SECTION 118504 - PASSENGER BOARDING BRIDGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This specification sets forth the description, technical and performance specifications for apron drive type passenger boarding bridges (PBB).

1. This specification is intended to include both two and three tunnel type passenger boarding bridges, of corrugated or truss style construction, and all lengths thereof, as well as any fixed section of tunnel used as a walkway to the apron drive bridge; however, only truss style (smooth sided) 3- tunnel bridges will be allowed on this project.

2. The aircraft parking requirements for each PBB are available upon request.

1.02 RELATED SECTIONS

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

B. Section 118502 - Dx Point of Use Preconditioned Air Unit.

C. Section 118600 - Aircraft Ground Power Cable.

D. Section 118602 - Solid State Frequency Converter.

E. Section 118604 - Cable Hoists.

1.03 REFERENCES

A. The bridge shall conform to all applicable federal, state, and municipal codes and regulations that apply to the installation site. The design of all parts and subassemblies shall be in accordance with good commercial practices to assure safe, efficient, and practical designs in keeping with standards that have been adopted by the passenger loading bridge industry. Applicable documents include, but are not limited to, the following. The latest approved version or edition, 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.

1. American Institute of Steel Construction (AISC)

2. Society of Automotive Engineers (SAE) Standards

3. American Society of Mechanical Engineers (ASME) Standards


6. American's with Disabilities Act (ADA)

7. Steel Structures Painting Council (SSPC)

8. National Electrical Code (NEC)

9. National Electrical Manufacturers Association (NEMA) Standards

10. Occupational Safety and Health Administration (OSHA)

11. American Welding Society (AWS) Standards


13. American Insurance Association (AIA)

14. Structural Steel ASTM-A36

15. Hollow Structural Sections (HSS) ASTM-500
16. Wide Flange Sections ASTM-A992
17. Steel Pipe ASTM-A53
18. Steel Sheet ASTM-A570
19. T-1 Steel ASTM-A514 and A517
20. Hinge Pins ASTM-A 311 Grade 1018 and Grade 1144
22. Bolts—High Strength SAE-J429 Grade 5 and 8
23. ANSI/UL 1449 Standard for Surge Protective Devices
24. IEEE Std 1100 Recommended Practice for Powering and Grounding Electronic Equipment

1.04 GENERAL REQUIREMENTS

A. The term "Passenger Boarding Bridge", "Passenger Loading Bridge", "Boarding Bridge" "Loading Bridge", "bridge", "PLB", and "PBB" as used within this specification and throughout the contract documents is understood to mean the components, subcomponents and subsystems that constitute a complete, operable, and maintainable Passenger Boarding Bridge and as referred to herein, are synonymous.

B. The terms, “Seller”, “Contractor”, “Provider” and “Manufacturer” as referred to herein, are synonymous. The term Owner, shall include the Owner, or his authorized representative.

C. Applicable contract and terminal building drawings will be made available upon written request.

D. The PBB 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 system.

E. It is the design intent that all GSE equipment specified within this project, is to be provided, delivered, installed, and commissioned by one Contractor. This includes Passenger Boarding Bridges, Preconditioned Air, 400 Hz, and related ancillaries. This Contractor will be responsible for providing complete passenger boarding bridges that are factory prepared, in every sense, including, but not limited to electrically, structurally, and mechanically to accommodate the installation of preconditioned air and 400 Hz equipment as specified, on the PBB’s. This is to include all brackets, electrical, hoses, communications, etcetera as required.

1. The Contractor shall coordinate with the 400 Hz, PCA, and other equipment for the provisions for, or installation of, all necessary infrastructure prior to final factory painting of the passenger loading bridge. The intent is to eliminate site welding/painting after final factory painting.

F. The manufacturer shall be a qualified source, who has been regularly engaged in the engineering, manufacturing and installation of commercial aviation PBB equipment and components for a minimum of five (5) years and with a minimum of one hundred (100) units installed.

G. Qualified manufacturers and installers will have completed no less than five (5) jobs of similar size and scope within the last five (5) years.
H. The manufacturer shall have proven technical capabilities and adequate manufacturing facilities together with sufficient financial depth and stability to permit prompt and satisfactory execution of the contract.

