SECTION 34 77 13 PASSENGER BOARDING BRIDGE (PBB)

PART 1 – GENERAL

1.01 SUMMARY OF SCOPE

A. General – The intent of this guide specification is to describe the design requirements, quantities, performance and maintenance properties of the passenger boarding bridges (PBB) for the **Passenger Boarding Bridges Design/Build Services** project at Cleveland Hopkins International Airport, Cleveland, Ohio. This procurement shall be performed by the Design Builder selected for the performance under this contract. This document is a guide specification for the design, procurement, and installation of passenger boarding bridges as required by the Department of Port Control (Department). The Design Builder's work shall include the following:

1. Passenger Boarding Bridges: Provide apron drive passenger boarding bridges, complete including all structural, support, rotunda foundation, anchor bolts, mechanical, electrical and finish requirements including connection to the Terminal Building to serve the aircraft mix indicated in the Design Performance Criteria.
2. Fixed Walkway Section (if utilized): Provide fixed walkway sections including connection to the Terminal building. The fixed walkway tunnel extensions shall meet all structural, dimensional, and finish requirements specified for the passenger boarding bridges.
3. Point-of-Use Preconditioned Air Units: Provide preconditioned air equipment units as a complete system installed and supported under the passenger boarding bridge with PBB manufacturer approved mountings.
4. Aircraft Ground Power / 400 Hz Equipment Converters: Provide 400 Hz equipment converters, including Cable Hoist, as a complete system installed and supported under the passenger boarding bridge with PBB manufacturer approved mountings. The 400 Hz equipment shall supply both 400Hz and 28VDC for regional aircraft.
5. Potable Water Delivery Systems: Provide ground mounted, freestanding potable water units as a complete system adjacent to the PBB rotunda column.

1.02 APPLICABLE CODES, STANDARDS, REGULATIONS AND REFERENCES

A. These criteria requirements represent the minimum required constructed and performance characteristics of passenger boarding bridges, fixed walkways, and associated elements provided in this project.

B. The passenger boarding bridges, fixed walkway, and associated elements shall be designed to conform to all federal, state and municipal codes and regulations as applicable to the State of Ohio, Cleveland Hopkins International Airport, and the City of Cleveland which are in effect at the time of manufacture. All standards and codes referred to throughout this specification will be of the latest edition or revision in effect unless otherwise indicated.

C. PBBs and fixed walkways shall meet the requirements of the National Fire Protection Association Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways, NFPA 415, current edition.

D. The design, fabrication and installation shall conform to current applicable state and national (State of Ohio and the United States) Codes and Regulations and Industry Standards, including, but not limited to the following:

1. Structural: All structural design and fabrication shall conform to the following:

   a. International Building Code (IBC of the latest edition.)
   b. American Institute of Steel Construction (AISC) Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings.
   c. American Welding Society (AWS) Standards.
   d. Structural Design and Corrugated Steel Panels based on Van Karmon Theory and on buckling studies by Peterson and Card.
   e. National Plywood Association.

2. Mechanical: All mechanical components and design shall conform to the current recommendations and standards established by the following:

   a. Society of Automotive Engineers (SAE).
      1) J429 Mechanical and Material Requirements for Externally Threaded Fasteners.
   b. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).
   c. American Society of Mechanical Engineers (ASME).

3. Electrical: All equipment and methods of installation shall conform to the rent applicable requirements and recommendations of the following:

   a. NFPA 70 - National Electric Code (NEC), with modifications as adopted by the Authority Having Jurisdiction.
   b. National Electrical Manufacturers Association (NEMA).
      1) NEMA 3R – Rainproof and Sleet (Ice) Resistant.

4. Paint: Surface preparation and painting of the passenger boarding bridges and fixed walkways shall conform to the current guidelines and standards of the Steel Structures Painting Council (SSPC).
   a. SP1 - Solvent Cleaning: Removes oil, grease, soil, drawing and cutting compounds.
   b. SP3 - Power Tool Cleaning: Removes loose material. Not intended to remove all.
   c. SP6 – Commercial Blast Cleaning: Two-thirds of each square inch free of all visible surface defects.

E. Design, fabrication and construction, including all manufactured components, fittings and hardware, shall be in U.S. Standard Units.

F. The design, fabrication and installation shall conform to current material specifications, including, but not limited to the following:

1. American Society for Testing and Materials (ASTM):

   a. A36 - Carbon Structural Steel.

b. A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
c. A307 - Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength.
d. A311 - Cold-Drawn, Stress-Relieved Carbon Steel Bars Subject to Mechanical.
e. A325 - Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
f. A449 - Quenched and Tempered Steel Bolts and Studs.
g. A490 - Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength.
h. A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing.
i. A514 - High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable.
j. A517 - Pressure Vessel Plates, Alloy Steel, High-Strength, Quenched and Tempered.
k. A569 - Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip.
l. A570 - Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.
m. A572 - High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
n. A576 - Steel Bars, Carbon, Hot-Wrought, Special Quality.
o. A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy- Coated (Galvannealed) by the Hot-Dip Process.
p. A1011 - Steel, Sheet and Strip, Carbon, Structural High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
q. D2047 – Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine
r. D2240 - Standard Test Method for Rubber Property - Durometer Hardness.
s. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
t. E648 - Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
u. F3125 – High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 and 150ksi Minimum Tensile Strength.

1.03 QUALITY ASSURANCE

A. Qualifications:

1. The Design Builder shall provide evidence of successful delivery in design-build terminal construction and have a minimum of at least five (5) years of qualified experience in the design, fabrication, and installation of PBBs as specified herein.
2. The PBB manufacturer shall provide a minimum of five (5) client references for similar passenger boarding bridge design and installation projects.

B. Materials and Methods of Construction. All materials and components furnished shall be new and free from defects.

C. Quality industry standard workmanship and methods shall be employed in the manufacture of the passenger boarding bridges, fixed walkway, and all related equipment. The Department shall have the right to inspect all materials and workmanship and reject any or all work they deem to be unsatisfactory.

1.04 PROJECT/SITE CONDITIONS

A. The Design Builder shall prepare and submit to the Department drawings that indicate the location of each PBB and/or fixed walkway foundation and types of aircraft at each gate. The

submittal shall also present the PBB corridor slope when connected to the lowest and highest sill heights for the aircraft listed in the Design Performance Criteria. The Design Builder shall be responsible for verifying all locations and elevations (rotunda foundation in relation to aircraft position, for the mix of aircraft serviced at each gate), and shall advise the Department of any conflict or code violation (such as excessive slope, lack of serviceability, etc.) prior to beginning the fabrication of the passenger boarding bridges.

1.05 WARRANTY

A. Provide special project warranty agreeing to replace, repair or restore defective materials and workmanship of passenger boarding bridge and related elements and work during the warranty period. This warranty shall be in addition to, and not a limitation of, other rights the City of Cleveland may have against the terms of the Contract.

1. Warranty period is 24 months following the date of final acceptance in writing by the Department of each passenger boarding bridge.

1.06 DESIGN PERFORMANCE CRITERIA

A. The Design Builder shall prepare a design for the installation of passenger boarding bridges at the Gates prescribed by the scope of this project. The Design Builder shall design, procure, and install passenger boarding bridges which conform to the fleet mix, gate dimensions, and provide a useful transition for passengers concurrent with Professional Standard Care and Industry standard. Existing passenger boarding bridges to be removed shall be removed from airport property and become the property of the Design Builder except for Gate A3.

1. *Exception*: The Design Builder shall return the Passenger Boarding Bridge at Gate A3 to the Department. This PBB shall remain the property of the Department. The Department shall provide instructions to the Design Builder as to the transfer of the PBB to their storage facility or to relocate it to another gate.

2. The Department shall have the right to obtain all parts and materials off the old bridges to be removed. The Design Builder shall retain any spare parts on the removed PBBs the requested by the Department prior to removing the PBB off the airport property.

3. The Manufacturer shall have the capability of providing and maintenance agreement with the Department of up to 5 years from the date of substantial completion. The terms of the maintenance agreement shall be negotiated between the Manufacturer and the Department at the time of procurement. The Design Builder may coordinate the procurement of the maintenance agreement but shall not be liable to its execution or performance of the Manufacturer's maintenance after substantial completion.

4. The Design Builder shall provide up to 6 additional cameras at each PBB. Contractor shall coordinate with airport security and Customs and Border Patrol (CBP) for camera specifications. One camera shall be designated for CBP use. Cameras shall be located as follows:

a. Rotunda looking toward cab.
b. Cab camera looking up at Rotunda
c. Cab Looking toward Aircraft Door

d. CBP camera at ramp level to see aircraft
e. Over service door
f. Ramp camera for airport operations.

5. Group V aircraft capable gates shall be equipped with a motorized wheelchair lift at the PBB. Two additional wheelchair lifts shall be provided, one at each concourse.

B. Fleet Mix:

1. Aircraft Fleet Mix: The PBB and gate parking for each gate shall be capable of parking an A321-NEO or B737-10MAX. Narrowbody gates shall also include regional jets and in between sizes.
2. Gate A14 is capable of ADG V and other widebody aircraft. The design aircraft is an A350-1000. Regional aircraft are not required at this gate.

PART 2 - PRODUCT

2.01 MANUFACTURERS

A. Manufacturers: The Department to review and verify accepted manufacturers. Subject to compliance with requirements, provide products by one of the following:

1. Oshkosh AeroTech Jetway Systems.
2. TK Airport Solutions, Inc.

2.02 MATERIALS AND GENERAL REQUIREMENTS

A. The Design Builder shall meet the following design requirements:

1. The PBB shall be an apron-drive, telescoping corrugated tunnel design with 2 or 3 tunnels.
2. Where the PBB rotunda is installed at the face of the building, it shall be supported entirely by its own structural support and no load or structural stress shall be transmitted to the aircraft or building.
3. The vertical dimension from the passenger boarding level finished floor to the top of concrete rotunda foundation and the horizontal dimension from the boarding level face of the building to the center of the rotunda column anchor bolt pattern shall be field verified by the Design Builder prior to ordering a PBB from the manufacturer. Field measurements shall be coordinated with the PBB manufacturer to ensure that the shop drawings meet field conditions prior to approval of the PBB construction.

B. Operational Limits:

1. The PBB cab shall be capable of moving to any point on the air carrier apron within its design operation range. The PBBs shall be capable of having simultaneous directional movements, extension-retraction, lateral motion, vertical elevation, and cab rotation.
2. The PBB shall be able to operate through its full operating range without operating in a slowdown mode. Slowdown limits shall be installed to prevent hard stops at the limits of

the PBB.

C. Operating Environment:

1. The PBB shall operate satisfactorily under ambient temperatures from -20°F to 125°F with winds up to 70 mph on wet apron surfaces.
2. The entire bridge shall be weatherproof when extended while parked to the aircraft and in the stowed position with the cab door closed. Equipment and controls Exposed to the weather shall be of weatherproof-type or housed in weatherproof enclosures. Electrical panels or cabinets mounted external to the bridge shall be equipped with heaters or electric components to control condensation where required by the installation environment.

D. Operating Instructions:

1. A weatherproof and water resistant placard outlining the bridge operating instructions shall be displayed in a prominent location in the cab of each bridge in plain sight of the Operator.
2. A qualified graphics expert shall prepare the placard and the displayed instructions.

E. Safety Requirements:

1. All equipment shall be designed to be fail-safe and all controls that regulate bridge motions (i.e., horizontal travel, vertical travel, and cab rotation) shall be of the dead-man type. Dead-man type shall mean controls that require the operator to apply constant pressure to be engaged. Once the pressure is released the control is disengaged.
2. All operating mechanisms (i.e., horizontal and vertical drive, cab rotation) shall be designed so the drive mechanism is locked when power fails or is shut off.
3. Positive mechanical stops or equal mechanisms shall be provided to prevent over-travel where any component might become disengaged from its guiding or restraining component. The positive stop shall be in addition to all limit switches provided to restrict over-travel during normal operating conditions, including drive wheel steering motions and cab rotation. This does not apply to tunnel rotation which shall have dual limit switches. Mechanical stops shall be identified and detailed on the shop drawings provided by the PBB manufacturer.
4. The operator's position in the control cab shall be designed to provide the operator adequate visibility to position the boarding bridge with the cab weather door closed. Suitable enclosures, guard rails, and other restraint devices shall be provided to protect the operator from being pitched out the open end of the cab in case of sudden stops or inadvertent movements of the bridge when operated with the door open. A handhold shall be attached to the wall on both sides of the cab weather door.
5. Bogie wheel camera shall be installed underneath the PBB and the feed relayed to the operator consol. The camera shall be able to see the wheels, lift column, and entire safety zone for the operation of the PBB.

F. Maintenance Provisions:

1. Install bridge components with adequate access and appropriate fastener types to permit access by one person. If a component's weight requires mechanical assistance to lift, the component or assembly shall be provided with lift eyes, forklift guides, or other means of

providing a mechanical advantage. Components shall be simple, rugged and easily accessible for routine maintenance, lubrication, exchange and adjustment. Electrical cabinets shall be located so they are always accessible to maintenance personnel standing at ground level without the use of a ladder, regardless of the vertical position of the bridge. Clearance for electrical panels shall meet the requirements of the NEC 110.26.

2. Access panels, where required to gain access to equipment or maintenance areas, shall be sized to allow necessary tools and equipment to be inserted to complete the work. The panel shall be permanently attached to the structure by stainless steel hinges and fasteners required shall be permanently affixed to the panel.
3. Provide all product specific tools required for routine maintenance.
4. Modular components: Utilize standardized modular components that are readily available in the continental United States to provide rapid corrective measures of malfunctioning critical components. Critical bridge components shall be located to allow for ease of access and installation.
5. All hardware items required including, but not limited to, bolts, studs, nuts, washers and fasteners shall be provided in Inch-Pound or Metric unit sizes.
6. The manufacturer shall maintain an adequate inventory of all proprietary or vendor fabricated and modified parts 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 date of the last unit supplied.
7. All mechanical and electrical systems shall be protected from potential damage resulting from climatic conditions, falling objects or collision with aircraft service equipment and other moving vehicles.
8. Provide safety tie-offs on the centerline of the roof of the PBB for Maintenance tie-off meeting all requirements of OSHA.

G. Power and Communication Characteristics:

1. The PBB shall operate on a 480 volt, 3 phase, 3-wire, 60 Hz, 60 Amp circuit, with ground. A minimum of four spare conductors shall be included in the bridge control circuitry for possible future additions or changes to the control system.
2. Provide transformers and circuit breakers as required to transform the 480 volts, 3 phase power for the bridge drive to 120/208 volt or 120/240-volt power for the bridge lighting and other power distribution and controls on the bridge.
3. All exterior electrical components shall be housed in weather-tight and corrosion resistant enclosures.
4. Provide sufficient cable lengths to reach the panel board or disconnect switches mounted on the face of the building wall at the apron level.
5. Provide strain relief devices on all unsupported cables.
6. Provide cabling for the following across each bridge: Bridge drive, bridge controls, bridge lights, controls, installation of 400 Hz frequency converter and preconditioned air point-of-use systems. Cables shall be flexible copper.
7. Rotunda Column Grounding: Provide a grounding stud on the rotunda base plate and attach grounding system rod in accordance with NEC and local codes.
8. Electrical Components:

    a. General: All electrical equipment and components shall be manufactured in Inch-Pound units and conform to installer recommendations and standards listed in the

Quality Assurance Article and elsewhere in this section.

b. Electrical Junctions: All electrical junction points and connections within the boarding bridge shall be made directly to terminal strips, not by means of plug-type connections or splices.

   1) Power cables shall be hardwired from the PBB directly to the disconnect switch mounted on the rotunda pedestal.
   2) 480/277V 3PH power provided to disconnect from building.
   3) Electrical or communication service conduit shall not be permitted on the exterior sides of the PBB.
   4) All cables and wiring shall be installed in cable carrying devices provided by the PBB Manufacturer and installed by the Design Builder.
   5) All electrical switch and receptacle device plate covers shall be stainless steel and shall match the device configurations, and on exposed wiring shall exactly fit the outlet box dimensions.

c. All electrical circuitries shall be successfully tested before the unit leaves the manufacturer's plant with certified testing.

d. Primary Power: The main primary power "ON" indicator light shall be located on the operator's control panel adjacent to the power "ON/OFF" control switch.

e. Anti-Chafing Devices: Whenever electrical cables are required to slide or move, anti-chafing devices shall be provided. Acceptable anti- chafing devices include grommets, flexible sleeves and jackets, and other similar approved devices.

f. Identify all cables with wire/cable identification bands on both ends. Bands shall be pre-numbered plastic coated style or type-on style with clear plastic self-adhesive cover flap, numbered to show circuit identification numbers indicated on shop drawings.

g. All J-boxes shall be labeled with engraved placards to indicate usage (e.g., Bridge Power).

h. Breakers in the raceways or J-box shall be capable of being re-set from a locked box located on the side of the bridge, accessible from the service stairs and labeled appropriately.

9. Electrical Control Elements:

   a. Primary power for the PBB will be supplied from the building by a 480 volt, three phase, three wire, 60 Hz non-fused disconnect. Provide disconnect sizes coordinated with Electrical Contractor and appropriate to the demand load required by the Pre-Con Air, 400Htz and Bridge Power. Transformers shall be supplied and installed by the Design Builder. Power for the PBB and other related equipment shall be separately supplied from the rotunda mounted disconnects. Include a separate disconnect switch for each service (PBB, PCA, and other related equipment) at the rotunda and provide separate power cabling from the rotunda to the cab.

   b. Disconnect Panels shall be supported top and bottom by painted steel brackets welded to the rotunda column. Brackets shall not protrude more than 2 inches beyond end of panels.

   c. The electrical disconnect panel and transformer shall adapt the specified building power to the PBB's electrical requirements and shall be provided and installed by the Design Builder and shall be mounted on the rotunda support column. Disconnect panel shall be

located in a weatherproof rated NEMA 3R.

H. Mechanical Characteristics:

1. Mechanical Design and Components:

a. Only standard components readily available in the continental United States, manufactured in Inch-Pound standard units and conforming to installer recommendations and standards listed in the Quality Assurance Article shall be used.
b. All operating mechanical components shall be assembled and tested before the unit leaves the manufacturer's plant. The Department reserves the right to witness all testing.

2.03 PERFORMANCE REQUIREMENTS

A. The telescoping tunnel shall permit servicing of all commercial jet aircraft with door sills within the range of 5'-4" to 16'-11" above the apron. Service to the maximum sill height shall be provided at the minimum and maximum extensions from the rotunda. Service to the minimum sill height shall be provided at tunnel extensions which provide slopes which fall within the maximum slope range.

B. Telescoping Tunnel Slope: Maximum slope shall be 8.33% (1:12) measured from the vertical hinge point at the rotunda to the center point of the adjustable cab floor (except at the transition ramps), for each aircraft type serviced.

C. Cab Rotation: The cab shall be designed to rotate a total of 125 degrees (92.5 degrees counterclockwise and 32.5 degrees clockwise from center) at a maximum speed of 145 degrees per minutes (2.41 degrees per second) in either direction.

D. Bridge Rotation: The rotunda shall permit the entire unit to rotate 175 degrees (87.5 degrees clockwise and 87.5 degrees counterclockwise).

E. Drive Wheel Rotation: Steer angle shall be 180 degrees in place and in motion. Steer speed shall be adjustable from 16-degrees minimum to 42-degrees per second maximum.

F. Vertical Lift Speed: 2.5 feet per minute (fpm) to 4 fpm as measured at the cab spacer.

G. Drive Speed: The drive system shall permit the unit to extend/retract and rotate to any point within its operating envelope at a variable speed between 0 and 90 fpm.

H. Deceleration: The horizontal drive system shall include a decelerator device to reduce or eliminate shocks when approaching maximum and minimum extension, or when horizontal travel is stopped or reversed suddenly, for protection of the equipment and passenger boarding bridge operator.

