip. All breakers for HVAC equipment shall be listed as "HACR" type. The breakers to be furnished shall, in each instance, be determined by the specifications, the ampacity and poles in

**SECTION 16820**  
**60 HZ ELECTRICAL REQUIREMENTS (Cont'd)**

schedules or as indicated, and by the minimum UL labeled RMS symmetrical amperes interrupting capacity at circuit voltage as indicated by the schedules but in no case less than 10,000 RMS symmetrical amperes. However, the minimum interrupting rating of circuit breakers used as feeders and branches shall be in accordance with prescribed UL recognized series connected circuit breakers combinations. All electrical equipment using these UL recognized circuit breaker combinations shall be clearly marked indicating same. NEMA ratings are not acceptable in lieu of UL ratings. Breakers shall be labeled as required by the NEC. Provide with mechanical screw type removable connector lugs, AL/CU rated.

2. Circuit breakers shall be as manufactured by General Electric, Square D, or Westinghouse.
3. Circuit breakers shall be positively identified and panels properly marked.

**2.07 MANUFACTURED SUPPORTING DEVICES**

A. General: Provide supporting devices, complying with manufacturer's standard materials, design and construction in accordance with published product information, and as required for a complete installation, and as herein specified.

B. Supports: Provide supporting devices of types, sizes and materials indicated, and having the following construction features:

1. Riser Clamps: For supporting two-inch and larger rigid metal conduit; black steel; with two bolts and nuts, and four-inch ears; approximately 510 pounds per 100 units.
2. Reducing Couplings: Steel rod reducing coupling, 1/2" x 5/8"; black steel; approximately 16 pounds per 100 units.
3. I-Beam Clamps: Black steel, 1-1/4" x 3/16" stock; 3/8" cross bolt; flange width 2"; approximately 52 pounds per 100 units.
4. Two-Hole Conduit Straps: For supporting 3/4" rigid metal conduit, galvanized steel; 3/4" strap width; and 2-1/8" between center of screw holes. Strap shall have back plate to hold conduit 1/4" from the wall.
5. Hexagon Nuts: For 3/8" rod size; galvanized.
6. Round Steel Rod: Black steel; 3/8" diameter; approximately 30 pounds per 100 feet.
7. Offset Conduit Clamps: For supporting 2" rigid metal conduit; black steel; approximately 200 pounds per 100 units.
8. Anchors: Provide anchors of types, sizes and materials indicated; and having the following construction features.
  - a. Lead Expansion Anchors: 1/2"; approximately 38 pounds per 100 units.
  - b. Toggle Bolts: Springhead; 3/16" x 4", approximately five pounds per 100 units.

**2.08 GROUNDING / BONDING**

A. Grounding / Bonding:

1. Provide connectors, terminals, lugs and clamps for all new equipment. Grounding accessories shall be as manufactured by Burndy, Copper Weld or Blackburn.
2. All equipment shall conform to UL 467 and shall be labeled for their intended usage.
3. All equipment shall be grounded / bonded in accordance with the National Electrical Code.

**SECTION 16820  
60 HZ ELECTRICAL REQUIREMENTS (Cont'd)**

**2.09 TRANSFORMERS**

- A. Indoor transformers shall be general purpose dry type in an indoor enclosure. Outdoor transformers shall be provided with a weatherproof (NEMA-3R) enclosure, pad mounted. Indoor and outdoor transformers shall be K rated and have copper windings with class "H" or better insulation. Maximum coil rise temperature shall not exceed 150°C for the rated transformer capacity based on 40°C maximum ambient. The transformers shall conform to National Electrical Manufacturers' Association (NEMA) Standard ST 1. Full-capacity NEMA standard taps shall be provided with two (2) 2-1/2 percent taps below and two (2) 2-1/2 taps above the normal primary voltage.
- B. Transformers rated more than 15 KVA shall be provided with four (4) 2-1/2 percent taps below and two (2) 2-1/2 percent taps above the normal primary voltage. Transformers shall be quiet type with average sound level not exceeding the following:

Transformer Rating Average Sound Level

<u>(KVA)</u>	<u>(Decibels)</u>
0-9	37
10-30	41
31-112-1/2	45

- C. Audible-sound-levels tests shall be made in accordance with NEMA Standard ST 1. Transformers with sound levels greater than 45 decibels shall be installed on resilient vibration-isolating mountings to prevent amplification of sound.
- D. Dry type transformers shall be as manufactured by Square D/Sorgel, General Electric Company, or Westinghouse.