I. Manufacturers are required to satisfy all requirements of this specification. Should the Manufacturer 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 Manufacturer 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.

J. The Manufacturer shall be responsible for verifying installation locations and methods and shall notify the Engineer of any conflicts or code violations prior to manufacture of the PBB units. Verifications shall include field verifications of terminal building heights, appurtenances and finishes, including terminal doors; electrical, mechanical, special systems, and communications interfaces; as well as PBB and walkway foundation locations, rotations, elevations and bolt details. Modifications to eliminate conflicts or code violations will be coordinated with and approved by the Engineer. Modifications shall be made at no additional cost to the Owner.

K. The Manufacturer shall furnish and install all necessary equipment to provide a complete, operable and maintainable unit.

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

M. 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.

N. The equipment and its accessories shall be designed and constructed with reliability of operation a primary consideration. The minimum reliability design requirement is that the equipment be designed to operate between periodic preventative maintenance periods of 300 operating hours or six weeks, whichever occurs first. The above interval does not apply to components in those cases where the component manufacturer recommends more frequent maintenance intervals.

1.05 SUBMITTALS

A. Drawings, sketches, details, and materials shall be submitted in the English language, with United States Units, including dimensions, volumes, weights, and forces. The use of the metric or SI units is not acceptable.

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

1. Alternate configurations per 1.04.L.
3. Spare Parts List: Provide manufacturer’s recommended spare parts list. Spare parts list shall include Owner applicable pricing. Spare parts pricing shall remain valid for two (2) years from the date of final completion.
4. Proposed PBB models with manufacturer’s standard cut sheets for proposed models.
5. Foundation loads for each passenger boarding bridge model proposed.
6. UL/ETL Certification per 1.06.C.
C. Pre-Manufacture Submittals: The following submittals shall be made as necessary to meet the project schedule, and shall be submitted to and approved prior to manufacturing the PBB units.

1. The manufacturer shall submit shop drawings, technical specifications, and descriptive product data for review and approval. An index prepared in chronological order listing drawings, sketches, details, and material submitted shall be provided.

2. Product data for selected models including specialties, accessories, and the following:
   a. Critical design items related to the human factors including operation and maintenance shall be addressed with Shop Drawing and shall include, but not be limited to:
      1) General:
         (a) General Arrangement drawings to include dimensions
         (b) General Erections drawings to include dimensions
      2) Interior Finishes:
         (a) Interior scheme of each type
         (b) Transition details
         (c) Wall finish attachment
         (d) Light fixture details and layout
         (e) Joint details
         (f) Interior Finishes
         (g) Carpet edging details, including, lines of demarcation between carpeted and hard surfaced floor at wall areas and treatment at doors and thresholds
      3) Exterior Configurations:
         (a) General bridge layout
         (b) Exterior sketch of each type
         (c) Graphics
         (d) Paint finishes
         (e) Handrails
         (f) Flashing (terminal to passenger loading bridge)
         (g) Flashing (terminal to fixed walkway)
         (h) Flashing (fixed walkway to passenger loading bridge)
         (i) Flashing (bridge segments)
         (j) Cab door seal
         (k) Ramp Service Stairway
         (l) Illuminated gate signs including fonts and font sizes.
      4) Cab:
         (a) Operator's cone of visibility
         (b) Control panel location and functional layout with labeling.
         (c) View panels
         (d) Interface with aircraft
         (e) Designs necessary for appropriate mating with required aircraft types (including auto-leveling devices)
(f) Operator protection while bridge is in motion with weather door open

(g) Operator instruction placard

(h) Copies of all graphic screen shots in color, including indication of different colors for those items that change colors to indicate changing states of equipment or systems.

5) Safety Markings:
   (a) All safety decals and stencils

b. PBB operational envelopes dimensioned.

c. Motor ratings and electrical characteristics including motor and fan accessories.

d. Materials, gauges and finishes, including paints, wallboards, floor coverings, etcetera.

e. Engineering Certification:
   1) Manufacturer shall submit Engineering Certification stating that the PBB and all components thereof are constructed in accordance with this specification, as well as all codes and standards and local laws and regulations applicable to the design and construction of passenger boarding bridges, including without limitation, NFPA, Underwriter’s Laboratories, and OSHA.