I. Cab/Aircraft Threshold Auto leveling

1. The boarding 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 boarding varies.
2. It shall function with equal reliability for all aircraft, regardless of the door location or fuselage contour.
3. The wheel type leveling sensor shall be located on the right side of the cab area within full view of the operator.
4. The rotary sensor shall be deployed when the "AUTO" position is selected on the Master Switch.
5. "DANGER DO NOT TOUCH" shall be printed in red letters on the wheel hub.
6. The auto level arm shall be mounted so that the position of the arm cannot be loosened when engaged on the aircraft.
7. The system shall stop vertical travel and sound an audible alarm in the event the system does not neutralize within a pre-set adjustable distance (1 inch to 4 inches).
8. The audible warning device shall be installed at the console and at the rotunda, or walkway, whichever is closest to the terminal door.
9. The auto leveler circuit shall include a sustained travel timer.
10. The timer shall limit auto level operation to a maximum of 6 seconds.
11. If the separation exceeds the set time limit a fault condition is assumed, all motor power shall be disconnected, audible and visual alarms shall be energized.
12. The main auto level sensing switch shall be activated upon a 5-degree auto level wheel rotation.
13. The auto level switch shall have a cover.
14. System reset shall be by returning the auto level switch to the "OFF" position.

2.04 STRUCTURAL DESIGN AND SUPPORT ELEMENTS

A. Loads: In addition to the dead loads and dynamic effects caused by movement, the entire passenger boarding bridge shall support the following minimum loads, unless the governing building code prescribes more severe requirements. These loads may be applied in total or in part, singularly or simultaneously. The design shall be based on the combination that imposes the most adverse loading.

1. Live load (Extended or Retracted): 40 lb./sq. ft. over entire floor area.
2. Wind load:
    a. Retracted and stowed: 25 lb./sq. ft., or an approximate wind velocity of 90 mph or greater if required by the local building code.
    b. Operational: 12.5 lb./sq. ft., or an approximate wind velocity of 70 mph.
3. Roof live load: 25 lb./sq. ft. and the ability to concurrently support a 250 lb. person at any location on the roof.
4. Equipment minimum loads (approximate), to be verified by the Design Builder:
    a. Preconditioned Air Unit (PCA): 3,500 lbs.
    b. 400 Hz Power Unit: 1,400 lbs.
    c. 400 Hz Cable Hoist: 600 lbs.
    d. 28 VDC Cable Hoist: 600 lbs.
    e. Potable Water Cabinet.

f. Baggage Slide.

5. The structural design shall provide sufficient torsional rigidity to minimize sway when the boarding bridge is brought to a gradual stop.
6. All mechanisms for actuating, guiding and restraining the boarding bridge and its components shall be designed to minimize the noise, deflection, and vibration apparent to passengers. No operating vibrations or loads shall be transmitted to the building.
7. The Design Builder shall verify the structural suitability of the design of the PBB rotunda foundations. This verification shall be based on the load information received from the manufacturer for each PBB model and based on actual field measurements, previous record drawings, and available design reports. The Design Builder shall advise the Department of any deficiencies or conflicts prior to beginning the fabrication of the PBBs.
8. New foundations shall be designed by a structural engineer licensed in the State of Ohio.
9. Existing foundations if reused shall be validated for the load of the new PBB and calculations showing the acceptance of the existing foundation shall be signed by a structural engineer licensed in the State of Ohio. Existing foundation shall be validated by field measurements by the engineer and examination of existing record drawings provided by the Department. If the existing foundation is found to be inadequate for the design loads provided by the PBB manufacturer, the Design Builder shall design and install a new foundation to meet the design requirements.
10. Foundation design/validation shall occur prior to the PBB manufacturing by the manufacturer.

2.05 BRIDGE ASSEMBLY ELEMENTS

A. Rotunda Assembly:

1. Corridor:

a. The rotunda entry corridor shall be a fixed rectangular tunnel at a constant height that connects the building with the rotunda, or in the case of the fixed walkway, connects the fixed walkway with the rotunda.
b. The rotunda entry corridor shall be cantilevered from the rotunda column to the building face. The entry corridor shall not rest against the building. A minimum of 3 inches shall be separated from the building face and the entry corridor.
c. Provide flashing to create a weather-tight connection between the rotunda entry corridor and the building. Flashing shall be sloped so as not to trap or pond water. Flashing shall also be installed on the interior. Flashing shall be continuous to provide a weather tight seal around the entire periphery between the bridge and the building, and to allow independent thermal movement of building structure, and shall meet the requirements of NFPA 415, current edition.
d. Building Door Threshold: Install a threshold at the building door/boarding bridge interface that allows for bridge movement. The threshold shall be aluminum diamond plate with abrasive finish and be ADA compliant.
e. Provide Security control to prevent unsecured access to the terminal through the rotunda door. Coordinate with Airport security for equipment.

2. Rotunda:

    a. The rotunda shall be a cylindrical structure supported on a tubular column. The rotunda floor shall remain level at all positions and shall be installed at the same elevation as the immediately adjacent floor elevation.
    b. Flap-type seals (dual) shall be provided for complete weather tightness between the rotunda and the hinged telescoping tunnels.
    c. Rotunda side curtain shall be galvanized steel and provided with adjustable tensioning devices, positive tracking system, and interior weather seals. Covers shall be full length with galvanized hinged access panel to allow access to curtain idled barrel grease fittings.
    d. Provide interior metal flashing to allow bridge movement.

3. Support Column: The rotunda column shall not be anchored or secured to the building, nor shall it transmit any live or dead loads or vibrations to the building. Verify foundation bolt pattern for installation of new rotunda support columns. Refer to structural for modifications required at existing PBB foundations. The Design Builder shall coordinate the design of the anchor bolt pattern configurations at required new foundations.

B. Telescoping Tunnels:

1. Telescoping tunnels shall be rectangular in cross-section, constructed of 14-gauge corrugated metal panels or 14-gauge galvannealed steel panels and hinged at the rotunda end for vertical motion. Minimum inside dimensions of the telescoping tunnels, not including handrails, shall be:

    a. Minimum Interior Width: 58”
    b. Minimum Interior Height: 82”
    c. Minimum Transition Ramp Width: 5'-8"

2. Where telescoping sections overlap, low angle transition ramps shall be provided to accommodate the difference in elevation. The inner tunnel transition ramp shall be hinged, and slope shall be less than 3 degrees relative to the tunnel centerline slope. Means shall be provided to adjust and maintain the ramp lip clearance to preclude carpet wear. Where the design permits the ramp lip to ride the carpet, it shall be sheathed in a smooth low friction material to minimize wear.
3. Provide tunnel roof with adequate provisions for positive water run-off.
4. Provide crown roof smoothly sloped to edge. Roof surface to be smooth. Corrugated roof shall not be allowed.
5. Design the telescoping tunnels and all other elements of the structure to prevent the accumulation of water at low points and pockets in the structure. Drain holes shall be provided where necessary to drain collection points in any operating height. Drains from internal gutters shall be carried clear of the structure and walkway and shall be sized to prevent blockage by accumulated debris.
6. Provide mechanical stops with elastomeric bumpers to prevent over-travel in the event of limit switch failure.
7. Maintain clearance between the telescoping tunnels such that no soiling or wear of the interior surfaces occurs as the result of movement.
8. Utilize flap-type dual seals between the individual tunnel assemblies to provide a weather

tight seal and to prevent the entrance of fire and/or smoke in the event of an apron fire. Exterior seals shall utilize EPDM rubber and ALFA fire material.

9. The telescoping tunnels shall be equipped with an exterior electrical cable conveyance system. The electrical cable conveyance system shall not be mounted on the exterior sides or top of the PBB. The electrical cable conveyance system can only be mounted on the underside of the exterior of the PBB or in a manufacturer supplied pantograph system. Cables shall be secured and neatly confined in an accessible and premanufactured cable tray system or pantograph which expands and contracts with the tunnel. This system must be accessible to maintenance personnel for inspection and maintenance.
10. The C Tunnel shall be designed and equipped to support Design Builder provided 400 Hz ground power and preconditioned air units.

C. PBB Cab:

1. The cab shall be equipped with a forward facing operator control station located behind a window to permit the operator full view of the aircraft contact area. Additional visibility shall be provided through windows on the left side of the control station.
2. Cab side curtains shall be galvanized steel slats. The left and right curtains shall be equipped with interior weather seals. The exterior metal curtain covers shall be full length, hinged and galvanized.
3. Weather door:
   Cab shall be equipped with swinging double doors with manufacturer's standard vision panels or an electric roll up door. The doors shall seal and secure the interior when the PBB is not in use. The clear width of double doors, if used, shall be minimum 43 inches when open. The clear width of electric roll up door, if used, shall be 60 inches when open. Operation of the PBB shall be possible without opening the doors.
4. The cab shall be rotated by a gear motor and chain drive operating on the circumference of the fixed circular floor section of the PBB cab. Adjustable limit switches and fixed physical stops shall control the limits of rotation.
5. Articulating Cab Floor with Side-Shift Cab:
   The aircraft end of the cab shall be provided with an automatic level device when the cab is rotated at an angle up to 95 degrees off the centerline of the bridge tunnels.

   a. The articulating cab floor shall level automatically and shall be equipped with a manual override control switch. The floor shall be capable of providing a level surface adjacent to the aircraft doorsill for passenger boarding bridge slopes from 10% to +10%.
   b. No portion of the cab floor shall exceed 8.33% slope in the direction of expected passenger traffic.
   c. The system shall include a double hinge floor. The maximum slope of this floor shall be limited to +/- 6.5 degrees (11.4%).

6. Spacer:
   Provide a spacer spanning the full outside width of the boarding bridge cab opening, along the front edge of the cab floor at the point of contact with the aircraft.

   a. Spacer installation and material shall not mark the aircraft skin and shall prevent any damage or abrasion of the aircraft skin when the bridge is in contact with the aircraft.
   b. The spacer shall provide bodily support when stepped upon and shall have a Shore A

Durometer hardness of 70 +/- 5 when measured in accordance with ASTM D2240.

c. The spacer material shall be an EPDM, or other suitable polymer, compounded to meet the fireproofing requirements of NFPA 415.
c. PBB motion control or limit devices mounted on the spacer shall be located at the extreme outboard ends or continuously across the spacer's face along its centerline.
d. Provide Safety Track or 3M anti-skid on C-channel between the cab floor and spacer.
e. No metal trim or structural element shall be capable of contacting the aircraft fuselage outside the canopy padding and/or spacer.
f. All bridges shall accommodate L1 and L2 doors of all listed aircraft. Note: Provide cutout in the cab spacer to miss the B737 pitot tube.

7. Provide an adapter cab floor to accommodate the CRJ and Embraer RJ's and Plug Type doors or storable handrails. The cab floor shall not preclude service to other aircraft up through B787 and larger where shown on the Construction Drawings. The cab floor shall be designed to provide a positive protection to the CRJ door. The floor shall be provided with a Side-Shifting Cab with leveling floor and side shift centering feature on the PBB. One button on the operator console is used to shift the cab portion in either direction from center of cab. The Side-Shift Cab shall shift up to 24-inches total travel from center of cab. The cab shall have a slide or movable floor that can move independently out towards the aircraft past the bumper of the cab and retreat away from the aircraft inward past the leading edge of the bumper. This feature provides a walkway, which allows passengers to board or deplane the aircraft without the need of a plank or other removable or replaceable device. Additionally, the cab shall have a flip-up floor panel to accommodate the stair cables for the CRJ aircraft. The cab shifting capability shall be independent of the PBB's main drive and independent of any tunnel of the PBB.
8. Electrical interlock sensors shall be provided to modify the operation of the PBB when in close proximity to the aircraft. These shall include, but not be limited to:

a. Reduce cab forward speed when within 6 to 10 feet of the aircraft.
b. Safety limit switches around the cab floor opening and on the leading edge of the moveable section of the aircraft spacer.
c. Built-in logic to ensure protection of the aircraft.

D. Aircraft Closure (Canopy):

1. Equip the aircraft end of the cab with an adjustable closure with folded accordion bellows to make a weather-tight seal against the aircraft. Canopy frame shall be seven bowsystem. Provide inner liner curtain that covers the canopy frame members.
2. The closure shall be able to enclose both the open aircraft door and doorway of all listed and shall include a B-737 spacer cut out and accommodate A-320 type doors.
3. The entire Aircraft Closure Canopy shall be designed to be water-resistant, withstand weathering, remain elastic and flexible between 0 degrees F and 125 degrees F, be tear-resistant, and meet fire resistance requirements of NFPA 415.
4. Each side of the aircraft closure shall be electrically controlled and adjustable to permit the seal to conform to critical aircraft contours to provide a weather- tight seal. The mechanism shall be designed to preclude excessive pressure on the aircraft fuselage.
5. Cushion pad seals shall be provided at the point of contact between the canopy and aircraft

fuselage to prevent denting and/or scratching of the aircraft skin or cabin and cockpit windows. This includes damage to rain diverters or troughs that may be located over the doors. The seals that contact the aircraft shall be segmented and attached to the main closure assembly by Velcro-type fastener strips.

6. Canopy supports or stiffening rods shall be thoroughly padded to prevent contact with the aircraft and protect canopy material when in its retracted position. The padding shall be firmly attached in such a manner that it will not slip, turn, twist, or distort from repeated usage. Allow replacement of the padding sides and top, and any inserts in sections, without replacing the entire canopy.
7. Changes in the position of the aircraft and/or passenger boarding bridge while the canopy is in contact with the fuselage shall not cause loads to be exerted on the aircraft skin. Pressure exerted by closure against the aircraft fuselage shall not exceed 2 psig. Dependence upon the automatic leveling device to prevent such an occurrence is not acceptable.
8. No chains, cables, or electrical wire shall penetrate the floor or wall structure and shall have adequate clearance, be protected, and securely fastened. Cables and electrical wire shall not be visible from the traveling public.
9. Cab seal shall be resilient bellows type. Tarpaulin types are not acceptable.
10. The canopy, when in its retracted position, shall be protected by a hood or other device to prevent water from laying in the folds of the canopy material when the bridge is not inuse. Exterior liner shall include a third strap made from the same material and at the same size as the existing end straps at center of top canopy liner, or other suitable method to prevent water ponding.

E. Service Assembly:

1. Provide a service door, stair and landing located on the right side of the cab. Door shall open outward.
2. Service door: The service door shall be hollow core, steel construction and shall meet or exceed a 3/4-hour fire rating. It shall have minimal nominal dimensions of 2'-6" x 6'-8" with half wire mesh upper window.

    a. The door shall be provided with a Simplex Unican 1000-1 Lock with five button combination lock with interior and exterior doorknob. If a key is required for the removal of the Lock Set, all lock cores shall be keyed the same. Provide ASSA key to match the existing airport security keys.
    b. Provide a 34" x door width less 2" stainless steel kick plate on both sides of the door.
    c. The door hardware shall be heavy duty industrial type (using stainless steel standard U.S. hinges and finish hardware), and it shall be provided with an automatic heavy duty door closer installed on inside of the door.
    d. A doorstop shall be provided to prevent damage to the passage set and/or door. Provide a latch to hold door in open position located on the second railing up from the floor.
    e. The door shall be constructed so the door and its components can be removed and reset or replaced for maintenance.

3. Service Platform: The service platform shall be constructed of open mesh (grip strut) steel grating equipped with tubular steel handrails on the outside perimeter in accordance with OSHA Standards. Provide an access ladder (OSHA Standard) to the cab roof, accessible from the service landing platform. Roof handrails at the roofs of the cab and largest tunnel section shall be included with the access ladder. All steel material shall have galvanized

dipped finish. Platform and access ladder is required even if roof access is not required for regular maintenance.

a. Unit deck at loading bridge platform shall be minimum 52' x 52" with minimum 42" height handrails/guard protection. Platform shall provide support equivalent to the loads designed for the bridge stair platform by the PBB manufacturer. Unit shall have a total weight up to 900 lbs., bridge platform loading of up to 390 lbs, and a load of 500 lbs. on the swivel casters. Unit shall have a demonstrated installation and service record with the PBB manufacturer.

4. Service Platform Roof Structure: Provide a tubular steel frame metal roof above the service landing platform area for weather protection at the end of the baggage conveyor chute. All steel material shall have galvanized dipped finish.
5. Provide a weatherproof light above the landing near the service door. It shall include a fifty (50) watt equivalent vapor proof LED lamp, with standard fittings, encased in a safety cage, and be installed in such a manner as to optimally illuminate the stairway and landing.
6. Service Stairs: The service stair assembly shall be galvanized steel and equipped with equal self-adjusting risers with open mesh steel treads (grip strut) and supported at the apron on minimum 6-inch diameter wheels.

a. The wheels shall have solid rubber tires designed to operate on concrete or asphalt pavement in elevated temperature conditions.
b. All steps shall have an equal rise, with a minimum tread width of 28 inches and a depth of 9-1/2 inches.
c. Both sides of the stair shall be equipped with tubular galvanized steel handrails of proper height to comply with applicable building codes and OSHA Standards.
d. Clear width between handrails shall be a minimum of 31 inches.
e. The service stair shall be fully usable at all boarding bridge elevations and positions.
f. Provide (2) sets of service stair spare tires and wheels (4 each tires & wheels).

F. Bag Slide:

1. Provide a bag slide unit designed to be mounted to an aircraft passenger boarding bridge next to the external stairs that lead from the ramp to the platform located next to the bridge crew door. The sole intended use of this unit is to transfer carry-on baggage from the top of the bridge floor level to the ramp.
2. Unit shall be securely fastened and move both vertically and horizontally with the movement of the bridge stair. The bag slide shall be an HDPE surface and attached to an aluminum or steel frame. All steel components shall receive a powder coat finish. All aluminum parts shall have a natural finish.
3. Bag slide shall be equipped with an aluminum rail or other means of preventing baggage from sliding onto the ground.

G. Service/maintenance stair and roof handrails shall be provided for OSHA- approved access to service equipment, as required to maintain equipment.

H. Drive Column: The drive systems shall be an electro-mechanical vertical lift system, and meet the criteria listed below:

1. Vertical Drive - Electro-Mechanical Lift System.

    a. The bridge shall be moved vertically by means of two recirculating ball bearing screw assemblies or two extra capacity electro-mechanical drive systems. Each assembly shall be independent of the other, with individual motors. Each assembly shall be capable of supporting the passenger boarding bridge with passengers on the interior of the bridge under full design load. The lifting mechanism shall hold its position at any elevation within the travel range with or without power supplied.
    b. For electro-mechanical drive system, the ball screw and ball nut shall be equipped with wiper brushes to remove grit or dirt from screw threads and a self-locking acme-type thread which will prevent unit collapse in the event of ball nut failure.
    c. For electro-mechanical drive systems, the vertical drive motors shall be AC induction motors with integral reducer and brake. The brakes shall be spring-applied and electrically released only when signal is received from the operator's console or the auto-level system. Motor covers shall be provided.
    d. The brakes shall hold securely at all elevations, without creeping, whether the bridge is in operation or not.
    e. For electro-mechanical drive systems, a fault detector shall sense differential motion of the ball screw assemblies. The fault detector circuit shall shut down the electrical power to the vertical drive motors and set the brakes independently of the operator if a fault is detected.
    f. For electro-mechanical drive systems, a tapered collar that prevents the screw from disengaging the ball nut shall be attached to the ball screw's lower end.
    g. Boarding bridge vertical rate of travel shall be a constant speed.
    h. Reference stripes shall be painted or mechanically fastened on the inner tube(s) to indicate column travel limits, both high and low.
    i. Backup emergency plunger-type limit switches shall be provided in the vertical circuit, for both high and low limits.
    j. Inspection holes in each column tube shall be provided to allow baroscopic inspection of the ball screw surface. All holes shall be aligned in inner and outer column tubes. Stainless steel cover plates shall be provided in outer tube.

2. Horizontal Drive - Electro-Mechanical:

    a. A variable speed electro-mechanical drive system shall provide horizontal travel of the passenger boarding bridge. The drive shall be two-wheeled with solid rubber tires.
    b. An AC gear motor shall independently drive each wheel. The gear motors shall be provided with integral brakes. Solid-state variable frequency motor controllers shall drive the AC motors. The controller shall provide built-in diagnostics to assist in trouble shooting. Motor covers shall be provided.
    c. A regenerative braking system shall allow the bridge to come to smooth, controlled stops. Integral electrically released spring actuated brakes shall be provided with each drive motor and shall lock the bridge in place whenever electrical power is cut off, either by moving the control lever to the neutral position or if power fails.
    d. Provide a manual override to release drive wheel brakes to permit towing the passenger boarding bridge into or out of position on the apron in case of power failure. The override system shall be mechanically interlocked to preclude normal operation with

the brakes locked out.

e. Connection lugs shall be provided to allow the bridges to be towed in the event of power failures.
f. Provide positive identification for both the front and backsides of the wheel bogie. Such identification shall be clearly readable by the operator while operating the control panel. Include instrumentation (a wheel bogie position indicator) on the control console.