**PART 3 – EXECUTION**

**3.01 PAINTING OF EQUIPMENT**

- A. Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test.

**3.02 FIELD APPLIED PAINTING**

- A. Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria.

**3.03 NAMEPLATE MOUNTING**

- A. Provide number, location, and letter designation of nameplates indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

**SECTION 16820**  
**60 HZ ELECTRICAL REQUIREMENTS (Cont'd)**

**3.04 INSTALLATION OF EQUIPMENT**

- A. Mount conduit and equipment as shown on drawings and in accordance with the NEC. Provide all materials, fittings, equipment and labor necessary for the complete installation of the electrical conduit, motor starters, panels, etc.
  
- B. Coordinate with other work including motor and electrical wiring/cabling work, as necessary to interface installation with other work.

## SECTION 16830 - ELECTRICAL IDENTIFICATION

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.02 SUMMARY

- A. The work included under this Section consists of furnishing and installing engraved nameplates or other means of identification on all major units of 400 Hz equipment.

### PART 2 - PRODUCTS

#### 2.01 ELECTRICAL IDENTIFICATION MATERIALS

##### A. Equipment:

1. The following items shall be equipped with nameplates: All control panels, panelboards, and gate boxes.
2. Nameplates shall adequately describe the function of the particular equipment involved. Where nameplates are detailed on the Drawings, inscription and size of letters shall be as shown and shop drawing shall be submitted for approval.,
3. Nameplates for equipment on normal power only shall be laminated phenolic plastic, black front and back with white core, with lettering etched through the outer covering. White engraved letters on black background. Attach with plated self-tapping screws or brass bolts.
4. Nameplates for equipment that is also supplied from standby power shall be laminated phenolic plastic, red front and back with white core, with lettering etched through the outer covering. White engraved letters on red background. Attach with plated self-tapping screws or brass bolts.

##### B. Empty Conduits:

1. Each end of each pull rope shall be tagged to identify the conduit system and the other end of the pull rope. Each tag shall contain, but not be limited to, the following information:
  - a. Conduit system name (e.g. "400 Hz").
  - b. Gate name (e.g. "Gate D11").

## SECTION 16830 - ELECTRICAL IDENTIFICATION (Cont'd)

### PART 3 - EXECUTION

#### 3.01 APPLICATION AND INSTALLATION

##### A. General Installation Requirements

1. Install electrical identification products as indicated, in accordance with manufacturer's written instructions, and requirements of NEC.
2. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.
3. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.

##### B. Equipment/System Identification: Install engraved plastic-laminate sign on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication/control/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Provide text matching terminology and numbering of the contract documents and show drawings. Provide signs for each unit of the following categories of electrical work:

Panel boards, electrical cabinets and enclosures  
Access panels/doors to electrical facilities.  
Gate boxes

##### C. Install signs at locations indicated or where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate substrate.

### PART 4 – MEASUREMENT AND PAYMENT

#### 4.01 MEASUREMENT

##### D. There will be no separate measurement for payment of work in this section.

#### 4.02 PAYMENT

##### C. There will be no separate payment for the work in this section. This work shall be considered incidental to the component of associated work.

## SECTION 16840 - ELECTRICAL SUPPORTING DEVICES

### PART 1 – GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and, other specification sections bound within, apply to this Section.

#### 1.02 SUMMARY

- A. Extent of supports, anchors, sleeves and seals are indicated on the Drawings and specified in other Electrical sections, or as required by other equipment installation.
- B. Types of supports, anchors, sleeves and seals specified in this section include the following:
1. Riser clamps.
  2. I-beam clamps.
  3. Two-hole conduit straps.
  4. Round steel rods; threaded rod.
  5. Lead expansion anchors.
  6. Toggle bolts.
  7. Wall and floor seals.