   2) Structural shop drawings shall be submitted and shall be stamped by a registered State of Florida Structural Engineer certifying structural integrity of the passenger boarding bridge system including all welds, fasteners and appurtenances for the intended use.

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

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.

D. Pre-Ship Submittals: The following shall be submitted for approval prior to shipping PBB units to the project site:
   1. Factory Test Reports: Indicate factory tests and results and inspection procedures.

E. 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.

F. Installation Submittals: The following submittals shall be submitted and approved during installation if necessary per these specifications.
   1. Welding Certifications per PBB Mechanical Erection and Lifting section of this specification.
G. 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.
   4. Training Rosters. Provide training roster with trainee names, dates and types of training, as well as durations.
   5. All original software packages and documentation, registered in the Owner’s name.
   6. Hard copies as well as electronic (compact disk of flash card) copies of all final programs loaded into all machinery under this contract.

1.06 QUALITY CONTROL
   A. NFPA Compliance: Comply with applicable portions of NFPA 70 and NFPA 415 for components and completed and installed products.
   B. NEMA Compliance: Motors, enclosures and electrical accessories shall comply with NEMA standards and be so rated.
   C. UL Compliance: PBB 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.

1.07 DELIVERY, STORAGE, AND PROTECTION
   A. Lift and support PBB's with the manufacturer's designated lifting or supporting points.
   B. Deliver equipment as factory-assembled unit, or sub-units whenever practical for shipping purposes with protective covering.
   C. Store equipment and material in suitable facilities until delivery, installation, and final 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 final accepted by the Owner.
   E. Properly dispose of all waste, including, but not limited to, packaging, crates, etcetera.

1.08 ROYALTIES AND LICENSE FEES
   A. The PBB manufacturer shall pay all royalties and license fees and shall defend all suits or claims for whatever infringements of any prior, pending, or future patent rights and shall save the Owner and Engineer harmless from liability, expense, or loss on account thereof, with respect to any processes, devices, methods, articles, inventions, or procedures used by the manufacturer.

1.09 WARRANTY
   A. Provide a full parts and labor warranty for the new units and ancillaries. 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, or the date that the facility/Gate is placed into commercial operation, whichever occurs later. 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.

1.10 OPERATION AND MAINTENANCE MANUALS

A. Provide two (2) bound copies, and three (3) electronic copies (CD or DVD) of the approved, comprehensive Operation and Maintenance Manual for each model PBB supplied fourteen (14) days prior to Substantial Completion.

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, at minimum, 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 including 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. Interconnection with other systems shall clearly be indicated, including 400Hz equipment, Preconditioned Air equipment, and ancillaries.

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

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

H. Lubricants list: Provide manufacturer's recommended lubrication product list. Base on a single lubricant manufacturer.

1.11 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 one (1) training session of eight (8) hours classroom instruction and eight (8) hours hands-on instruction for twelve (12) personnel, and operator's training shall consist of a minimum of four (4) classes at two (2) hours duration each hands-on instruction for six (6) personnel.

1. Operator's training may require some night hour training classes at the Owner's discretion without additional cost to the Owner.

2. The maintenance training course will fulfill the technical information requirements of the Owner's maintenance instructors, engineers and mechanics. This course, with number of classes as specified shall emphasize the following:
   a. Orientation providing overview of system/subsystem concept, configuration, and operation.
   b. Familiarization with and use of electrical schematics, control programs and functional block diagrams.
   c. Operations theory and interfaces.
d. Instruction in basic theoretical and practical understanding of equipment appearance, layout, and functions.

e. Safety precautions.

f. Use of standard and special tools and test equipment.

g. Adjustment, calibration, and use of related test equipment.

h. Detailed preventative maintenance activities.

i. Troubleshooting, diagnostics, and testing.

j. Equipment assembling/disassembling.

k. Repair and parts replacement.

l. Failure and recovery procedures.

m. Cabling and/or interface connectors.

n. Operation and Maintenance Manuals, and related reference publications familiarization.

o. Procedures, practices, documentation and materials required for system maintenance.

p. Towing and Jack Stand operations.