3. Wheels and Tires:

a. Passenger boarding bridge wheels and tires shall be of sufficient width and surface quality to preclude damage to apron pavement and shall be designed to operate on concrete or asphalt pavement.
b. The tires shall be solid rubber type mounted to a cast steel wheel for use by passenger boarding bridges. Tires shall be manufactured of a rubber compound that will not chip or fray at the edges, and not be affected or damaged due to contact with oil, lubricating fluids, and/or fuels from aircraft and servicing equipment.
c. Only the wheel to axle hub bolts/nuts shall be able to be removed while the wheel is mounted on the wheel bogie. This shall preclude accidentally loosening the tire from the rim while still mounted on the wheel bogie assembly.

I. Control Console:

1. The operator's control console shall be designed to allow easy operation by personnel possessing no special skills and with minimum training. Controls shall have a "Point and Go" option for movement of the PBB as well as conventional maneuverability. The PBB shall have the capability to preposition for easy access to each aircraft in the gate fleet.
2. The controller shall be equipped with a manufacturer supplied Program Logic Controller.
3. The PLC shall be compatible with the airport Building Management System.
4. The console faceplate shall be made of a heat and scratch resistant material.
5. A placard outlining the bridge operating instructions shall be displayed in a prominent location in the cab of each bridge to be easily visible by the Operator.
6. All controls necessary for the operation and control of the boarding bridge are to be located on the control console and grouped on the control console faceplate in functional groups.
7. Provide interface with electronic SACS (security access control system) to enable controls when authorized credential are presented.
8. The following controls shall be located on the control console. All switches and/or push buttons shall be labeled. Each function shall be spelled out (e.g. "Canopy", Extend", Retract"):
   a. A "Power On" push-to-start button, labeled on the button.
   b. An "Emergency Stop" push/pull button
   c. A four (4) position lever arm or joystick to control all forward, reverse, steer right and steer left motions. Any variations to this shall be submitted to the Department for approval.
   d. Two individual push buttons marked "Raise" and "Lower" for controlling the vertical travel of the bridge.
   e. Two individual push buttons marked "Rotate Left" and "Rotate Right" for rotating the cab.
   f. Push buttons to independently control the adjustment of the left and right side of the bellows type aircraft enclosure.

g. A switch to control the floodlights that illuminate the ramp area under the aircraft and drive column undercarriage. Control lamps and switches shall be installed on the operator's console.
h. A switch to control the cab floor heater.
i. A switch to control the light in the cab.
j. A switch to change the adjustable cab floor operation from automatic to manual.
k. A pushbutton switch to control the adjustable cab floor while in manual mode.

9. Power and control circuit switches or combined power/control circuit switch shall be non-keyed, switch operated using a three position (i.e. OPERATE, OFF, and AUTO) locking switch device as follows:

a. The operator musth be able to switch to either the OFF or AUTO position.
b. Provide hinged Lexan cover to protect the console when not in use.
c. Provide lighted and labeled controls for all switches and indicators.
d. Console shall have a lamp test button to test all console lamps and alarms. Lamp test shall be enabled in the operator switch "OFF" position only and shall supply 110 volts to console lamps.
e. Controls: All passenger boarding bridge motion controls shall be the momentary contact (deadman) type. All motion controls shall be located logically relative to the function of the passenger boarding bridge being controlled. The control console includes the following control switches and indications. Electrical power and control schematic diagrams.
f. Provide exact location of electrical power and communications J-boxes.
g. Indicators: The control console shall have indicators that display the current status of the passenger boarding bridge. The passenger boarding bridge status shall be provided in accordance with the following:

1) Installed to indicate the height of the cab bumper from the ramp.
2) Calibrated to indicate the specific aircraft type that corresponds to the height of the cab.
3) Only aircraft serviced at the gate shall be displayed.
4) Provisions for the addition of future aircraft types shall be made.
5) The indicator needle or equivalent shall have a minimum movement of 3 inches for indicating the movement of the boarding bridge from its full up to full down positions.
6) A wheel position indicator showing the orientation of the wheels along the center of the tunnel, regardless of the cab rotational position.
7) A light shall indicate if the cab floor heater is On or Off.

h. Warning devices:

1) Swing Limits. Indicated by a Red Strobe Light and audible warning.
2) Slope Limits.
3) Auto Level (Red Strobe Light - Failure Indicator, Amber Light indicating Auto Level is energized and operating).
4) Vertical Column Fault lighted indicator/alarm on Control Console
5) for electro- mechanical drive systems with fault detector circuits.

6) Oversteer.
7) Warning Rotating Beacon under cab when bridge is in Operation Mode only.
8) 110-volt Travel Alarm Bell.
9) Auto Level Sustained Travel alarm horn mounted under cab.

10. Interlocks:

a. General: The control system logic shall preclude damage to circuits or mechanical systems due to simultaneous contrary control signals or an otherwise unsafe control signal combination.
b. Contrary Control Signal Interlock: All boarding bridge motion shall be precluded whenever contrary control signals (i.e., extend and retract) are activated simultaneously.
c. Control Console Doors: Provide safety interlock switches on all control console doors; upper console, console face and console front door.
d. Canopy Interlock: Interlock shall prevent all forward or reverse horizontal drive operation when canopy is lowered. All PBB motion, except auto-leveling, shall be possible only when the canopy is in a fully retracted position. Provide for a dead man- type mechanical override to permit the retraction only in case of mechanical emergency or bridge failure with the canopy not in the fully retracted position.
e. 400 Hz Interlock: Interlock shall prevent horizontal drive operation when the 400 Hz unit is engaged, and the hoist is lowered. The control console shall be equipped with warning horn and flashing light to indicate when:

1. 400 Hz hoist is lowered.
2. 400 Hz cable is engaged, and the unit is operating (to be independent of each other).

f. Limit Switches:

1. Electrical limit switches shall be provided on all PBB movement actuator systems, cab spacer and canopy system. These shall include fail-safe proximity limit switches activated near the end of horizontal and vertical travel. These switches shall de- energize their respective actuator systems when contacted.
2. Bridge extension and retraction: Provide two limit switches, one for slow down and one for stop.
3. Cab rotation: Provide limit switches to control the extremes of cab rotation.
4. Drive wheel: Provide limit switches to control oversteer of drive wheels.
5. Rotunda rotation: The rotunda shall be equipped with adjustable limit switches to control the traversable area of the bridge. If the bridge activates the limit switch, all power shall be disconnected, stopping the bridge. The limit switch located on the rotunda shall only be reset locally when activated.
6. When the 400 Hz power is energized all bridge motion (except for auto- leveling) shall be precluded.
7. Spacer Limit Switches:
   Provide spacer limit switch to stop forward movement of the PBB when aircraft deflects limit switch arms.

g. Upper Console: Cabinet or housing for AC drive packs shall be:

1. Waterproof.
2. Equipped with a service light.
3. Equipped with a thermostatically controlled heat strip.

h. Automatic Leveling:

1. PBBs shall be equipped with an automatic leveling device. The auto-leveling system shall automatically respond to small changes in aircraft elevation that occur during aircraft loading and unloading to maintain a constant relationship between the aircraft floor and the boarding bridge floor. The auto-leveling system shall function with equal reliability for all aircraft contours.
2. The auto-leveling system shall be engaged when the master switch is positioned to "AUTO".
3. The leveling system shall not exert any stress on the boarding bridge.
4. The leveling device actuating mechanism or sensor which contacts the aircraft shall be located on the right side of the cab behind the canopy actuator covers.
5. The leveling system shall function reliably on all aircraft specified regardless of door location, fuselage contour, and aircraft doorsill height and shall allow a range of adjustment of at least six inches up or down from a neutral position.
6. The auto-leveler circuit shall include an adjustable solid-state sustained travel timer. The timer shall limit the automatic leveler's continuous response in either direction to an adjustable range from 1.6 to 6 seconds. A fault condition shall be identified when the timer has tripped. Upon sensing of a fault condition, all motor power shall be disconnected, and audible and visual alarms shall be energized.
7. The circuitry shall include an audible alarm and a red warning light at the control station, and a red strobe light on the exterior base of the PBB in the general ramp area, which shall produce a distinctively different sound than any other on the passenger boarding bridge. Provide an additional auto-level warning horn mounted under the cab of the PBB. These warning systems shall be automatically activated by any movement of the PBB except when in the auto level mode. The orange rotating beacon shall illuminate when the switch is in the "Operate" position. When the timer circuit is interrupted, the vertical lift system shall automatically be locked in position and de-energized, and a vertical travel brake automatically engaged.

11. Exterior Lighting:

a. Service platform light shall be controlled by light switch located on the interior wall adjacent to the service stair access door.
b. Cab exterior cold weather LED light: Two bulb light.
c. Exterior flood lights: Weatherproof.
d. Provide two (2) adjustable (LED) flood lights with safety cages having a minimum intensity of three hundred (300) watts each and located on the exterior base of the bridgehead/cab and controlled from the control panel. Provide additional flood light to illuminate the area around the drive column, PC Air and 400Hz, and be controlled by a switch located on the control console.
e. Obstruction Light: Provide a 50 watt equivalent LED light on top of cab right side.
f. Interior Lighting: Lighting shall be controlled by three-way switches located at the cab and

rotunda or Terminal end of fixed bridge. All receptacle device plate covers shall be stainless steel. Lights shall be placed every eight (8) feet in the boarding bridge.

1) Lamps: Energy saving LED lights.
2) Light shall be provided for 0 F cold weather rated applications.
3) Tunnel: Energy saving LED lights.
4) Rotunda: Energy saving LED lights.

g. Emergency lighting ballast shall be provided in the following locations to operate when bridge power is lost. The red power indicating light shall be located in the tunnel light fixture.
h. Rotunda ceiling light.
i. A-tunnel middle and end.
j. B-tunnel middle and end.
k. C-tunnel middle and end.
l. Cab external light.
m. Fixed tunnel
n. Emergency LED Lamp Power Supply: Provide self-contained battery powered inverter unit for direct mounting in designated fluorescent fixtures. Provide unit with 120Vac input, fully automatic two rate charger, nickel-cadmium battery, automatic low voltage battery disconnects, AC "ON" pilot light, and test switch. Unit shall automatically transfer to battery supply on loss of normal AC power and operate one 4-foot 34-watt fluorescent lamp with a minimum output of 1100 lumens for 1-1/2 hours.
o. In addition to battery powered emergency lighting, provide PBB with emergency lighting connected to the building emergency power system.
p. Illumination Level: Intensity of illumination will be measured at the floor.
q. Tunnel and Cab: 25 footcandles average.
r. Control panel: 60 footcandles. Switched at control panel.
s. All lighting fixtures shall have adequate access for lamp replacement and fixture cleaning.
t. Provide 120V, 20-amp electrical circuit with conductors terminated in a weatherproof junction box located on the underside of the cab.
u. Provide electrical circuit to extend the building lighting circuit to power a bridge mounted sign located at the cab end. Provide a 277 volt, 20-amp circuit and conductors from the face of the building, under the passenger boarding bridge, to a weatherproof junction box located on the underside of the cab.

12. Insulation:

a. Provide R7.8 (standard insulation) in ceiling/roof and R8.3 insulation in the walls and corrugations.
b. Insulation materials shall not be exposed to the weather or applied with glues or tape.
c. All insulation materials shall be covered with appropriate weather resistant finish material.
d. Insulation shall be installed full width of ceiling with all areas insulated.
e. Insulation shall butt against light frame edges with separate piece over light fixture.
f. The design shall eliminate the possibility of condensation in the insulation that might cause unsightly water stains appearing on the interior finished surfaces and/or rust at the interface of the insulation and outer shell.

g. The use of asbestos or asbestos products as an insulation material or for any other use is not permitted.

13. Windows: Provide windows as follows:

a. Cab: Provide clear safety glass front window to permit operator at control console full view of the aircraft contact area. Provided a wire reinforced safety glass window to the left side of the control station.
b. Cab roll-upside curtains: Provide two wire-reinforced glass windows in every other panel, 1/4" thick x 1-3/4" wide x 12" long. The windows shall be in the low normal positions on the right side and high normal position on the left side.
c. Service door: Equip the door with a 1/4" thick x 14-7/8" wide x 2' 5-7/8" high wire reinforced glass window.

14. Utilities:

a. Convenience Outlets: Ground Fault Interrupter (GFI) duplex outlets (unswitched 120 volt, 1 phase, 15 amp) shall be located as follows:

1. A (building and aircraft end) and C Tunnels.
2. Left side wall of the cab, adjacent to the operator's control console.
3. Rotunda.
4. Drive column wheel carriage crossbeam.
5. Rotunda Column.

15. The apron drive bridge telescoping tunnels shall be equipped with an under-bridge cable carrier transport system or pantograph system for the 60 Hz power transmission cables, to the 400 HZ frequency converter.
    a. This system must be accessible to maintenance personnel for inspection and maintenance.

16. Provide illuminated signage identifying the gate number on each PBB.
    a. The sign shall be installed and supported on the roof of the rotunda and be visible by taxing aircraft.
    b. Text of the illuminated sign shall be minimum 36" height, Helvetica, medium font.

2.06 ACCESSORIES

A. Cab Safety Chain: Provide stainless steel link cab safety chain installed forward of the cab doors with red plastic sleeve.

B. Mirrors: Provide two 18-inch circular convex safety mirrors with stainless steel backing. Locate on the left side of the cab to enable the operator to have full view of the apron and drive wheels and on service platform railing to allow operator to view the bottom of the service stairs from the control console.

C. Handrails: Handrails shall be Americans with Disabilities Act (ADA) compliant (1-1/4" to 1-1/2" O.D.), stainless steel #4 finish, mounted at a height of 34" to 38" above floor surface, with a

clearance from the sidewall of 1-1/2" and with return ends. Provide handrails in the following locations:

1. A-tunnel, full length on the right side and left side.
2. Transition ramp areas, both sides of the tunnel. The handrail shall extend over the transition ramps and shall be sloped at a uniform dimension above the ramp.

D. Jack Stand: Provide one standard A-frame type jack stand structure with casters suitable to straddle and support the boarding bridge from the ground. It shall be designed to support the weight of each bridge for servicing undercarriage components, and the cab lifting mechanisms. The jack stand shall be delivered prior to substantial completion.

E. Tow Bar: Provide minimum of three (3) tow bars (painted red) designed and constructed to be stored, transported and connected to the boarding bridge undercarriage for towing of a disabled unit. Tow bar shall be configured for connection to a standard height hitch on a pickup truck.

2.07 POINT OF USE PRECONDITIONED AIR UNITS

A. Preconditioned Air Unit Requirements: See Specification Section 34 77 14:

2.08 SOLID STATE FREQUENCY CONVERTER – See Section 34 77 15

A. Solid State Frequency Converter: Provide 400 Hertz power and 28 VDC converters at each PBB to meet the following requirements:

1. Basis of Design Unit: Oshkosh Aerotech Jetpower 4 – Up to 2 Units as required (for point-of-use service at each gate), or approved equal
2. Input Volts: 120 kVA, 480 v, 3 Phase /170 amps
3. Unit Dimensions: 60" L, 8" H, 48" D
4. Weight: 1250 lbs.
5. Housing: Completely sealed unit with aluminum casing and structural steel internal frame.
6. Finish: To Match Passenger Boarding Bridge
7. Installation: Unit to be installed on underside of the non-telescoping PBB tunnel

2.09 AIRCRAFT POTABLE WATER CABINET – See Section 34 77 16

A. Aircraft Potable Water Cabinet: Provide Aircraft Potable Water Cabinet at each PBB to meet the following requirements:

1. Basis of Design Unit: Oshkosh Aerotech Jetflo Potable Water Delivery System, or approved equal
2. Input Volts: 115 volts AC, 60hz, 1 Phase
3. Cabinet Dimensions: 3'-0" L, 2'-9" H, 3'-2" D
4. Cabinet Construction: Six (6) sided, welded, double-wall construction throughout with 1" Polystyrene insulation between walls
5. Exterior Walls: 18 Gauge, Type 304 2b Stainless steel
6. Doors: Double door access
7. Installation: Unit to be installed adjacent to PBB rotunda column.

8. Piping shall consist of a pipe to supply potable water to the potable water cabinet, and a pipe to convey flush water produced from the potable water cabinet back to the building. All piping shall be of a material suitable for permanent exposure to sunlight, high and freezing temperatures, and other environmental conditions in which the piping will exist.
9. The Design Builder shall determine the appropriate size for each pipe and shall be responsible for making all connections to pipes at the building.
10. Cabinet hose shall have a self-winding motor and hose reel for easy access and storage of the water hose.
11. Water connections shall have a RPZ reduced pressure double check backflow preventer.

2.10 FINISHES

A. Exterior Finishes:

1. The exterior finish of PBBs and fixed walkway shall consist of the following:

   a. Hot roll/cold roll steel only commercial blast clean per SSPC SP6, profile 1.5-2.5 mils (37.5-62.5 microns).
   b. Prime surfaces in solvent free, high solids epoxy primer with semi-gloss, American Coatings Rustlock 2010 Series Epoxy (two components). Apply to a dry film thickness of 3 mils (75 micron) for galvanized surfaces. Apply to a dry film thickness of 8 mils (200 microns) for carbon steel surface surfaces.
   c. Finish: Topcoat roof only, flexible latex roof mastic color coat with satin gloss finish (30-50 on a 60-degree gloss meter). American Coatings WB Series Roof Mastic. Apply to a dry film thickness of 10 mils (250 microns) topcoat-all other surfaces, aliphatic polyurethane color coat with semi-gloss finish (60-65 on a 60-degree gloss meter). American Coatings SU Series, low VOC (2.8), polyurethane. Apply to a dry film thickness of 2-6 mils (50-150 microns).

2. Color to be provided by the manufacturer and approved by the Department prior to PBB manufacturing.

B. Interior Finishes:

1. Interior Tunnel and Fixed Walkway Walls:

   a. Interior wall treatment shall consist of 3/8-inch thick fire-rated particle board sandwiched between two high pressure laminates wall panels laminated on both sides to prevent bowing, four feet on centers with stainless steel trim and recessed accept strips. Provide water drain holes in the bottom J-channel.
   b. The finished product shall carry a UL label and shall meet the flame spread test as listed in ASTM E84.
   c. The design shall allow each panel to be removed individually.
   d. Department to select color and finish from full range of premium and custom color chart.

2. Interior Floors:

a. Floors of tunnels, rotundas, and fixed walkway shall be constructed of minimum 3/4-inch marine grade plywood A-B, seven-ply minimum or galvanized steel.
b. The cab floor shall be constructed of minimum 7/8-inch marine grade plywood AB, seven-ply minimum or galvanized steel.
c. The cab bubble area floor shall be constructed of minimum 7/8-inch marine grade plywood A-B, seven-ply minimum with outside edge sealed or galvanized steel.
d. All wood products shall be fire retardant treated as required by applicable codes.

   Transition ramps shall be constructed of aluminum. Transition ramps shall be hinged. A-tunnel ramp shall be full width of tunnel. Nosing on ramps shall have abrasive anti-skid surface. Ramps shall slope starting in each tunnel to meet ADA slope requirements. Ramps shall not cut or mark the tunnel floor the ramp is riding over. Ramps shall be covered in sheet vinyl as described below.
e. Tunnels and rotunda floors shall be covered in sheet vinyl. Sheet vinyl shall be minimum 3 mm thickness with integral grit surface; 7.19 lbs / square yard; Static Coefficient of Friction of .92 dry and .88 wet per ASTM D 2047; Class 1 Fire Rating per ASTM E648; and warranty against defect for 10 years. Sheet vinyl product to be approved and color selected by the Department. Sheet vinyl shall be supplied and factory installed by the PBB manufacturer. Provide stainless steel transition bar between sheet vinyl and ribbed rubber in the cab with countersunk flat head stainless steel screws. Transition ramp sheet vinyl shall be installed continuously over the ramp hinge area with no vinyl seams in length of width of the tunnel ramp.
f. All trim and moldings required for the sheet vinyl installation shall be stainless steel and shall be provided by the Design Builder.
g. Cab Floor Finish: One-quarter inch ribbed fire-resistant black rubber with anti-skid surface shall be installed from building side of service door to the aircraft spacer assembly. Rain gutter ends, door threshold and rubber matting seams shall be sealed with black silicone.