#### 1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of supporting devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than three years.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURED SUPPORTING DEVICES

- A. General: Provide supporting devices, complying with manufacturer's standard materials, design and construction in accordance with published product information, and as required for a complete installation, and as herein specified.
- B. Supports: Provide supporting devices of types, sizes and materials indicated, and having the following construction features:
1. Riser Clamps: For supporting two-inch and larger rigid metal conduit; black steel; with two bolts and nuts, and four-inch ears; approximately 510 pounds per 100 units.
  2. Reducing Couplings: Steel rod reducing coupling, 1/2" x 5/8"; black steel; approximately 16 pounds per 100 units.
  3. I-Beam Clamps: Black steel, 1-1/4" x 3/16" stock; 3/8" cross bolt; flange width 2"; approximately 52 pounds per 100 units.
  4. Two-Hole Conduit Straps: For supporting 3/4" rigid metal conduit, galvanized steel; 3/4" strap width; and 2-1/8" between center of screw holes. Strap shall have back plate to hold conduit 1/4" from the wall.

## SECTION 16840 - ELECTRICAL SUPPORTING DEVICES (Cont'd)

5. Hexagon Nuts: For 3/8" rod size; galvanized.
  6. Round Steel Rod: Black steel; 3/8" diameter; approximately 30 pounds per 100 feet.
  7. Offset Conduit Clamps: For supporting 2" rigid metal conduit; black steel; approximately 200 pounds per 100 units.
  8. Anchors: Provide anchors of types, sizes and materials indicated; and having the following construction features.
    - a. Lead Expansion Anchors: 1/2"; approximately 38 pounds per 100 units.
    - b. Toggle Bolts: Springhead; 3/16" x 4", approximately five pounds per 100 units.
- C. Sleeves and Seals: Provide sleeves and seals, of types, sizes and materials indicated; and having the following construction features:
1. Wall and Floor Seals: Provide factory-assembled watertight wall and floor seals, of sizes required; suitable for sealing around conduit, pipe, or tubing passing through concrete floors and walls. Construct with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.

## PART 3 - EXECUTION

### 3.01 INSTALLATION OF SUPPORTING DEVICES

- A. Install hangers, anchors, sleeves and seals as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA, NEC and ANSI/NEMA for installation of supporting devices.
- B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.
- C. Install hangers, supports, clamps and attachments to support conduit properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports with maximum spacing indicated.

**SECTION C  
GENERAL TERMS AND CONDITIONS**

- 1) A PDF version of the General Terms and Conditions (00700) can be viewed on the following web link:

[https://purchasing.houstontx.gov/Construction/Construction\\_General\\_Conditions\\_October\\_2006.pdf](https://purchasing.houstontx.gov/Construction/Construction_General_Conditions_October_2006.pdf)

- 2) A PDF version of the Supplementary Conditions (00800) can be viewed on the following web link:

[https://purchasing.houstontx.gov/bids/C23455/Supplementary%20Conditions%20\(00800\).pdf](https://purchasing.houstontx.gov/bids/C23455/Supplementary%20Conditions%20(00800).pdf)

- 3) A PDF version of the following Drawings can also be viewed on the following web Link:

1)	G0001	<a href="#">Cover Sheet</a>
2)	G0002	<a href="#">Project Staging</a>
3)	C0001	<a href="#">Terminal D Passenger Loading Bridge Plan</a>
4)	C0002	<a href="#">Gate D4 Passenger Loading Bridge Plan</a>
5)	C0003	<a href="#">Gates D7 and D8 Passenger Loading Bridge Plan</a>
6)	C0004	<a href="#">Gates D9 and D10 Passenger Loading Bridge Plan</a>
7)	C0005	<a href="#">Gates D11 and D12 Passenger Loading Bridge Plan</a>

**SECTION D  
EVALUATION MATRIX**

The City may award a contract to the bidder whose Bid represents the best value to the City. In determining the best value, the City will evaluate each Bid on the basis of the following criteria:

A	Experience & Reputation of Bidder	35%
B	Price	30%
C	Bidder's ability to meet or better project milestone	20%
D	Bidder's Financial Stability	10%
E	MWBE Participation	5%
	<i>Total %</i>	100%