3. Interior Ceiling:

a. All ceiling areas of PBBs and fixed walkway shall be finished with linear solid metal panels (matching the width of the light fixtures) a minimum 6" width. Ceiling panels shall be full width of bridge and have reveal system minimum ¾". Finish shall be powder coat LRV96; non-glare, 3% low gloss finish. Color shall be manufactured standard performance white finish.
b. The aluminum corner molding that finishes the ends of the ceiling panels and top edge of the wall panels is painted black to match the light fixture.
c. Interior flashing shall be 1-inch wide x 1/8-inch thick with flat felt backing.
d. Architectural Metal and Trim Items: Anodized aluminum and other galvanized, aluminum, or stainless steel trim items shall have a satin finish.
e. Paints and sheet vinyl adhesives shall have a maximum VOC of 1.25 lbs/gal

for field applied applications. Stated VOC shall be the maximum as certified by the manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:

1. The Design Build Drawings shall indicate the lead-in line and nose wheel stop bar locations of each aircraft position at each gate. The Design Builder shall be responsible for verifying all locations of aircraft positions for the various types of aircraft serviced at each gate and shall advise the Department of any conflict or code violations prior to beginning the fabrication of any passenger boarding bridge. Any modification to the Design Build Drawings as necessary to eliminate conflicts or code violations will be made by the Design Builder.
2. Verify the exact building door sill and bridge foundation elevation, and foundation bolt patterns and dimensions at each gate prior to preparation of shop drawings. Design Builder to notify the Department of any discrepancies between Construction Drawings, passenger boarding bridge, or fixed walkway tunnel requirements.
3. Verify apron elevations at each bridge location and at any fixed walkway location. Confirm these elevations with the bridge operation requirements, layout and maximum allowable slope.

3.02 INSTALLATION

A. Structural Support Elements:

1. All anchor bolts shall be protected from bending and damage during construction. Provide anchor bolts to Design Builder and coordinate placement. Provide template as required. Furnish anchor and leveling nuts, as required, to complete the installation. Nuts shall meet the requirements of ASTM A449 and shall be galvanized. After installation, tack-weld the anchor nuts to the base or provide two nuts. All zinc coating removed or damaged by welding or any other means shall be cleaned and repaired with galvanizing repair primer meeting the requirements of Federal Specification TT-P-641 G (1), Type II.
2. An approved non-shrink grout shall be used underneath the column base plate and leveling plate. Grout shall be a no-iron mix to avoid rust marks. Grouting of the rotunda base plate shall be formed and placed using the holes in the base plate. Grouting by dry packing and filling the center area with bags and blocks will not be acceptable. The grouting shall be done to American Concrete Institute standards, or other established and recognized standards as approved by the Design Builder's Engineer and/or Department.

    a. Grout shall be 3 -inches minimum thickness and 7-inches maximum thickness.
    b. Setting of rotunda requires a leveling nut and washer on each anchor bolt on the underside of the rotunda base plate and one or two nuts and one washer on

the top.

3. Installation:

   a. Install edge strips where sheet vinyl abuts other flooring including door openings where thresholds are not indicated. Secure edge strips with countersunk flat head stainless steel screws at 12 inches o.c. maximum.
   b. Finished appearance shall be smooth, level, free from misalignment, neatly cut and closely fitted at projections and openings, with joints as close and inconspicuous as possible.
   c. Clean the sheet vinyl as recommended by manufacturer and cover with non-staining, protective materials.
   d. PBB and Fixed Walkway Flashing: Install PBB and fixed walkway flashing to create a weather-tight connection between the rotunda entry corridor and the building, and between the fixed walkway and the building. Slope flashing so as not to trap or pond water. Flashing shall also be installed on the interior. Flashing shall be continuous to provide a weather-tight seal around the entire periphery between the bridge and the building, and to allow independent thermal movement of building structure.
   e. Repair and repaint damaged finishes so no evidence remains of repairs.
   f. Where damaged beyond acceptable condition as determined by the Department, replace damaged component at no added cost to the Department.
   g. Paint exposed metal, including foundation bolts.

4. On-site delivery:
   During the on-site delivery, storage, and installation process, the Design Builder shall be responsible for securing all PBB elements, tools and equipment against hurricane force winds.

3.03 FIELD QUALITY CONTROL

A. Tests: Perform as required by NFPA 415.

B. Inspection:

   1. Preliminary Inspection:

      a. The Design Builder and PBB Manufacturer shall perform a functional inspection and demonstration of each unit at the installation site in the presence of the Department.
      b. Verification of compliance with this criterion shall be accomplished by inspection, review of data, demonstration, testing (if required), or combination of these items.

   2. Final Acceptance Inspection:

      a. The Department shall perform the final inspection of the unit after full compliance by the Design Builder with all outstanding punch list items as determined from the preliminary inspection.

b. Full acceptance of the unit shall be made in writing to the Design Builder after satisfactory completion of all punch list items as determined by the Department.

C. Training Requirements: Provide in accordance with the terms and conditions of the Contract, and:

1. Provide training session at the construction site, on the actual installed equipment for Department and Terminal Operator personnel for one (1) eight (8)-hour day.

2. The training session shall be conducted by a manufacturer's qualified representative. The training program shall consist of the instruction on the operation and major components of the PBB, Ground Power 400 Hertz Power Converter Unit, Point-of-Use Preconditioned Air Unit, Potable water unit, service stair carry-on baggage conveyor, including all fail-safe and safety features.

3.04 CLOSE OUT DOCUMENTS

A. Recommended Spare Parts List

a. A recommended spare parts list shall be submitted with the Operation and Maintenance Manuals covering all items of equipment and categorized accordingly, with current unit as well as recommended lot price.

B. Record Drawings

a. Record Drawings shall be submitted within 30 days after system acceptance.

C. Warranty Service and Parts

a. Manufacturer shall warrant that its products and work shall meet all applicable specifications, codes and other specific product and work requirements (including those of performance) and shall be free from defects in material and workmanship for a period of two (2) years from commissioning acceptance.

D. Operation and Maintenance Manuals

a. A complete manual in a protective binder or cover shall be provided for components provided in PBB contract and shall contain the following information:

i. Starting, Operation Maintenance and Troubleshooting instructions.
ii. Schematics and Connection wiring diagrams.
iii. Recommended Spare Parts List.
iv. Operation and Maintenance Manuals shall follow the intent of the International Air Transport Association (IATA)

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SECTION 34 77 14

POINT OF USE PRECONDITIONED AIR UNITS (PCA)

PART 1 – GENERAL

1.01 SUMMARY OF SCOPE

A. General – The intent of this guide specification is to describe the design requirements, quantities, performance and maintenance properties of Point of Use Preconditioned Air Units (PCA) for the **Passenger Boarding Bridges Design/Build Services** project at Cleveland Hopkins International Airport, Cleveland, Ohio. This procurement shall be performed by the Design Builder selected for the performance under this contract. This document is a guide specification for the design, procurement, and installation of passenger boarding bridges as required by the Department of Port Control (DPC). The Design Builder's work shall include the following:

1. Point of Use Preconditioned Air Units (PCA): Designing, manufacturing, testing, furnishing, installing and commissioning Direct Expansion, Point-of-Use Preconditioned Air Units rated as indicated herein, with single output and dual output units, as indicated, to provide preconditioned air for both pre-heating and pre-cooling commercial aircraft.

1.02 DEFINITIONS

A. The terms "Direct Expansion (Dx), Point-of-Use (POU), Preconditioned Air Unit", "PCA Unit", "Unit", and "PCA" as used within this specification, shall be construed to mean the components, sub-components and sub-systems that constitute a complete, operable, and maintainable Direct Expansion, Point-of-Use Preconditioned Air Unit, including all ancillary equipment, such as air hoses, hose couplings, hose storage devices, etc.

1.03 GENERAL REQUIREMENTS

A. The PCA unit and all components thereof shall be constructed in accordance with all codes and standards and local laws and regulations applicable to the design and construction of this type of equipment, which are generally accepted and used as good practice throughout the industry, including without limitation, NFPA, Underwriter's Laboratories (UL), OSHA, SAE Publications, American National Standards, Military Standards, etc. The design of all parts and subassemblies shall be in accordance with good commercial practice and shall be the responsibility of the manufacturer to assure safe, efficient and practical design in keeping with requirements peculiar to this type of system.

B. The Manufacturer of the PCA units shall be a qualified source, who has been regularly engaged in the engineering, manufacturing and installation of commercial aviation PCA equipment and components for a minimum of five (5) years and with a minimum of five hundred (500) units installed.

C. Qualified Design Builders will have completed no less than ten (10) jobs of similar size and scope within the last five (5) years.

D. Submit Design Builder qualifications and references for those projects listed in 1.03.C with bid. References should include Project Names, Descriptions, and Durations, as well as Owner and Prime Architect contacts with Name, and Phone contact information.

E. The Design Builder is required to satisfy all requirements of this specification. Should the Design Builder desire to deviate from any portion, either because the specification is in error, violation of any law or regulation, or is in need of modification to permit a more satisfactory functional and economical design, they must submit a written request for such deviation. The Design Builder shall not contract, purchase or cause to be delivered, equipment which does not meet all requirements of this document as specified, without obtaining prior written approval.

F. The Design Builder shall be responsible for verifying installation locations and methods and shall notify the Owner of any conflicts or code violations prior to manufacture of the PCA units. Modifications to eliminate conflicts or code violations will be coordinated with and approved by the Owner. Modifications shall be made at no additional cost to the Owner.

G. The Design Builder shall design, furnish, and install all necessary equipment and incidentals to provide a complete operable and maintainable unit.

H. Should alternate mounting configurations or physical attributes, other than those specified herein, be proposed, Proposing Design Builders shall submit alternates for approval prior to bid date. Alternate mounting, configurations, or attributes shall be provided at no additional cost to the Owner.

I. EMI/RFI: Unit shall be designed so as not to affect aircraft radio/navigation equipment. It shall be applicable throughout the entire aircraft radio frequency range. Provisions shall be designed into the unit to protect it from voltage fluctuations which might result from the operation of aircraft radio frequency equipment.

1.04 REFERENCES

A. The latest approved version or edition, of the following codes, references and standards shall apply. If the Department has not approved or adopted a particular code, reference, or standard, the latest published edition shall be applicable.

1. FM P7825 - Approval Guide Fire Protection.
2. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association.
3. NFPA 70 - National Electrical Code; National Fire Protection Association.
4. NFPA 415 - "Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways".
5. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; Society for Protective Coatings (Part of Steel Structures Painting Manual, Vol. Two).
6. AFBMA - Anti-Friction Bearing Manufacturers Association.
7. ARI - Air-Conditioning and Refrigeration Institute.
   a. ARI Standard 410 – Performance Rating of Forced-Circulation Air-Cooling and Air Heating Coils.
   b. ARI Standard 850 - Commercial and Industrial Air Filter Equipment.
8. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers.

a. ASHRAE 52 - Method of Testing Air-Cleaning Device Used in General Ventilation for Removing Particulate Matter.
9. NEBB - National Environmental Balancing Bureau
10. SAE - Society of Automotive Engineers.
11. AISC - American Institute of Steel Construction Code.
12. ASME - American Society of Mechanical Engineers.
13. OSHA - Occupational Safety and Health Act.
14. UL - Underwriters Laboratories.
15. MS-33562 - Military Specification, Connection, Aircraft Ground Air Conditioning, 8", latest edition.

B. In the event of conflict between a reference and another reference or this specification, request clarifications. All responses are final and will be at no additional cost to the Owner.

1.05 SUBMTITALS

A. **Bid-Submittals**: The following submittals shall be included with bid:

1. Alternates per 1.03 H
2. Preliminary Product Data and manufacturer's data sheet for PCA.
3. UL Certification per 1.06E.

B. Pre-Manufacture Submittals: The following submittals shall be made as necessary to meet the project schedule and shall be submitted and approved prior to manufacturing the Dx POU PCA units.

1. Product data for selected models including specialties, accessories, and the following:
   a. Direct expansion (Dx) Point-Of-Use (POU) Preconditioned Air (PCA) unit airflow performance curves with system operating conditions indicated; include airflow vs static pressure and airflow vs blower horsepower.
   b. Manufacturer shall submit performance data of the Dx POU units at the design conditions indicated in this Section. Performance data shall include, but not be limited to, air flow, static pressures, temperatures and humidity levels, at points of significance through the unit and at the aircraft inlet, refrigerant pressures and temperatures at points of significance through the refrigeration circuits, and power requirements of major components as well as entire unit.
   c. Motor ratings and electrical characteristics including motor and fan accessories.
   d. Materials, gauges and finishes.
   e. Dampers, including housings, linkages, and operators.
   f. 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.
   g. Certification report of airflow test apparatus by an independent third party such as the National Environmental Balancing Bureau (NEBB) or another approved agency.
   h. Dx POU unit air flow control, capacity control and defrost control.
   i. Flexible hoses, clamps, rigid ducts and mounting brackets.

2. Shop Drawings: Provide schematics and interconnection diagrams, indicate front and side views of enclosures with overall dimensions and weights shown; conduit/cable entrance locations and requirements; and nameplate legends. Differentiate between manufacturer-installed wiring and field-installed connections. Include appurtenances such as hose

baskets, ducts, pushbuttons, etc.

3. Installation Details: Provide complete installation details including, without limitation, installation details of all appurtenances. Show installed configuration as well as any pertinent details regarding interface to other equipment and systems, include electrical connection service points.

C. Pre-Ship Submittals: The following shall be submitted and approved prior to shipping Dx POU units to the project site:

1. Factory Test Reports: Indicate factory tests and results and inspection procedures.

D. Pre-Substantial Completion Submittals: The following submittals shall be submitted and accepted prior to 14 days before substantial completion, unless otherwise noted herein.

1. Operation and Maintenance Manuals.
2. Training Program: At least 60 days prior to substantial completion, a training program summary, course syllabus, instructor qualifications, and copy of the training manual shall be submitted for review and acceptance.
3. Field Commissioning Report: Submit proposed field commissioning report for review and acceptance. This accepted form shall be utilized for the final field commissioning as specified in Section 3 - Execution.

E. Pre-Final Completion Submittals: The following submittals shall be submitted and approved prior to 14 days before final completion.

1. As-Built Drawings. Provide field edited redlined project drawings showing deviations from design documents.
2. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and have been registered with the manufacturer.
3. Field Commissioning Report: A completed field commissioning report for each installed unit as specified herein. Utilize approved form.
4. Training Rosters. Provide training roster with trainee names, dates and types of training, as well as durations.
5. Original software and documentation registered in the Owner's name.
6. Hard copy and electronic version in PDF format of all programs and settings loaded into equipment provided hereunder.

1.06 QUALITY CONTROL

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 and NFPA 415 for components and installed Dx POU Units.

D. NEMA Compliance: Motors, enclosures and electrical accessories shall comply with NEMA standards and be so rated.

E. UL Compliance: Dx POU units shall be UL, or ETL listed and shall be labeled by a nationally recognized testing laboratories at the time of bid. Submit verification with bid submittals.

1.07 DELIVERY, STORAGE, AND PROTECTION

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

B. Provide Dx POU units which do not require disassembly and reassembly because of movement into the final location and follow manufacturer's written instructions.

C. Deliver equipment as a factory-assembled Dx POU unit whenever practical for shipping purposes with protective crating and covering.

D. Store equipment and material in suitable facilities until delivery, installation, and acceptance.

E. Coordinate the delivery acceptance of this equipment at the job site. Receive, offload, store and protect this equipment until such time as it has been final accepted.

F. Installing contractor shall properly dispose of all waste including, but not limited to, packaging, crates, and other shipping or storage waste.

1.08 WARRANTY

A. The Manufacturer shall provide a full parts and labor warranty for the new units and ancillaries. The manufacturer shall certify the installation was performed per their requirements to certify and commission the PCA prior to Substantial Completion.

B. If the manufacturer cannot certify the installation, then the Design Builder shall replace and/or correct the installation at no additional cost to the Owner.

C. Labor warranty shall be performed by factory trained service technicians. Warranty shall run two (2) years from the Date of Substantial Completion. Date of Substantial Completion is defined as the date the system is turned over by the Design Builder, and accepted by the Owner, for normal operation. All warranty services shall be at the site of the installation. Warranty provider (Manufacturer) shall be responsible for all travel and sustenance expenses necessary for warranty services.

D. Shipping and handling charges for warranty parts are the responsibility of the Manufacturer.

E. Warranty Services shall be commenced with on-site representation, by qualified repair technicians, within 72 hours from the request of the Owner.

1.09 OEPRATION AND MAINTENANCE MANUALS

A. The Manufacturer shall provide six (6) bound copies and three (3) electronic copies (USB drive or download link to PDF file) of the approved, comprehensive Operation and Maintenance Manual for each model PCA unit fourteen (14) days prior to Substantial Completion which is in compliance with the manufacturer's recommendations.

B. The content of the manuals shall be limited to information and data that specifically apply to

products provided and shall include routine normal and special operating instructions and sequences. Also included shall be routine maintenance procedures and guides for troubleshooting, disassembly and reassembly instructions, and recommended spare parts list including current prices and sources.

C. Wiring diagrams and schematics shall be incorporated into the manuals to clearly show features such as controls, switches, instruments, points of connection, and indicators by name and location. Field corrections and variations from the manufacturer's shop drawings, shall be incorporated for each installation.

D. Operation and Maintenance Manuals: Include in ATA 101 format a general description, theory of operation and specification, schematics and wiring diagrams, start-up instructions, installation and maintenance procedures, parts list, recommended spare parts list, troubleshooting guides, controls and accessories information.

1. Special Tools List: Provide a list of any special tools required to perform any field performable maintenance tasks.

2. Spare Parts List: Provide manufacturer's recommended spare parts list.

1.10 TRAINING

A. The manufacturer shall provide a complete training program for the Owner's operating, engineering, and maintenance personnel. Training shall include both classroom and hands-on instruction and be of sufficient duration to adequately train personnel to perform on site routine, preventative, and remedial maintenance of the equipment, product or system. Unless noted otherwise, maintenance training shall consist of a minimum of three (3) sessions of four (4) hours classroom instruction and four (4) hours hands-on instruction for ten (10) personnel, and operator's training shall consist of a minimum of four (4) sessions of one (1) hour duration each, hands-on instruction for eight (8) personnel.

1. Some operator's training sessions may necessitate night training, at the discretion of, and without additional cost to, the Owner.

B. Operator training shall be completed no later than seven (7) days prior to beneficial use. The manufacturer shall provide maintenance training within 30 days of beneficial use. At least 60 days prior to substantial completion, a training program summary, course syllabus, instructor qualifications, and copy of the training manual shall be submitted for review and approval.

C. Training shall be conducted at the installation site property at the direction of the Owner.

D. Provide Owner a minimum of seven (7) days' notice prior to conducting any training.

PART 2 - PRODUCT

2.01 MANUFACTURERS

A. Manufacturers: Dx POU PCA Unit

1. Oshkosh AeroTech Jetway Systems.
2. ITW GSE (Previously Hobart)

3. Twist Aero
4. Or Approved Equal

B. Hoses

1. ITW GSE
2. AmCraft Manufacturing
3. Or Approved Equal

C. Hose Cart/Basket

1. Twist Aero
2. ITW GSE
3. Or Approved Equal

D. Hose Trolley

1. Metroplex Custom Services (MCS)
2. Hall Industries, Inc.
3. Or Approved Equal

E. Hose Retriever

1. BGSE
2. Twist Aero
3. Or Approved Equal

2.02 GENERAL DESCRIPTION

A. The manufacturer shall provide a new, compact, lightweight, low-noise and insulated Dx POU unit that can be mounted on the roof of the Passenger Boarding Bridge (PBB), such that the operational characteristics of the bridge are unrestricted, and the bridge's structural integrity is uncompromised. It is the Owner's intent to have the Dx POU units mounted under the tunnel closest to the aircraft end of the PBB.

1. The Dx POU unit manufacturer shall ensure the unit and the unit's mounting methods are structurally sound and that they do not affect the structural integrity of the passenger boarding bridge. The Dx unit shall not cause deflections of the passenger boarding bridge tunnel sections or rails. The Dx POU unit shall not affect the dynamic operation of the passenger boarding bridge. All steel, rails, brackets, bolts, reinforcing, etcetera shall be provided and installed with the proper ratings for the finished system.

B. The Dx POU units shall have a minimum of two (2) distinct assemblies:

1. A control assembly which contains the low voltage logic and control circuits.
2. A blower/coil unit containing a blower, inlet butterfly damper, cooling coils, compressors, condenser coil, condenser fans, filters, complete motor starting equipment, outlet plenum and condensate drain pan to provide the required cooled or heated air to maintain the

aircraft cabin temperature specified.

C. Each Dx POU unit shall be primed and painted to match the color of the passenger boarding bridge on which it is installed.

D. Each Dx POU unit shall operate properly to serve the full range of aircraft which park at its respective gate position. It shall be the manufacturer's responsibility to review the aircraft parking plans and verify that the units supplied will meet this requirement. Unit sizing indicated in the contract documents shall be considered the minimum sizing of units supplied.

E. Unit external static pressure shall be defined as the gauge pressure measured at the outlet of the Dx POU unit. The Dx POU unit's manufacturer shall submit the gauge pressure the Dx POU unit can produce at the outlet of the hose and at the aircraft connection through 75' of 14" hose.

F. The maximum sound level for the Dx POU units at maximum cooling/heating shall not exceed 85 dBA at a distance of 15' from the unit (external) and 65 dBA inside the bridge (internal).

G. The Dx POU unit components shall operate satisfactorily under ambient temperature conditions of -25° to 122° F including static soak up to 48 hours within this range with or without wind of 50 MPH. All components shall be designed or selected for long service life under such conditions.

H. The Dx POU units shall not produce or induce objectionable vibrations into the bridge structure. Vibration levels induced by the units and/or its components shall not be injurious to the units or the bridge structure or be harmful or annoying to passengers and employees. The manufacturer shall provide any and all necessary vibration insulation devices required to meet this requirement. The blower wheel and shaft assembly shall be direct coupled to the motor and shall receive a two (2) plane dynamic balance at maximum RPM and the maximum allowable vibration velocity shall not exceed 0.1 inch/second or 0.5 MIL displacement.

I. The Dx POU units shall be designed so as not to affect aircraft radio/navigation equipment. It shall be applicable throughout the entire aircraft radio frequency range. Provisions shall be designed into the Dx POU unit to protect it from voltage fluctuations which might result from the operation of aircraft radio frequency equipment.

J. Where the Dx POU unit components are assembled within a unitized enclosure, provide access doors of the hinged and insulated type. Locate as required for proper access to the following:

1. Blower/dampers.
2. Filters.
3. Coils.
4. Compressors.
5. Motors.
6. Variable Frequency Drives (VFD).
7. Smoke Detectors.
8. Any other item requiring maintenance access at the discretion of the Engineer.

K. The Dx POU units shall be supplied with all necessary ducts, transition hoses and brackets required to route the discharge air from the Dx units to a point above and then to the hose storage device. Such installation method shall ensure that air flow equipment is not restricted or interfered with during all PBB operations.

L. The minimum reliability design requirement for the Dx POU units shall be to operate between preventative maintenance periods of a minimum of 840 operating hours or 12 weeks, whichever comes first.

M. The Dx POU units shall provide for PBB pre-cooling and pre-heating. The Dx POU units shall be furnished with a dual output damper assembly, and connecting 10" diameter flexible duct to form a PBB directed supply air branch. The Dx POU unit control system shall provide pre-cooling or pre-heating upon demand of a manual selector installed in the PBB cab console. PBB precooling/pre-heating status shall be initiated manually and terminated manually or automatically by depressing the aircraft servicing start button.

1. The Design Builder shall be responsible for all work required to install the PBB pre-cool plenum, including cutting into the PBB tunnels, the plenum, interior work, etc.

N. The Dx POU unit design shall be based on the use of self-contained refrigeration systems and an electrical heater combined successively by the supply air passage and operationally by a common control system.

1. Primary and secondary systems shall form the basic unit.
2. Primary and/or secondary systems within the basic two-system arrangement may be divided into multiple refrigeration sub-systems for severe capacity requirements caused by extreme design ambient conditions and/or air flow parameters.

2.03 PERFORMANCE REQUIREMENTS

A. All design parameters shall be verified by the Design Builder and shall meet the fleet requirements at the gates where the installations are to take place.

B. Cooling

1. The Dx POU units shall be designed to automatically maintain a 75°F cabin temperature in all aircraft within its specified class, based on the following design conditions:

a. Design ambient temperatures: 91.9°F/77.9°F Dry Bulb/Wet Bulb.
b. Passenger Load: Full (100%), for the largest aircraft in its classification, including full crew.
c. Full solar load (bright sunshine).
d. Aircraft electrical load: 75,000 BTU/h.
e. One aircraft door open (typically either L1 or L2).

2. All temperatures, air flow rates, and static pressures denoted in this section must be simultaneously achieved.

C. Heating

1. The Dx POU units shall be designed to automatically maintain a 70°F cabin temperature in all aircraft within its specified class, based on the following design conditions:

a. Design ambient temperatures: -4°F Dry Bulb.
b. Passenger Load: None (0%), for the largest aircraft in its classification.

c. No solar load.
d. Aircraft electrical load: 0 BTU/h.
e. One aircraft door open (typically either L1 or L2).

2. All temperatures, air flow rates, and static pressures denoted in this section must be simultaneously achieved.

2.04 ELECTRICAL REQUIREMENTS

A. All design parameters shall be verified by the Design Builder and shall meet the fleet requirements at the gates where the installations are to take place. The Design Builder shall verify the source of power for the Dx POU unit for each gate is available and install the required panel and disconnects for each unit.

B. All Dx POU units shall be constructed in accordance with standard electrical manufacturing processes, and shall comply with all applicable Federal, State, and Local laws, codes and ordinances.

C. Input Voltage Rating: 480V, 3 phase, 60 hertz.

D. The Dx POU units shall be provided with a built-in, main circuit breaker of suitable size that provides an electrical disconnecting means for the Dx POU unit and protection from short circuits. This circuit breaker shall be lockable in the OFF position for maintenance purposes.

1. All primary disconnecting means shall be suitably rated to be capable of withstanding and interrupting fault currents available at the input.

E. Wiring, Motors and Electrical Components

1. All wiring shall be permanently identified. Wrap around adhesive style wire markers will not be permitted. Numbers are to be located one inch from the end of each termination point. If the wires are to be stamped, they must be numbered the full length with indelible ink, with the numbers no more than four inches apart, and the number shall be visible at all terminating points. Wires are to be numbered in a logical sequence. Manufacturer shall indicate all wire numbers on electrical shop drawings.

2. All circuits shall have suitable overload protection. Each conductor shall be sized to have current carrying capacity as allowed by the National Electrical Code (NEC) equal to or greater than the capacity of the circuit breaker provided in its circuit. Circuit breakers shall be grouped in convenient locations and suitably marked for size and function. Logical grouping of circuits is anticipated. Protection devices shall be sized to protect wiring and motors from damage due to overload and prevent electrical or mechanical damage to associated PCA unit components in the event of failure of one of the components. Each electric motor shall have a suitable magnetic starter providing over-current and under-voltage protection, and each motor circuit shall be separately protected by fuses or circuit breakers. Optional and add on components shall be considered in sizing and in the number of conductors provided. Spare wires shall be provided as necessary.

3. All wiring shall be terminated on terminal blocks and/or suitable connectors. The wiring shall be formed and restrained to give a neat appearance. Common wiring splices shall

not be used. Connections shall be made using terminal strips and staked lugs or by patent connectors.

4. Grommets and suitable anti-chafe material shall be used where wires are required to pass through structure or other similar relief or opening which exposes the wire to possible chafing. All wiring shall be in conduit (preferably automotive split loom) or spot-tied and shall be routed away from possible pinch points. Wiring shall be adequately supported to protect it from damage due to ice and snow buildup, bumping, kinking, and flexing.

5. All meter panels and any components containing printed circuit boards or solid state electronics shall be shock mounted.

6. Electrical interlocks shall be fail-safe design.

7. Electrical devices including switches, relays, wiring, and terminals when located in an area exposed to weather, shall be of weatherproof design or protected by weatherproof enclosures.

8. Weatherproof schematics shall be installed on the interior of the controller door. Schematics shall include all wiring and devices and shall include all wire numbers. Schematic shall be impervious to grease, water, ice, or other elements that they may be exposed to in an aviation maintenance environment on an active apron with the doors open.

9. All exterior conductors/cables shall be in conduit. Exposed cables will only be allowed where required due to flexibility needs and then will be limited to a maximum of 48".

F. Ampacity

1. Each POU PCA Dx unit shall operate satisfactorily, at full load.

2.05 COMPONENTS AND OPERATION

A. Compressors:

1. Compressor(s) shall be serviceable, single-speed, hermetic sealed scroll compressors with integral vibration isolators and crankcase heaters which de-energize during compressor operation. Safety controls shall include a low/high refrigerant pressure cutout with manual reset, a compressor motor overload with manual reset, an adjustable low-ambient lockout, and low oil pressure cutout with manual reset.

2. High efficiency shall be achieved through the use of complete enclosed compression chamber design.

3. Vibration isolator/absorber with a wire mesh-covered metallic bellows shall be installed in the suction and discharge line to isolate/absorb the compressor vibrations.

4. A 2-pole compressor motor shall be designed as an integral part of the compressor assembly. It shall drive the compressor scroll or screw. Industrial Grade epoxy shall lock the motor windings in place and resist corrosion of insulation by refrigerant and oil.

B. Casing:

1. Manufacturer's standard casing construction, having corrosion protection coating, and exterior finish. Where the Dx POU unit is provided as a unitized enclosure construction, casings shall have removable panels or access doors for inspection and access to internal parts, a minimum of 1" thick thermal insulation, knockouts for electrical and exterior condensate drain connection, and lifting lugs.

C. Blower:

1. Provide blower that is factory fabricated and assembled, factory tested, and factory finished, with required capacities and characteristics. The blower shall be centrifugal type and sized for the appropriate constant volume airflow requirements in accordance with the selected size of the Dx POU unit. The blower motor shall be selected such that the fan brake horsepower does not exceed the maximum supplied by the motor over the design operating range of the Dx POU unit.

2. Blower and Shafts: Statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower. Vibration shall not be more than 0.1 inches/second or 0.5 MIL displacement. Blower shaft to be 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.

4. Blower: Centrifugal, direct-drive fans; and permanently lubricated motor bearings where bearings are not accessible for greasing.

5. A 2-pole, drip-proof blower motor shall be directly connected to the blower impeller. Motor shall be of NEMA Design B, Class F insulation, 1.15 S.F.

D. Condenser Fan

1. An axial type of multi-blade fan shall be utilized for condenser air flow. Fan blades shall be constructed from spark and corrosion proof material. Each Dx POU unit shall utilize two (2) identical motor/fan assemblies.

2. A 4-pole, totally enclosed fan-cooled fan motor shall be directly connected to the fan propeller. Motor shall be NEMA Design B, Class F insulation, 1.15 S.F.

E. Factory Finish

1. Exterior Sheet Metal Parts: Prime coating prior to final assembly. Final color to match the PBB.
2. Interior Surfaces: All air flow surfaces shall be stainless steel or aluminum. Manufacturer's standard finish is acceptable on all other interior surfaces.

F. Coils:

1. Aluminum plate fins and seamless copper tube. 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 and shall be easily removable for maintenance.

2. Coils shall be constructed and tested in general accordance with ASHRAE 15 and ARI 410.

3. Coils shall be proof tested to 450 psig and leak tested to 250 psig with air pressure under water, cleaned, dehydrated, and sealed with a holding charge of nitrogen until serviced with refrigerant.

4. Each compressor coil section shall have an expansion valve, a solenoid valve, and a distributor.

G. Airflow Control

1. Airflow control shall be via a VFD driven blower motor to control the air flow capacity of the blower. The VFD shall automatically adjust the air flow during aircraft cooling to the requirements of the aircraft selected on the remote control station. During aircraft heating, the VFD shall automatically adjust to the 50% mass air flow position for the aircraft selected on the remote control station.

H. Air Flow Ducting:

1. All ducting, plenum transitions, and other air flow components shall be made from either aluminum or stainless steel.

2. Plenum and air flow ductwork shall be properly insulated with polyurethane foam insulation so as to prevent the forming of condensation on ductwork surfaces and as necessary to minimize impacts to unit performance.

I. Inlet Air Filters:

1. Inlet air filters shall be factory fabricated by a company regularly engaged and specialized in filter manufacturing. Filters shall be cleanable, encased in a metal frame, and rated for the application for which they are being used. The air filters shall meet the following minimum requirements:

   a. The Dx POU units shall utilize standard size, commercially available, cleanable air filters. Filter media shall be made from polyurethane foam an open cell structure providing high arrestance and dust-holding capacity. Foam material shall have a flame-resistant additive making it self-extinguishing.

   b. The metal enclosing frame shall be constructed of rigid, heavy duty, and at least 20 gauge galvanized steel.

   c. Face velocity shall be no greater than 500 feet per minute with an initial resistance of 0.3" water gauge, final resistance of 0.5" water gauge, and an average resistance of

80%.

d. The filter section shall be furnished with a differential pressure sensor measuring across all filters to activate a "dirty filter" alarm. The PCA unit shall be equipped with a visual indicator for notification of alarm.

J. Acceptable Refrigerants:

1. R-407C
2. R-407H

K. Refrigerant Filter Dryer:

1. A sealed type of filter-dryer shall be installed in the liquid line to remove moisture and contamination from the refrigerant. The filter-dryer shall be soldered in place to preclude leakage. Location and installation method shall not inhibit or preclude field replacement of the filter-dryer unit. Filter-dryer shall contain a 100-mesh screen and molded blend of desiccant for acid and water removal.

L. Expansion Valve:

1. A thermostatic expansion valve shall automatically meter the refrigerant flow to the evaporator coil by sensing the evaporating pressure and temperature of the vapor leaving the evaporator. The valve shall regulate the rate of liquid refrigerant flow into the evaporator coil in exact proportion to the rate of evaporation of the liquid refrigerant by maintaining the pre-adjusted superheat. This shall optimize the evaporator efficiency and prevent the return of the liquid refrigerant to the compressor. The valve shall also contain an external equalizer to compensate for the pressure drop in the evaporator coil.

M. Electric Heat:

1. Staged Electric heat shall be provided on each Dx POU unit. Each Dx POU unit shall consist of a minimum of two (2) stages of electric heat. Each unit shall have a total heat capacity as necessary to meet the performance requirements outlined in the Heating Section of this specification. The electric heater shall be designed such that the power consumption in the Heating mode shall not exceed the maximum power consumption in the Cooling mode. The intent of this paragraph is to maximize the available stages of heat for optimal performance.

N. Controls:

1. Controllers shall monitor all phases of operation of the PCA Dx Unit. The controller shall be based on a 32 bit microprocessor and utilize flash memory technology to store operation parameter information. Operation parameters of controller shall not be affected by loss of 60 Hz power to controller. PCA manufacturer shall provide with their bid a detailed description of the controller, type of graphics and software, sequence of operation, types and number of control points, and limitations of the control system they intend to provide and install.

a. The practice of sharing the passenger boarding bridge controller, either directly, or through remote I/O racks will not be permitted. Each Dx POU PCA unit shall have a

dedicated and separate controller. Controller shall be able to communicate with the building management system.

2. Control system shall be low voltage (12 & 24 VAC). Control transformer shall be provided and sized to adequately serve all connected loads.

3. Contactors shall be full voltage non-reversing type and designed to meet international standards including UL and IEC. Contactors shall be AC operated with 120V 50/60 Hz holding coil and functionally assigned for ON-OFF control.

4. Thermostats shall be utilized in the system to maintain the required temperature parameters of the supply air.

O. Interlocks

1. Unit shall interlock with the PBB to prevent PBB horizontal operation while PCA unit is operating. Coordinate with the apron drive passenger boarding bridge specification section. Appropriate messages shall be displayed at the PBB operator's console to indicate unit's run status is preventing PBB operations.

P. Remote Control Station

1. The control station shall be housed in a NEMA 4X stainless steel enclosure and shall operate on 24 volts or less and shall be located on the bridge lift column (aircraft side of the bridge), so as to be accessible from ground level. Coordinate this position with all other installed equipment and ancillaries so as to prevent interferences. The station shall be configured as indicated on the design drawings. Modifications to this configuration must be submitted and approved.

2. The control station shall have a fault-indicator lamp as follows:

   a. Flash: non-critical fault, Dx POU unit still operational.
   b. Steady: critical fault, Dx POU unit prevented from operating.

3. The control station shall have a selector switch to choose the aircraft the Dx POU Unit is to serve. This selector switch shall be as shown on the drawings and shall be labeled with the abbreviations of the class of aircraft as follows:

   a. RJ (Regional Jets)
   b. NB (Narrow Body Aircraft)
   c. WB (Wide Body Aircraft)

Q. Condensate Drains

1. Condensate shall be routed across the bridge and deposited into a condensate collection system provided by the Design Builder. A condensation pumping system utilizing lift pumps and drain pan shall be included. The condensate pump shall be lightweight, self-priming, and capable of running dry. Minimum pump rating shall be 3gpm, 40' head, 1/3 hp or as required by the specific bridge configuration. Position the drain pan under the coil section. Drain pan shall be stainless steel. Condensate pump shall automatically expel condensate from the Dx POU unit as needed.

R. Safety Provisions

1. All corners of the unit's lower rim shall be equipped with corner bumpers.

2. The entire lower rim, and all vertical corner edges of the Dx POU unit shall be distinguished with an alternating yellow/black adhesive safety tape. Safety tape minimum width shall be 2 inches.

3. The lower corners of all units shall be equipped with fluorescent safety corner locater rods as necessary to match airfield standards.

4. The electric circuitry of the Dx POU units shall be protected against short-circuit currents or grounds by means of circuit breakers.

5. Each motor shall have separate overload protection.

6. The Dx POU units shall be protected against overheating when in the Heating mode. Protection shall be automatically resetting.

7. The refrigeration system shall be protected against operation at abnormal refrigerant pressures by high and low pressure limit switches.

8. The refrigerant compressor motors shall be protected against short cycling. A timer shall be installed in the motor control circuit to provide an appropriate delay on re-energizing after each stop.

9. Smoke Detector:

   a. Each Dx POU unit shall be equipped with a factory installed and tested smoke detector.
   b. The smoke detector shall be of the ionization type and shall be mounted at each Dx POU unit discharge plenum. The smoke detector shall interface with the Dx POU unit control circuitry. When sufficient smoke is sensed, the entire Dx POU unit shall shut down. A manual switch shall be utilized to reset the smoke detector.
   c. A fault of the smoke detector itself shall also cause the entire unit to shut down and alarm.

2.06 ACCESSORIES

A. Mounting Brackets

1. Factory fabricated mounting brackets shall be utilized for installation of the PCA Dx unit. Design of these brackets shall be such to prevent any welding or cutting of the bridge components to facilitate installation. Brackets shall be universal in nature to allow for installation on industry standard, commercially available passenger boarding bridges.

B. PCA Air Hose

1. Each DX POU unit shall be provided with single or dual, as specified, length as indicated on drawings, of 14" diameter insulated hose and one 14" to 8" reducer terminating with

an aircraft coupling. Complete hose assembly and connectors shall conform to MS-33562. This requirement shall apply to each output of dual hose units.

a. Hose lengths specified, or indicated on drawings, are a minimum length only. Provide and install sufficient hose lengths to reach all aircraft capable of being serviced at the gates as indicated on the aircraft parking plans.

2. Air delivery hose shall be of the lightweight insulated type, maximum thermal conductance of 1.28 BTU/hr/ft/°F, pressure rated for 50" water maximum. Hose shall be 14" diameter flat type. Hose is to be supplied in sections of no more than 25' in length, connected with Velcro seals (zippers not allowed), with a 14" to 8" diameter reducing adaptor on the end section.

3. All ducts, hose support sleeves and mounting hardware shall be provided and installed in accordance with the contract drawings and shall be painted to match the color of the newly installed passenger boarding bridge.

C. Hose Storage / Management

1. Hose Basket

a. PCA Hose shall be stored by a Hose Basket that attaches to the wheel bogey of the PBB. Hose Basket shall be capable of storing 80' of 14" diameter flat PCA air hose.

b. The Design Builder shall design hose storage lengths required for each gate and provide and install sufficient hose storage capacity to store length of hose provided.

c. The Design Builder shall install hose storage baskets at the front of the wheel bogey (as necessary based on aircraft serviced and as shown on the drawings) of each bridge and shall be of sufficient size to easily store the required quantity and length of hose. Hose storage baskets and Dx POU unit shall be installed such that they do not interfere with the PBB operation for the full range of aircraft served. PCA hoses must be fully accessible when PBB is lowered to its lowest position as determined by the mix of aircraft served. Hose storage baskets shall be constructed of metal, primed, and painted safety yellow.

2.07 CONFIGURATION

A. The manufacturer shall provide a new, compact, lightweight, low-noise, and insulated Dx POU unit that can be mounted under the Passenger Boarding Bridge (PBB), such that the operational characteristics of the bridge are unrestricted, and the bridge's structural integrity is uncompromised. It is the Owner's intent to have the Dx POU units mounted under the "C" tunnel closest to the aircraft end of the PBB.

B. The Design Builder shall install units as necessary to prevent damage to the units while simultaneously allowing full passenger boarding bridge operational movement to service all aircraft as indicated.

C. In the event the manufacturer's equipment, or project conditions, will not allow for under "C" tunnel mounting, alternative mounting arrangements will be submitted by the Design

Builder to the Owner. Alternates, which include roof mounting or ground mounting, shall include all items necessary for a complete and safe system, including ductworks, brackets, access ladders and handrails to allow full maintenance of units in a safe and OSHA compliant manner.

D. All mounting brackets, hose brackets, handrails, and other exposed metal surfaces shall be primed and painted to match the color of the new passenger boarding bridge.

2.08 FACTORY TESTING

A. The manufacturer shall test every Dx POU unit to assure compliance with the specifications. Submit manufacturer certification test sheets. The Owner shall be notified fourteen (14) days prior to the date of such tests. The Owner reserves the right to witness tests and request additional tests if necessary to demonstrate compliance with the specifications.

B. Factory mass flow tests shall be conducted for each size of Dx POU units at design ambient conditions with a test apparatus whose resulting calculated mass flow has been certified by the NEBB or other approved Agency. The submittal for the Dx POU units shall include the agency certification report of the test apparatus, sealed and authenticated by the agency.

C. Should factory tests fail to indicate compliance with specifications, all costs associated with re-testing, including costs associated with the Owner's witness services, will be the responsibility of the Design Builder.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The Design Builder shall design and install the Dx POU Unit in accordance with manufacturer's instructions and project documents. The Design Builder shall verify all equipment loads and mounting configurations prior to installation.

B. Equipment installation personnel shall meet all local security and safety requirements.

C. The Dx POU unit or its associated routing of hoses, air ducts, etc., shall not hinder or restrict the boarding bridge from operating within its full designed operating range.

D. Arrange installation of Dx POU units to provide adequate clearance for service and maintenance.

E. The Dx POU units shall be properly aligned, adjusted, and lubricated before final acceptance and commissioning.

F. Complete all punch list items.

3.02 EXAMINATION

A. The Design Builder shall verify/perform the following items or tasks:

1. Air inlets or exhaust louvers are not obstructed
2. Check to be sure that there are no tools or loose objects in the unit.
3. Make a final check of the security of the power connections.
4. Re-install any covers removed during installation.
5. Full passenger boarding bridge and related equipment operational non-interference test.

3.03 INTERFACE WITH OTHER WORK

A. The installation may occur with active gates adjacent to the work area. The Design Builder shall plan for only working on one gate at a time and coordinating access with airport operations.

3.04 CLEANING

A. The Design Builder shall clean the unit from all construction dust and debris prior to start-up. Touch up scratched or marred surfaces to match original finish. Protect the installed unit from subsequent construction operations.

3.05 STARTING EQUIPMENT AND SYSTEMS

A. Submit complete approved field commissioning report. Report shall include, but shall not be limited to, smoke test, communications test as applicable, cooling and heating test, aircraft model selector response.

B. The Design Builder shall demonstrate complete functional operation of equipment to the satisfaction of the Owner.

END OF SECTION

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SECTION 34 77 15

SOLID STATE FREQUENCY CONVERTER

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. General – The intent of this guide specification is to describe the design requirements, quantities, performance and maintenance properties of the ground power unites (GPU) for the Passenger Boarding Bridges Design/Build Services project at Cleveland Hopkins International Airport, Cleveland, Ohio. This procurement shall be performed by the Design Builder selected for the performance under this contract. This document is a guide specification for the design, procurement, and installation of passenger boarding bridges as required by the Department of Port Control (Department). The Design Builder's work shall include the following:

1. Solid State Frequency Converter (SSFC).
2. Work Includes: Designing, manufacturing, testing, furnishing, installing and commissioning 60 Hz to 400 Hz pulse width modulated (PWM) frequency converters rated at a continuous capacity of 90 kVA single output and 180 kVA dual output, to provide 400 Hz power designed to conform to MIL-STD-704F standard for aircraft ground power systems. 400 Hz frequency converters shall have the capabilities for provide 28 VDC current to regional carrier aircraft. An additional 28VDC cable and hoist shall be provided.

1.2 REFERENCES

A. The standards and codes applicable to only a portion of the work specified in this section are referenced in the relevant parts or clauses. Standards and codes which are generally applicable to the work of this section, are listed below. The latest approved version oredition, by the authority having jurisdiction, of the following codes, references and standards shall apply. If the authority having jurisdiction has not approved or adopted a particular code, reference, or standard, the latest published edition shall be applicable.

MIL-STD-704 - Aircraft Electrical Power Characteristics.

MIL-STD-461 - Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference.

NFPA 70 - National Electrical Code (NEC).

NFPA 70E - Standard for Electrical Safety in the Workplace

IEEE 519 - Recommended Practice and Requirements for Harmonic Control in Electric Power Systems.

Institute of Electrical and Electronic Construction Managers (IEEE) 127 and 519.

ARP-5015 SAE 400 Hertz Ground Power Performance.

DFS-400 (EURO-STANDARD 400 Hz).

NEMA ICS 6 - Enclosures for Industrial Control Devices and Systems.

NEMA ST 20 - Dry Type Transformers for General Applications.

ICS-1 General Standards for Industrial Control and Systems.

ANSI C84.1 - Voltage Ratings for Electrical Power Systems and Equipment.

ATA 101 - Ground Equipment Technical Data.

ISO 1540 - Aerospace Characteristics of Aircraft Electrical Systems.

ISO 6858 - Aircraft Ground Support Electrical Supplies.

MIL-STD-461 - Electromagnetic Interference Characteristics, Requirements for Equipment.

UL 489 - Circuit Breakers, Molded Case and Circuit Breaker Enclosures.

NEMA National Electrical Manufacturer's Association.

In the event of conflict between a reference and another reference or this specification,request clarifications. All responses are final and will be at no additional cost to the Owner.

1.3 GENERAL

A. The SSFC and all components thereof shall be constructed in accordance with all codes and standards and local laws and regulations applicable to the design and construction of this type of equipment, which are generally accepted and used as good practice throughout the industry, including without limitation, NFPA, Underwriter's Laboratories, OSHA, SAE Publications, American National Standards, Military Standards, etc. The design of all parts and subassemblies shall be in accordance with good commercial practice and shall be the responsibility of the manufacturer to assure safe, efficient and practical design in keeping with requirements peculiar to this type of system.

B. The Manufacturer shall be a qualified source, who has been regularly engaged in the manufacturing and installation of commercial aviation power supply equipment and components for a minimum of five (5) years and with a minimum of fivehundred (500) units installed.

C. Qualified Design Builders will have completed no less than ten (10) installations of similar size, quantity, and scope within the last five (5) years.

D. The Design Builder is required to satisfy all requirements of this specification. Should the Design Builder desire to deviate from any portion, either because the specification is in error, violation of any law or regulation, or needs modification to permit a more satisfactory functional and economical design, they must submit a written request for such deviation. The Design Builder shall not contract, purchase or cause to be delivered, equipment which does not meet all requirements of this document as specified, without obtaining prior written approval.

E. The Design Builder shall be responsible for verifying installation locations and methods and shall notify the Owner of any conflicts or code violations prior to manufacture of the SSFC. Modifications to eliminate conflicts or code violations will be coordinated with and approved by the Owner. Modifications shall be made at no additional cost to the Owner.

F. The Design Builder shall furnish and install all necessary equipment to provide a complete operable and maintainable unit.

G. Should alternate mounting configurations or physical attributes, other than those specified herein or indicated on the project drawings, be proposed, manufacturers shall submit alternates to the Owner for approval prior to bid date. Alternate mounting, configurations, or attributes shall be provided at no additional cost to the Owner.

H. The Design Builder shall size and design adequate service at each gate in the project. SSFM shall be capable of servicing the aircraft fleet mix for the design fleet mix to be provided by the Owner.

I. EMI/RFI: Unit shall be designed and manufactured so as not to affect aircraft radio/navigation equipment. It shall be applicable throughout the entire aircraft radio frequency range. Provisions shall be designed into the unit to protect it from voltage fluctuations which might result from the operation of aircraft radio frequency equipment.

1.4 SUBMITTALS

A. Bid-Submittals: The following submittals shall be included with bid.

1. Alternates per 1.3.G.
2. UL Certification per 1.5.A.

B. Pre-Manufacture Submittals: The following submittals shall be made as necessary to meet the project schedule and shall be submitted for approval prior to manufacturing the SSFC units.

1. Product Data and Specifications: The Design Builder shall provide manufacturer's data and specifications indicating, as a minimum, input/output voltages and amperages, power rating, physical characteristics, short circuit ratings, dimensions, and enclosure details to the Owner for approval.
2. Shop Drawings: The Design Builder shall provide the Manufacturer's schematics and interconnection diagrams, indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends. Differentiate between manufacturer- installed wiring and field-installed connections.
3. Installation Details: The Design Builder shall provide the manufacturer's complete installation details including, without limitation, installation details of all appurtenances. Show installed configuration as well as any pertinent details regarding interface to other equipment and systems, include electrical connection service points.

C. Pre-Ship Submittals: The following shall be submitted and approved prior to shipping SSFC units to the project site:

1. Factory Test Reports: Indicate factory tests and results and inspection procedures.

D. Pre-Substantial Completion Submittals: The following submittals shall be submitted and approved prior to 14 days before substantial completion, unless otherwise noted herein.

1. Operation and Maintenance Manuals.
2. Training Program: At least 60 days prior to substantial completion, a training program summary, course syllabus, instructor qualifications, and copy of the training manual shall be submitted for review and approval.
3. Field Commissioning Report: Submit proposed field commissioning report for approval. This approved form shall be utilized for the final field commissioning as specified in Section 3.

E. Pre-Final Completion Submittals: The following submittals shall be submitted and accepted prior to 14 days before final completion.

1. As-Built Drawings. Provide field edited redlined project drawings showing deviations from design documents.
2. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and have been registered with the manufacturer.
3. Field Commissioning Report: A completed field commissioning report for each installed unit as specified herein. Utilize approved form.
4. Training Rosters. Provide training roster with trainee names, dates and types of training, as well as durations.
5. Original software and documentation registered in the Owner's name.
6. Hardcopy and electronic version (USB drive) copies of all programs and settings loaded into any equipment provided hereunder.

1.5 QUALITY CONTROL

A. UL Certification: UL or ETL approved by a nationally recognized testing laboratory. Submit certification with bid.

1.6 DELIVERY, STORAGE, AND HANDLING

A. The Design Builder shall store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Handle carefully to avoid damage to components, enclosure, and finish.

C. Provide units which do not require disassembly and reassembly because of movement into the final location and follow manufacturer's written instructions.

D. Deliver equipment as a factory-assembled unit with protective crating and covering.

E. Store equipment and material in suitable facilities until delivery, installation, and

final acceptance by the Owner.

F. Coordinate delivery acceptance of this equipment at the job site. Offload, store and protect equipment until such time as it has been installed and accepted by the Owner.

G. Installing contractor shall properly dispose of all waste, including, but not limited to, packaging, crates, etcetera.

1.7 WARRANTY

A. The Manufacturer shall provide a full parts and labor warranty for the new units. Labor warranty shall be performed by factory trained service technicians. Warranty shall run two (2) years from the Date of Beneficial Use. Date of Beneficial Use is defined as the date the system is turned over by the manufacturer and accepted by the Owner for normal operation. All warranty services shall be at the site of the installation. Provider shall be responsible for all travel and sustenance expenses necessary for warranty services.

B. Shipping and Handling charges for warranty parts shall be the responsibility of the provider.

C. Warranty Services shall be commenced with onsite representation, by qualified repair technicians, within 72 hours from the request of the Owner.

1.8 OPERATION AND MAINTENANCE MANUALS

A. Provide six (6) bound copies and electronic copies for each of the approved, comprehensive Operation and Maintenance Manual to the Owner fourteen (14) days prior to Substantial Completion.

1. Electronic copies shall be in PDF format. Assemble O&M manuals into a single electronic PDF file with bookmarks enabling navigation to each section. Provide bookmarked table of contents at beginning of document.

B. The manuals shall fully describe each product, system, or subsystem numbered logically and separated into sections and contained in rigid plastic binders with identification inserted in clear plastic pockets on front and spine of each binder. Manuals shall be assembled in accordance with ATA 101.

C. The content of the manuals shall be limited to information and data that specifically apply to products provided and shall include a general description, theory of operation, routine normal and special operating instructions and sequences. Also included shall be routine maintenance procedures and guides for troubleshooting, disassembly and reassembly instructions, and recommended spare parts list consisting of current prices and sources.

D. Wiring diagrams and schematics shall be incorporated into the manuals to clearly show features such as controls, switches, instruments, and indicators by name and location.

E. Special Tools List: Provide a list of any special tools required to perform any field performable maintenance tasks.

F. Spare Parts List: Provide manufacturer's recommended spare parts list.

1.9 TRAINING

A. Manufacturer shall provide a complete training program for the Owner's operating, engineering, and maintenance personnel. Training shall include both classroom and hands-on instruction and be of sufficient duration to adequately train personnel to perform on site routine, preventative, and remedial maintenance of the equipment, product or system. Unless noted otherwise, maintenance training shall consist of a minimum of three (3) sessions each consisting of four (4) hours classroom instruction and four (4) hours hands-on instruction for eight (8) personnel, and operator's training shall consist of a minimum of four (4) sessions of one (1) hour duration each hands-on instruction for eight (8) personnel.

1. Operator's training may require some night training at the sole discretion of and without additional cost to the Owner.

B. Operator training shall be completed no later than seven (7) days prior beneficial use. The manufacturer shall provide maintenance training within 30 days of beneficial use. At least 60 days prior to substantial completion, a training program summary course syllabus, instructor qualifications, and copy of the training manual should be forwarded for review and approval.

C. Training shall be conducted at the installation site property at the direction of the Owner.

D. Provide Owner a minimum of seven (7) days' notice prior to conducting and training.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Oshkosh AEROTech (Jetway Systems)
B. ITW-GSE (Previously Hobart)
C. BGSE Group
D. Twist Aero
E. Cavotec
F. Or Approved Equal

2.2 INPUT

A. Input Voltage Rating: 480 Volts (nominal), +/-10%, 3-phase, 3-wire plus ground.

B. Frequency: 60 Hertz, +/- 5%.

C. Full Load Amperage:

1. Single Output, 90 KVA Model: 100 amps, maximum.
2. Dual Output, 180 KVA Model: 200 amps, maximum.

D. Input Power Factor: Unit shall be rated at a minimum of 0.95 power factor at 480 volts and loads of 25% or greater.

E. Phase Rotation: Any/or, with automatic phase lock for ABC (CBA) input phase rotation or protection and indication for out of phase condition

F. Inrush Current: Shall not exceed 100% of the input current required when unit is operating at rated load output.

G. Line Current Balance: From 10% to rated load, the input line current shall not differ by more than 5% from the arithmetic average current in the three (3) input lines.

H. Harmonic Distortion of Input Current Wave Form: 10 percent THD maximum overload rating of unit.

2.3 OUTPUT

A. 400 Hz

1. Single Output Rating: 90 KVA continuous at 0.8 power factor, lagging.
2. Dual Output Rating: 180 KVA continuous at 0.8 power factor, lagging.
3. Output Voltage: 118/204 Volts RMS, adjustable over a minimum range of +/- 10%, 3-phase, wye, 4-wire, grounded neutral in accordance with the international aircraft electrical power requirements.
4. Phase Voltage Displacement: The phase angle between each of the three output phases will be 120 degrees +/- 1.5 degrees under all rated balanced loads. The phase angle displacement with a maximum unbalanced load of 15% shall be 120 +/- 4.0 degrees.
5. Frequency: 400 Hertz +/- 0.1% and shall not be affected by load.
6. With the SSFC operating at a constant load, a change in ambient temperature up to 55 degrees Celsius in an eight (8) hour period, or as the SSFC stabilizes from cold condition at any load, shall not cause the voltage to change by more than 1% of its rated values.
7. Voltage Waveform Discontinuities: There shall be no evident discontinuities, spikes, or notches in the waveform when viewed on a high frequency oscilloscope.
8. Harmonic Distortion: Output voltage waveform shall not exceed 3% (THD) when

measured line-to-line and line-to neutral from no load to and including full rated load. Any single harmonic shall not exceed 2% of the fundamental at steady state voltage.

9. Efficiency: Shall be not less than 90% at any load. No load losses shall not exceed 0.5% of rated load.
10. Voltage Recovery: When initially operating at rated input frequency and rated voltage and following any sudden change in load of up to 100% of rated load, the transient output voltage shall not deviate beyond the limits of MIL-STD-704F.
11. Voltage Phase Balance: The maximum phase voltage imbalance shall not exceed 3.0V rms, with any applied load from no load up to converter's overload rating. Maximum imbalanced loads shall be limited to within the limitations set forth in MIL-STD-704F, Figure 1.
12. Voltage Modulation: Shall not exceed 0.5% at any steady state condition from no load up to and including 100% of the unit's rated kVA.
13. Voltage Regulation: Shall not exceed 1% of rated voltage from no load to rated load and from rated load to no load. This regulation shall be maintained with the input line voltage variations of +/- 10%.
14. Voltage Trim Adjustment: The output voltage trim adjustment shall be +/- 15% of nominal output span.
15. Overload Capacity: Shall be capable of supplying overloads of up to 115% of rated load continuously, for up to 150% of rated load for five (5) minutes, and for up to 200% of rated load for 10 seconds while maintaining the output voltage within the regulation band.
16. Line Drop Compensation: Shall be 0 to 5% of voltage span and shall be adjustable.
17. Crest Factor: Shall be 1.414, +/- 0.5%.
18. Frequency Modulation: <+/- 0.10% of the period of output voltage wave, unaffected by load.
19. DC content shall not exceed 100 millivolts, under any load condition.

2.4 PROTECTION

A. Input Protection

1. Phase Loss: The SSFC shall detect the loss of any phase and prevent unit from starting or shall shut down if already running.
2. Phase Rotation: The SSFC shall incorporate automatic phase lock circuits or shall detect incorrect phase rotation and prevent unit from starting.
3. High / Low Input Voltage.
4. Input Circuit Breaker: An internal circuit breaker of suitable size shall provide protection from short circuits and allow maintenance personnel the capability of completely removing power from the unit for maintenance purposes. Input circuit breaker shall be lockable in the off position.
   a. All primary disconnecting means shall be suitable rated to be capable of withstanding and interrupting fault currents available at the input.
5. Control Circuit Transformers: Shall have fused primaries and secondaries, suitably marked, for protection of all control and indicating devices.

B. Output Protection

1. Over/Under Voltage Protection: The SSFC shall detect if over/under voltage exceeds the voltage-time characteristics of MIL-STD-704E, or ISO 6858, and immediately shut down.
2. Overload/Short Circuit:

    a. The unit shall be isolated from the aircraft load by overload/short circuit protection specifically rated for 400 Hz or DC operation as applicable. The unit shall becapable of detecting overloads more than 200% of its rated capacity and shut down within 100msec
    b. The unit shall be capable of withstanding a bolted phase to ground, bolted phase to phase, or a three phase bolted fault at the output terminals without causing damage to the unit.

3. No Break Power Transfer: Unit shall be designed to provide continuous, trip free operation of aircraft designed for No Break Power Transfer operations duringground servicing at the gate.

2.5 CONTROLS

A. Remote Control Station:

1. The control station shall be housed in a NEMA 4X stainless steel enclosure and shall operate on 24 volts or less and shall be located on the bridge lift column (aircraft side of the bridge), to be accessible from ground level. Coordinate this position with all other installed equipment and ancillaries to prevent interferences. The station shall be configured as indicated on the design drawings. Modifications to this configuration must be approved by the Representative.

2. The control station shall have a fault-indicator lamp as follows.

    a. Flash: loss of E&F or 28.5 VDC feedback signal.
    b. Steady: critical fault, SSFC unit prevented from operating.

B. Voltage Adjustment Device: A device shall be provided within the unit's enclosure to adjust the output voltage of the unit by +/- 15% while viewing the voltmeter.

C. Line Drop Compensation: A means shall be provided to adjust the automatic line drop compensation for an aircraft cable of length from 0 to 100 feet.

D. Alarm Reset: A reset pushbutton shall be provided to reset all indicators from cleared alarm signals.

E. Diagnostic System: The unit shall be equipped with a complete diagnostic system including alarm messaging indicator. The diagnostic system shall permit testing of all critical circuits during normal operation.

F. The solid state frequency converter shall be able to communicate with the building management system.

2.6 PBB INTERLOCKS

A. Unit shall interlock with the PBB to prevent PBB horizontal operation while SSFC unit is operating. Appropriate messages shall be displayed at the PBB operator's console to indicate unit's run status is preventing PBB operations.

2.7 METERS AND INDICATORS

A. Voltmeter (Digital): The voltmeter shall be capable of displaying, on a single display, input and output voltages, line-to-line and line-to-neutral. The voltmeter shall be calibrated for 400 Hz and shall have an accuracy of +/-2% full scale.

1. This meter may also be used to display line-to-line DC output voltages, or a separate meter may be provided as necessary.

B. Ammeter (Digital): The ammeter shall be capable of displaying, on a single display, the output current for each phase. The ammeter shall be calibrated for 400 Hz and shall have an accuracy of +/-2% full scale.

1. This meter may also be used to display DC output currents, or a separate meter may be provided as necessary.

C. Frequency Meter (Digital): The frequency meter shall be capable of displaying, on a single display, the output frequency for the unit. The frequency meter shall be calibrated for 400 Hz and shall have an accuracy of +/-2% full scale.

D. Status Indicators: Three (3) indicating lights, visible from the designated front of the unit, shall be provided to indicate the following conditions:

1. Power On
2. Unit Fault
3. Converter On
4. Interlock Bypass On
5. Input Phase Loss or Incorrect Rotation
6. Interlock Feedback Loss

E. Lamp Test. A lamp test push-button when depressed shall test all door mounted light indicators and digital display segments.

F. Elapsed Time Meter: A non-resettable hour meter shall be provided to register total hours

equipment is providing a 400 Hz output. Meter shall register to 99,999 hours.

G. System Indicators: LEDs shall provide indication that all primary circuits and components are operating correctly.

H. Alarm messaging Indicator: A multi-line alpha-numeric readout shall be provided to indicate an internal fault. Fault code shall remain displayed until the unit is reset and shall automatically be re-displayed upon restoration of power should a power outage occur after unit faults and prior to re-setting of fault. The multi-line display can be utilized to provide other indications specified, with exception of the Status Indicators.

I. Unit shall be equipped with a battery backup sustainable memory function with ten year performance during absence of input power. Memory shall catalog, date stamp and store the last 200 power deliveries and or faults.

2.8 PHYSICAL CHARACTERISTICS

A. Design and Construction

1. The unit shall be designed as a modular assembly containing a solid state, 400 Hz frequency converter and 28.5 VDC power supply and all accessories needed to form an operating power supply. Accessibility to all components, modules, and sub-assemblies, shall be maintained.
2. The unit shall be designed and constructed so that parts will not work loose in service. It shall be designed to withstand the strains, jars, vibration and other conditions incident to shipping, storage, installation and service.
3. The converter and inverter sections of the unit shall be grouped for easy inspection or replacement. Each individual module shall be arranged for removal without disassembly of the unit. Control logic printed circuit cards shall be arranged for insertion in a standard card rack with vibration resistant latching mechanisms.
4. The phase modules shall be cooled by a long life fan(s) and the air flow shall be filtered and separated from the internal electronic components to provide a separate physically sealed, environmentally clean electronic sub-section. Cooling of the power transformers shall be convection.
5. The power transformers shall be mounted in separate compartments from the internal electric components.
6. The unit shall be equipped with approved weather tight fittings for all wiring that pass through the weather tight compartments to prevent the entrance of moisture and dust into isolated electronic compartments.
7. All major components and sub-assemblies shall be marked or labeled with an identification number or letter code, or both, on or near the device. The code shall be readily visible when examining the unit.
8. All wiring terminals shall result in a permanent, secure bond between the wire and terminal. All circuits which continue to field-wired components shall terminate at suitably identified and easily accessible terminal boards.
9. Control panel wiring shall be extra flexible, standard type conforming to MIL-W-16878D, or equal. Installation shall be color-coded to requirement of NEMA ICS-1. All wiring shall have ample service loops, shall be formed into neat appearance, and shall be laced

tightly. All wiring shall be permanently marked with an indelible process such as wire stamping, slip-on type markers or other approved methods. Wrap around adhesive markers shall NOT be acceptable. Wire markers shall be within 1" of all terminations and shall be readily visible. Wiring bundles shall be adequately supported and installed in the control cabinet in a neat workmanlike manner.

10. Workmanship: The unit, including all parts and accessories shall be fabricated and finished in a workmanlike manner. Particular attention shall be given to freedom from defects, burrs, sharp edges, quality of soldering, welding, brazing, painting, wiring, riveting, alignment or parts and tightness of assembly screws, bolts, etc.
11. Weatherproof schematics shall be installed on the interior of the controller door. Schematics shall include all wiring and devices and shall include all wire numbers. Schematic shall be impervious to grease, water, ice, or other elements that they may be exposed to in an aviation maintenance environment on an active apron with the doors open.
12. External conductors/cables shall be in conduit. Flexible cables outside of the unit will only be allowed where maximum flexibility is required and only in lengths of 48" or less.

B. Cabinet

1. The cabinet enclosure shall be designed to be suitable for the intended environmental conditions. The components and sub-assemblies shall be mounted in a suitable NEMA 3R, or IEC IP 54 enclosure.
2. Access doors and covers shall be provided for easy access to all component parts.
3. The control panel shall be mounted within the NEMA 3R enclosure with provisions included for attaching remote controls.
4. The unit shall be designed for lifting and transporting by forklift.
5. Door interlock switches shall be provided to shut down the unit, suitable warning labels or covers shall be provided where internal voltages decay slowly after shutdown
6. Factory fabricated mounting brackets shall be utilized for installation of the unit under the PBB. Design of these brackets shall be such to prevent any welding or cutting of the bridge components to facilitate installation. Brackets shall be universal in nature to allow for installation on industry standard, commercially available passenger boarding bridges.

C. Finishes

1. Case components and final assembly shall be painted and suitably protected from oxidation and corrosion to a color matching the passenger boarding bridge on which it is installed.

D. Maintainability and Repair

1. The unit shall have a minimum life expectancy of 20 years and a mean time between failures of 24,000 hours, while operating within the specifications herein at any load up to, and including, rated load.
2. The mean-time-to-repair shall be no greater than 30 minutes at the module level.
3. Replaceable module accessibility shall be consistent with mean-time-to-repair.
4. Test points shall be built into the equipment to permit rapid isolation of defective assemblies, modules, and piece parts, and facilitate alignment, calibration and test.
5. The unit design shall be such that no less than 99% of all faults are correctable at the user

level using recommended spare parts.

2.9 ENVIRONMENTAL CONDITIONS

A. The unit shall successfully operate under the following conditions:

1. Ambient Temperature Range: -40 degrees F to 131 degrees F.
2. Relative Humidity: 10% to 100% non-condensing.
3. Wind: Up to 80 mph with gusts to 125 mph.
4. Altitude: Up to 7000 feet above mean sea level without derating.
5. Audible Noise: Shall not exceed 70 dBA at a height of 60 inches and a distance of 78 inches.

2.10 FACTORY TESTS

A. The Manufacturer shall test every unit to assure compliance with the Specifications. Dated and signed certification test sheets shall be submitted as indicated in the Submittals section of this specification. The Owner shall be notified 14 days prior to the date of such tests. The Owner reserves the right to witness tests and request additional tests that show compliance with the Specifications. Tests shall include, but not be limited to, the following:

1. Operational Checkout:

a. Unit shall undergo a high potential test of 2000V for two (2) minutes on the input of the unit to detect wiring errors. Additional checks shall include temperature alarm, under voltage alarm, hour meter, and fans.

2. No Load Losses:

a. Operate at no load and nominal input voltage. Measure and record input voltage, output voltage, input current, output frequency, and input power factor.

3. Load Test:

a. Operate unit at 50%, and 100% loads. Measure and record output voltage, output frequency, output current, output voltage and input current THD.

4. Burn-In:

a. Before delivery, operate each unit for a minimum of 24 continuous hours.

B. Should factory tests fail to indicate compliance with specifications, all costs associated with re- testing, including costs associated with Owner's witness services, will be the responsibility of the manufacturer.

PART 3 EXECUTION

3.1 CABINET MOUNTING

A. SSFC shall be mounted by the Design Builder as indicated in approved submittal drawings.

3.2 ELECTROMAGNETIC COMPATIBILITY

A. Grounding:

1. The Design Builder shall install grounding conductors as directed by manufacturer and in accordance with the NEC requirements for separately derived systems.

B. The chassis and enclosure shall be continuously welded for maximum shielding.

3.3 EXAMINATION

A. Verify/perform the following items or tasks.

1. Air inlets or exhaust louvers are not obstructed
2. Check to be sure that there are no tools or loose objects in the unit.
3. Make a final check of the security of the power connections.
4. Re-install any covers removed during installation.

3.4 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. The units shall not hinder or restrict the passenger boarding bridge or ancillary equipment from operating within its full designed operating range.

C. Arrange installation of cables to provide adequate clearance for service and maintenance.

D. The unit and cables shall be properly aligned and adjusted before final acceptance.

E. Wire mesh strain reliefs shall be utilized at aircraft cable termination points.

3.5 INTERFACE WITH OTHER WORK

A. The installation may occur with active gates adjacent to the work area. The Design Builder shall plan for only working on one gate at a time and coordinating access with airport operations.

3.6 FIELD QUALITY CONTROL

A. The Design Builder shall inspect each installation for loose connections, proper grounding connections, and latching of circuit boards in card rack.

3.7 STARTING EQUIPMENT

A. Adjust for proper operation within manufacturer's published tolerances.

B. Field Tests

1. The startup personnel shall test every unit to assure compliance with the Specifications. The Owner shall be notified 14 days prior to the date of such tests. Dated and signed Field Commissioning Reports shall be submitted within 14 days of performance of tests. The Owner reserves the right to witness tests and request additional tests that show compliance with the Specifications. Tests shall include, but not be limited to, the following:

   a. Operational Checkout:

      1) Local and remote pushbuttons shall be checked for operation.
      2) Correct phase rotation shall be verified by unit's status indicator.
      3) E&F circuit interlock and bypass operation shall be verified by unit's status indicators.
      4) Lamp Test shall be verified by unit's status indicators.

   b. No Load:

      1) Operate at no load and nominal input voltage. Measure and record input voltage, output voltage(s), and output frequency at aircraft cable plugs.

   c. Load Test:

      1) Operate 400 Hz unit output at 50%, and 100% loads. Measure and record output voltage at aircraft cable plugs for each load interval.

   d. Provide complete functional testing to the satisfaction of the Owner.

C. The Design Builder shall complete all punch list items.

3.8 ADJUSTING

A. Adjust line drop compensation to operate with length of aircraft cable installed. Proper test equipment shall be utilized to verify adjustment of line drop compensation circuit.

B. 400 Hz: Operational Voltages:

1. No Load Voltage: 116.0 - 117.0 Volts.
2. Full Load Voltage: 115.0 - 116.5 Volts.

3.9 CLEANING

A. The Design Builder shall clean each unit from all construction dust and debris prior to start-up.

B. Touch up scratched or marred surfaces to match original finish.

C. Protect the installed unit from subsequent construction operations.

END OF SECTION

SECTION 34 77 16

AIRCRAFT POTABLE WATER CABINET

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Aircraft Potable Water Cabinet

1. The purpose of the potable water cabinet(s) is to provide a weatherproof enclosure for the equipment to permit the expeditious dispensing of potable water for the servicing of drinking water tanks on aircraft in commercial airline passenger service as indicated on the project aircraft parking plan.

B. Work Includes: Designing, manufacturing, testing, furnishing, installing and commissioning potable water cabinets.

1.2 RELATED SECTIONS

A. Drawings, General Provisions of the Contract, including General and Special Conditions, as well as General electrical and mechanical materials and methods of installation apply to work of this section.

1.3 REFERENCES

A. The latest approved version or edition, by the authority having jurisdiction, ofthe following codes, references and standards shall apply where applicable. If the authority having jurisdiction has not approved or adopted a particular code, reference, or standard, the latest published edition shall be applicable.

1. International Building Code - ICC (IBC)

2. Society of Automotive Engineers (S.A.E.) standards.

3. National Electrical Code - NFPA 70

4. American Society of Mechanical Engineers (A.S.M.E.) standards.

5. MG-1 Motors and Gears Motors Standards, IC-S Industrial Control and System Standards - National Electrical Manufactures Association (N.E.M.A.).

6. Williams - Steiger Occupational Safety and Health Act of 1970, Public Law 91-596.

7. Standards of Sanitation for the Construction and Operation of Commercial Passenger Aircraft and Servicing and Catering Facilities. By the Public Health Service - U.S. Department of Health, Education and Welfare.

8. Guidelines for Evaluation Aircraft Potable Water Servicing Vehicle

Construction. Interstate Travel Sanitation Branch, Bureau of Foods, Pesticides and Product Safety - Food and Drug Administration.

9. Code of Federal Regulations: Title 29, Part 1910 Occupational Safety and Health Standards

10. Cross Connection Control Manual - Water Supply division, U.S. Environmental Protection Agency.

11. American Welding Society - Applicable chapters/sections of welding standards.

12. ATA Specification 101 - Ground Equipment Technical Manuals - Air Transport Association.

1.4 SUBMITTALS

A. Pre-Manufacture: The following submittals shall be made as necessary to meet the project schedule and shall be submitted and approved prior to manufacturing the potable water cabinets.

1. Product Data: Provide manufacturer's data indicating, as a minimum, physical characteristics, dimensions, and cabinet details.

2. Shop Drawings: Provide schematics and interconnection diagrams, indicate front and side views of cabinet with overall dimensions and weights shown; conduit and piping entrance locations and requirements; and nameplate legends. Differentiate between manufacturer-installed wiring and field-installed connections.

3. Certificates: Certify that products of this section meet or exceed the sanitation standards as established by the United States Department of Health. Manufacturer shall furnish a certificate of compliance for all units.

4. Maintenance Data: Include routine preventive maintenance schedule, recommended spare parts list, and required tools.

5. Spare Parts List: Provide manufacturer's recommended spare parts list along with current pricing. Current pricing shall remain valid Owner pricing for two (2) years from date of final completion.

6. UL/ETL Certification per 1.05.E.

B. Pre-Substantial Completion: The following submittals shall be submitted and approved prior to 14 days before Substantial Completion.

1. Operation and Maintenance Manuals.

2. Field Commissioning Report: Submit proposed field commissioning report for acceptance. This accepted form will be utilized for the final field commissioning as specified in Section 3 herein.

C. Pre-Final Completion: The following submittals shall be submitted and accepted prior to

14 days before Final Completion.

1. Field Commissioning Report: A completed field commissioning report as specified herein. Utilize approved form.

2. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

3. As-Built Drawings: Provide field edited redlined project drawings showing deviations from design drawings.

1.5 QUALITY CONTROL

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. High Standards of workmanship and methods shall be utilized in the manufacture of the unit. No workmanship, which for any reason is otherwise, will be accepted.

C. Only standard components of highest commercial quality, currently available and conforming to the recommendations and standards established by the Society of Automotive Engineers (SAE) and the American Society of Mechanical Engineers (ASME) shall be used.

D. All materials and components assembled or fabricated into the equipment are to be new, unused, of high quality, of current production and free from defects or imperfections which might affect the appearance or serviceability of the finished product.

E. UL Compliance: Units shall be UL, or ETL listed and shall be labeled by a nationally recognized testing laboratory at the time of bid. Submit verification with bid submittals.

1.6 DELIVERY, STORAGE, AND PROTECTION

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

B. Deliver equipment as a factory-assembled unit whenever practical for shipping purposes with protective crating and covering.

C. Store equipment and material in suitable facilities until delivery, installation, and acceptance.

D. Coordinate the delivery acceptance of this equipment at the job site. Receive, offload, store and protect this equipment until such time as it has been installed and accepted by the Owner.

E. Properly dispose of all waste, including, but not limited to, packaging, crates, etcetera.

1.7 PROJECT CONDITIONS

A. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.8 WARRANTY

A. Provide a full parts and labor warranty for the new unit. Labor warranty shall be performed by factory trained service technicians. Warranty shall run two (2) years from the Date of Beneficial Use. Date of Beneficial Use is defined as the date the system is turned over by the manufacturer and accepted by the Owner for normal operation. All warranty services shall be at the site of the installation. Provider shall be responsible for all travel and sustenance expenses necessary for warranty services.

B. Shipping and handling charges for warranty parts are the responsibility of the provider.

C. Warranty Services shall be commenced with on site representation, by qualified repair technicians, within 72 hours from the request of the Owner.

1.9 OPERATION AND MAINTENANCE MANUALS

A. Provide six (6) bound copies and electronic copies of the approved, comprehensive Operation and Maintenance Manual to the Owner fourteen (14) days prior to Substantial Completion.

1. Electronic copies shall be in PDF format. Assemble O&M manuals into a single electronic PDF file with bookmarks enabling navigation to each section. Provide bookmarked table of contents at beginning of document.

B. The manuals shall fully describe each product, system, or subsystem numbered logically and separated into sections and contained in rigid plastic binders with identification inserted in clear plastic pockets on front and spine of each binder. Manuals shall be assembled in accordance with ATA 101.

C. The content of the manuals shall be limited to information and data that specifically apply to products provided and shall include a general description theory of operation, routine normal and special operating instructions and sequences. Also included shall be routine maintenance procedures and guides for troubleshooting, disassembly and reassembly instructions, and recommended spare parts list consisting of current prices and sources.

D. Wiring diagrams and schematics shall be incorporated into the manuals to clearly show features such as controls, switches, instruments, and indicators by name and location.

E. Spare Parts List: Provide manufacturer's recommended spare parts list.

F. Special Tools List: Provide a list of any special tools required to perform any field performable maintenance tasks.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Phoenix Metal Products

B. Semler Industries

C. Substitutions:

1. None.

2.2 BRANDING

A. The Owner, or Owner's tenant, reserves the right to provide branding on the exterior sides of the installed equipment and desires that this branding not be diminished by excessively large or aesthetically displeasing branding of individual pieces of equipment. All manufacturers branding, labeling, marking, etcetera, on their products shall be relatively small compared to the overall size of the piece of equipment. The Owner reserves the right to require any non-approved branding removed from finished products at no additional cost.

2.3 UNIT DESCRIPTION

A. The principal components of the potable water cabinet are the cabinet with doors and latching hardware; the reel; rewind motor; hose and coupling; water pressure regulator; shut-off valve; piping; vacuum breaker; pressure gauge; back flow preventer, light fixture, heaters; and operating controls.

2.4 COMPONENTS

A. All components of the cabinet shall be constructed in accordance with all codes and standards applicable to the design and construction of this type of equipment, which are generally accepted and used as good practice throughout the industry, i.e., NFPA, UL, OSHA, SAE, ANSI, Military Standards, etc. The design of all parts and subassemblies shall be in accordance with good commercial practice and is the responsibility of the manufacturer to assure safe, efficient and practical design in keeping with requirements peculiar to this type of system. All circuits shall be protected from short circuits and overload via circuit breakers.

B. Stand Assembly:

1. A primed and painted steel frame assembly shall be provided as necessary to stand mount and secure the unit on a suitable sub-surface. Nominal dimensions shall be 18"Hx 44" L x 33" W.

C. Cabinet:

1. The cabinet shall be constructed entirely of Type 304 stainless steel using 14 gauge material for the frame, main panels and stiffeners with 16 gauge material used for any removable panels, etc. Construction shall be of the double wall type with suitable insulation and welded and ground joints.
2. The cabinet shall be designed with mounting provisions and stiffeners to enable it to be mounted on the wall of a building or on a steel stand on the ramp or sidewalk. The cabinet shall be sized to comfortably hold the equipment required but not be more than 45" high, 52" wide, or 32" deep and shall be equipped with a sloping bottom and a centrally located drain fitting sized 1" N.P.T.

3. In addition to the small openings for water and electrical service lines, the cabinet shall embody one large opening in the front of the cabinet sized a minimum of 40" wide and

36" high to be fitted with overlapping double doors hinged at the outside on full length stainless steel piano hinges. The doors shall be constructed of 14 gauge Type 304 stainless steel with double wall construction and suitable insulation and utilize a two point latch assembly (Eberhard Mfg. Co. - Cleveland, OH, #5648) or (Versch Lock - McBee SC) or approved equivalent, and gravity operated hold-open rods.

D. Hose Reel:

1. The reel shall be a Clifford Hannay type DABZ-E-6028-25 26RT or DABZ-E6030-25-26RT, with 120 volt 60 Hz single phase rewind motor and auxiliary hand crank. The reel, steel discs and frame shall be electroless nickel plated (Enplate NI-422). The swing joint and internal piping shall be Bronze.

2. The size of the reel shall be sufficiently large to conveniently accommodate a maximum of 250 ft of three quarter inch (3/4") I.D. hose.

3. Reel shall be equipped with an adjustable rewind drag brake system.

E. Rewind Motor:

1. The rewind motor shall be of the flange mount type ½ horsepower single phase, 120 volt, 60 Hz. The motor speed and gearing shall produce an average hose rewind rate of between 5.5 and 6.3 ft per second.

2. Unit shall be equipped with an auxiliary hand rewind mechanism which allows rewinding the hose in the event of failure of the motor driven rewind system.

F. Hose:

1. The hose shall be NSF and FDA approved food-grade quality clear plastic tubing 3/4 in. I.D. x 5/32 in. wall by Nalge Co. Sybron Corp., Rochester, NY 14602, P/N Nalgene 180. The hose is to be furnished in one unspliced length. The length of the hose to be supplied with each cabinet shall be 250 ft minimum. The Design Builder shall verify the length of hose required for all aircraft to be serviced at each gate.

G. Hose End Fittings:

1. The hose end fittings and ball valves shall be non-ferrous or stainless steel; shall be installed so as to allow connection to commercial aircraft water inlets; and so as to start and stop flow at the aircraft end of the hose.

2. Hose end ball valve shall be fitted with a suitable fitting to cap the discharge when not in use. Cap shall be permanently tethered to the end of the hose and shall be easily and quickly removable and insertable with gloved hands.

3. Hose end shall be fitted with a light weight, high wear device of adequate dimensions so as to maintain hose end fitting a minimum of 2" above the ground level when temporarily rested on the ground by the operator.

H. Hose Receptacles:

1. The cabinet shall incorporate a hanger or receptacle in which to store the hose end and protect it from contamination. The receptacle shall be of the open type so as not to collect dirt and contamination, and shall be made of stainless steel.

I. Pressure Regulator:

1. The water pressure regulator shall be a "Cash-Acme" type E-24 size 1" with a range of 20 - 70 P.S.I. or equivalent.

J. Swivel Joint:

1. The reel shall have an OPW 3320-0101 or 3330-0101 swivel joint or equivalent.

K. Pressure Gauge:

1. The pressure gauge shall be a 2" diameter brass gauge with bronze internals, and have a 1/4" N.P.T. inlet fitting and a range of 0 - 150 P.S.I. Marshaltown No. 160 or equivalent.

L. Shut-Off Valve:

1. The plumbing in the cabinet shall incorporate a manual shut-off valve in the line just after the vacuum breaker. The shut-off valve shall be a 1" non ferrous ball valve equipped with teflon seals. Worcester P/N 4211-T or Smith equivalent.

M. Back Flow Preventer:

1. Double check, RPZ style, or other as necessary to meet all federal state and local laws, codes, ordinances, standards for cross connected water systems.

2. Provide all tests or certifications required by the authorities having jurisdiction.

N. Heater:

1. The unit shall be equipped with a heater for freeze protection. The heater shall consist of one or more electrical strip heaters with on/off switch and thermostat control with a capacity to maintain the equipment above freezing in ambient conditions as required at the location of the project.

2. The heaters shall be mounted or shielded such that the hose is protected from damage or excessive heat from direct contact with the elements.

O. Light Fixtures:

1. Illumination shall be provided by a 100 watt incandescent lamp, or LED equivalent, mounted in a guarded explosion proof fixture (Crouse-Hinds No. V2759) or Appleton Electric Co. A-51 series fixture or equivalent.

P. Heat Tape System:

1. All exposed piping shall be insulated and protected from freezing.

2. Heating Cable: Mineral-insulated, copper-sheathed, series resistance heating cable in single conductor configuration with one cold end. Heating cable shall be linked to the Building Management System with an alarm.

3. Rating: 120V, 10W/lineal ft.

4. Thermostat: Self-regulating.

5. Glass Fiber:

    a. Insulation: ASTM C 547 and ASTM C 795; rigid molded, noncombustible.

        1) 'K' value: ASTM C 177, 0.24 at 75 degrees F.

        2) Maximum service temperature: 850 degrees F.

        3) Maximum moisture absorption: 0.2 percent by volume.

    b. Vapor Barrier Jacket: White Kraft paper with fiber yarn bonded to aluminized film moisture vapor transmission when tested in accordance with ASTM E 96 of 0.02 perm inches.

    c. 'K' value: ASTM C 177, 0.24 at 75 degrees F.

    d. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

    e. Vapor Barrier Lap Adhesive: Compatible with insulation.

    f. Insulating Cement/Mastic: ASTM C 195; hydraulic setting on mineral wool.

    g. Fibrous Glass Fabric:

        1) Cloth: Untreated; 9 oz/sq yd weight.

        2) Blanket: 1.0 lb/cu ft density.

        3) Weave: 10 x 10 per inch.

    h. Outdoor Breather Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

    i. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

    j. Insulating Cement: ASTM C 449/C 449M.

6. Jackets:

   a. Aluminum Jacket: ASTM B 209 (ASTM B 209M) formed aluminum sheet.

      1) Thickness: 0.016 inch sheet.

      2) Finish: Embossed.

      3) Joining: Longitudinal slip joints and 2 inch laps.

      4) Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.

      5) Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

2.5 DESIGN REQUIREMENTS

A. General:

1. Unit and piped supply shall enable a minimum flow capacity of 12 GPM with a maximum pressure drop of 10 psi from the building connection to hose reel.

2. It shall be the manufacturer's responsibility to recognize and comply with all codes and standards applicable to the design, construction, and installation of this type of equipment which are generally accepted and used as good practice in the industry, as well as all federal, state and local laws, codes, rules, ordinances and standards.

3. The unit shall be designed and constructed to prevent parts from working loose in service. It shall be built to withstand stresses, jars, vibrations, and other conditions incident to shipping storage, installation, and service. Suitable and durable vibration isolators shall be used between moving components and structural mounts and to include all other structural mountings to protect the operator, instruments, components, hydraulics, and structure from vibration transmission.

4. All parts and materials needed to fabricate, assemble, and finish the equipment shall be furnished by the manufacturer unless otherwise specified.

5. Fire resistant and non-moisture absorbing materials shall be used wherever possible.

6. All bolted, screwed, and threaded fastenings shall incorporate adequate locking devices.

7. Weldments requiring alignment with assemblies, interchangeability, fit, and flatness, shall be fabricated with the use of fixtures capable of maintaining dimensions in the finished part within design tolerance.

8. Specified sections and weld design and application shall be such that heat distortion of plates and members is minimized in the final weldment.

9. Sub-components must be installed per the manufacturers' recommendations.

10. All components shall be chosen to be within their manufacturer's published ratings under the most severe conditions of operation.

11. Fastener heads shall not be located on rub or wear surfaces unless recessed below the surfaces.

B. Mechanical Design

1. The stress levels for design shall be based on the total structural weight plus maximum carried load. Consideration will be made for anticipated dynamic loads.
2. Structural members manufactured of ductile material shall be designed with a minimum factor of safety of 3 relative to the yield strength.

3. Structural members manufactured of non-ductile materials shall be designed such that the maximum working stress does not exceed one-fourth of the ultimate strength of the material or manufacturer's published recommended allowable working stress, whichever is lower.

4. In determining the design factor of safety, weld efficiencies as designated by the American Welding Society or applicable design codes shall be included in determination of the factor of safety for welded joints.

5. Joint efficiencies shall be included in determination of the factor of safety for bolted connections.

6. The unit shall be designed with sufficient structural rigidity that deflections due to load, wind, and motions of working parts do not create interferences, cause malfunctioning of the equipment, or present safety hazards to personnel, aircraft, or the unit itself.

7. Shoulder bolts, bearings, or bushings shall be used when attaching parts having relative rotary or linear motion.

C. Electrical Design

1. The electrical controls shall include:

a. Heater control thermostat.

b. Light switch.

c. Rewind motor push button station.

d. One 120 volt single phase power circuit for the heater assembly.

e. One 120 volt single phase power circuit for the rewind motor and the light.

f. Overcurrent Protection:

1) Overcurrent protection shall be a 600 volt, 30 amp, 3-pole, NEMA 3R, 20 amp

fused disconnect, field installed adjacent to the unit as indicated on the project drawings.

g. A junction box shall be provided at a convenient location just inside the cabinet rear wall to make service connections.

h. Duplex 120V GFCI protected convenience outlet with weatherproof cover.

i. Self regulating heat tape system for exterior piping.

2. Electrical motors shall be single phase, 120 volt, 60 hertz.

3. Toggle switches shall be NEMA rated quality and rated for the loads which they control.

4. All circuits shall have suitable overload protection. Fuses and circuit breakers shall be grouped in convenient locations and suitably marked for size and function. Protection devices shall be sized to protect wiring and motors from damage due to overload.

5. All wiring shall be in conduit and shall be routed away from heat sources. Conduit and wiring systems shall be adequately supported to protect them from damage, snow and ice buildup, bumping, kinking, and flexing.

6. Common wire splices shall not be used. Connections shall be made using terminal strips and staked lugs or by patent connectors.

7. Each conductor shall be sized to have current carrying capacity as allowed by the National Electrical Code equal to or greater than the capacity of the fuse or circuit breaker provided in its circuit. Optional and add-on components shall be considered in sizing and in the number of conductors provided.

8. Grommets and suitable anti-chafe material shall be used where wires are required to pass through a relief or opening which exposes the wire to possible chafing.

9. Each wiring conductor shall be identified by a permanent marker in accordance with a wiring diagram accessibly displayed in the equipment and in the maintenance manual. Wrap around style adhesive markers will not be permitted.

10. Any concealed wiring running within walls or other inaccessible areas shall be contained in conduit for the length of the run and shall be terminated on a terminal strip at each end of the conduit.

11. All electrical connections, including terminal strips, shall be protected with suitable covers or enclosures to prevent accidental contact and short circuiting.

12. Electrical interlocks shall be fail-safe design.

13. Electrical devices including lights, switches, relays, wiring, and terminals, when located in an area exposed to weather, shall be of weatherproof design or protected by weatherproof enclosures.

14. Spark producing electrical components shall be located at least 18 in (457 mm) above

ground level wherever possible. No electrical components shall be located below this level.

15. Lights, electrical apparatus, and wiring on units required to operate in hazardous locations shall comply with Article 500 of the National Electrical Code.

16. All lamps shall be heavy duty type.

D. Instruments and Controls

1. Controls and controlling circuits shall be designed such that any failure within a control or its circuitry will not introduce an unsafe operating condition.

2. Controls shall be grouped and located so as to be convenient to the operator when at their normal operating station but shall be located so as not to permit clothing to catch accidentally on them.

3. Controls shall be designed for satisfactory operation when the operator is wearing heavy arctic type gloves and overshoes.

4. Controls shall be identified with permanently affixed and non-fading placards.

5. Placards shall be provided for all controls which shall be in sharp color contrast in large enough letters or pictograms to be easily read from the operator's position indicating the function and direction of the motion of the control.

6. Control panels shall provide easy accessibility of controls and instruments and shall contain all items necessary for the safe operation and control of the equipment.

7. All instruments and control panels shall be lighted to a level of 5 ft-c (54 lx) of illumination and shall not produce a glare to the operator.

8. Instruments and controls exposed to the weather shall be of a rugged, weatherproof type and shall be protected from ice and snow accumulations.

9. No more than 20 lb. of force shall be required to actuate any hand control

E. Cabinet Design

1. The cabinet shall be constructed of 14 and 16 gauge #304 stainless steel.

2. The cabinet shall be designed with mounting provisions and stiffeners to enable it to be mounted on a wall or on a steel stand.

3. The cabinet will be sized to accommodate all components without interference of operation or maintenance but is to be no larger than 45" high, 52" wide, and 32" deep.

4. The cabinet shall have a minimum of 1" of insulation on all interior walls and doors.

5. The cabinet shall have a center drain in the bottom of the cabinet with a 1" NPT fitting.

6. The cabinet shall incorporate a hose receptacle to store the hose end inside the cabinet while not in use.

7. The cabinet shall incorporate a light fixture for illumination of the controls.

F. Environmental Requirements:

1. The unit shall operate satisfactorily under ambient temperature conditions of -20 to 125 degrees F. (-29 to 52 degrees C.) with heater, including a static soak of up to 48 hours within this range with or without wind of up to 50 MPH.

2. The equipment and all of its components shall be designed to operate satisfactorily after 6 hours of exposure to heavy rainfall (.30 in/hr) driven by a 25 mph wind in any horizontal direction.

3. Components shall be protected from mechanical, electrical, and corrosion damage and impairment of operation due to rain, snow, ice, sand, grit, and deicing fluids.

G. Service and Access

1. All components of the unit shall be fully accessible for maintenance personnel. If removal of one component is necessary, no other component should have to be removed first.

2. Equipment components and systems requiring frequent inspection or maintenance shall be readily accessible. Suitable access doors or removable enclosures shall be provided for this purpose.

3. Hinges shall be located on the forward edge of all vertically hung doors and on the lower edge of all horizontally hinged doors. Where possible, at least 8 inches of clearance above the ground shall exist when any door is open.

4. All hinged doors shall be provided with devices to secure them in either the open or closed position so that jet blast or ambient winds will not move them.

5. Fastener heads and nuts shall be provided with adequate clearance for wrenches or drivers. U.S. standard (inches) hardware shall be used.

2.6 IDENTIFICATION

A. Placards:

1. Each unit and its operating controls shall be placarded with permanent type metal or engraved phenolic type placards as follows:

a. Data Plate:

1) Each unit shall bear a data plate on the inside of the cabinet containing the manufacturer's data as follows:

(a) Manufacturer's name, address, phone number.

(b) Model number.

(c) Serial number.

(d) Date of manufacture.

(e) Electrical Information required by the NEC.

b. Electric Component Identification:

1) All electrical components shall be identified by placards affixed adjacent to the component. Control switch placards shall also identify the function of the switch.

2) All wire terminations shall be permanently identified in accordance with wiring diagrams and schematics on the "as built" drawings or in the manuals. Cloth wire markers are not acceptable.

c. Exterior Placards:

1) The front of the cabinet shall bear a placard, utilizing letters a minimum of one inch (1") high that spell out "Potable Water" in contrasting and highly visible colors.

2. Adhesive type placards are not acceptable for this requirement.

2.7 SAFETY

A. Health and safety of passengers, servicing personnel and the aircraft shall be of primeconcern in the design of the unit.

B. It shall be the responsibility of the manufacturer to ensure that the equipment contains all the safety features required to protect the equipment, the operator(s), the load, and the aircraft serviced, which are generally accepted and used as good practice in the industry, as well asall federal, state and local laws, codes, rules, ordinances and standards.

1. Personnel Safety

a. Where required, heat shields or guards shall be installed to protect personnel operating the equipment or performing routine periodic maintenance on the equipment against accidental contact with exposed parts which are subject to high operating temperatures. Warning labels shall be added where applicable.

b. Suitable Guards shall be provided for all moving parts located where operating personnel may make accidental contact with them. Warning labels shall be added where applicable.

c. Exposure to operating and maintenance personnel to electric shock hazards shallbe

minimized by the provision of suitable interlocks, grounding means, or protective devices.

d. Guards or enclosures shall be provided for all exposed portions ofelectrical equipment.

e. All pinch and shear points, sharp edges and protruding objects must beeliminated wherever possible and practical. If elimination is not possible, adequate guarding must be achieved to prevent injury and/or damage exposure.

f. Push/Pull forces required to move other than control handles and access doors shall be limited to 60 lb. (27.2 kg), when the operator is standing upright.

2.8 MAINTAINABILITY

A. The cabinet and its controls shall be easily operated by personnel possessing no specialskills and with minimum training. Maintenance requirements shall present no special problems to personnel knowledgeable in their respective fields of electrical, plumbing, and general assembly.

B. The design shall stress simplicity, ruggedness and ease of maintenance. Specialty tools shall not be required in routine maintenance operations.

C. All systems shall be designed to operate with a minimum of routine maintenance using long life components and sealed or self lubricating mechanisms, etc.

D. Components shall be installed with adequate access and types of fastenings to permit them to be changed by one man when the unit is in position bolted to an exterior wall of the building or the apron or sidewalk.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that site is ready to receive equipment.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Arrange installation of units to provide adequate clearance for service and maintenance. Ensure installation locations will not interfere with PBB related equipment operations in any manner and ensure unit does not present obstructions to sidewalk traffic flow. Verify prior to actual installation. Notify engineer if interferences exist, prior to installation.

C. The units shall be properly aligned, adjusted, and lubricated before final acceptance.

D. Install heat tape and insulation system as specified herein and as indicated on the contract drawings.

E. Commission equipment. Provide complete functional testing to the satisfaction of theengineer. Complete all punchlist items.

3.3 INTERFACE WITH OTHER WORK

A. Installation of unit shall be coordinated with other trades associated with project.

3.4 FIELD QUALITY CONTROL

A. Inspect for loose connections, proper grounding connections, and leaks.

3.5 STARTING EQUIPMENT AND SYSTEMS

A. Do not activate water to unit until electrical service is activated and all circuits including the heat circuits are verified to be operational.

B. Adjust for proper operation within manufacturer's published tolerances.

C. Complete and submit approved Field Commissioning Report. Report shall include, but shall not be limited to, water pressure setting, thermostat setting, FLA for all incoming phases with heat activated.

1. Owner reserves the right to witness such tests. Provide a minimum or 14 days' notice.

D. Demonstrate proper operation of equipment to Owner's designated representative.

3.6 ADJUSTING

A. Adjust hose reel for smooth operation.

3.7 CLEANING

A. Clean unit from all construction dust and debris prior to start-up.

B. Protect installed equipment from subsequent construction operations.

C. Touch up scratched or marred surfaces to match original finish.

END OF SECTION