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 prior to final acceptance of respective equipment, products, and systems and shall be given 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.

1.12 SYSTEM DESCRIPTION

A. General

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

2. The bridge shall consist of the following components:
   a. Fixed Walkway (if specified, or indicated on the project drawings)
   b. Rotunda Entry Corridor
   c. Rotunda
   d. Telescoping Tunnels (2 or 3 as specified)
   e. Vertical and Horizontal Drive Column Assembly
   f. Rotating Aircraft Cab with Operator Control Console
   g. Automatic Leveling Device
   h. Service Door, Landing and Service Stair
   i. Canopy Closure to Aircraft
   j. Electrical Distribution Systems and Components
B. Application

1. The apron drive loading bridge must be capable of reaching all passenger doors of specified aircraft parking positions as indicated on the project drawings. The bridge cab shall have sufficient flexibility to enable it to mate with the aircraft passenger loading door when the aircraft is parked at the gate. The bridge shall have sufficient vertical travel to accommodate all aircraft specified on the aircraft parking layout drawings. The bridge shall have additional extended travel beyond the outer most aircraft operational requirement and additional retract travel from the closest aircraft operational requirement or PBB stow box as indicated on the project drawings.

   a. Submit manufacturer's proposed PBB models with standard cut sheets with bid.


1. The bridge shall be designed to achieve the maximum safety of aircraft passengers, crew, operators, and maintenance personnel. The bridge shall conform to all current federal, state, and local Occupational Health and Safety Codes, along with standards developed and adopted by the passenger loading bridge industry.

2. All elements of the bridge shall be designed to be fail-safe in operation.

3. Operating controls and maintenance features shall be designed so that errors in the operation and maintenance of the bridge cannot cause structural damage to any of its elements.

4. All operating mechanisms shall be designed so that the drive mechanism is locked when power fails or is turned off. Electrical-Mechanical lift columns shall be equipped with a fault detector to sense differential motion of the ball screw assemblies. The detector shall disconnect electrical power from the vertical drive motors if a fault is detected.

5. Positive mechanical stops shall be provided to prevent hazardous over-travel where any component might become disengaged from its guiding or restraining component.

6. The operator's position in the cab shall be arranged to permit the operator to operate the loading bridge with the cab weather door closed.

7. Transition ramps shall have floor coverings as indicated in the finishes section with yellow chamfered edges and be equipped with brushed aluminum handrails on both sides.

8. Sheared or sharp metal edges must be deburred or broken and all exposed metal corners are to be rounded. All critical fasteners are to incorporate suitable locking devices.


   a. Submit certificates of compliance for its bridges including any assemblies or appurtenances affected, with NFPA 415, most recent edition, from a Nationally Recognized Testing Laboratory (NRTL) located in the United States.

   b. Provide written certification that the total PBB, including any design changes, is in compliance with NFPA 415, most recent edition.

10. The innermost or "A" tunnels, as well as the interiors of any fixed walkway section, and all interior ramps, to include brushed aluminum handrails on both sides. 1-1/2" O.D. with returns on ends.

11. Provide emergency lighting with 90-minute battery back-up complete with self-contained charger and automatic on-off control. Emergency lighting may be incorporated into normal lighting fixtures. Emergency lighting shall meet the minimum lighting level requirements of NFPA 101 - Life Safety Codes.
12. The PBB shall comply with all applicable Life Safety Codes in effect at the time of manufacture.

D. Personnel Safety

1. A high resolution color video camera (CCTV) shall be installed beneath the PBB in such a manner as to allow the PBB operator to view at a control console mounted high resolution 7” monitor, the wheel bogey and service stair areas during PBB operation.
   a. Install and adjust as necessary to prevent blocking the operator's view by items such as PCA units, hoses, etcetera.
   b. Monitor shall be a stand alone monitor and shall not be incorporated into the HMI operator's screen.

2. A round rear view mirror shall be provided on both sides of the cab to allow the operator full view of the horizontal drive wheels (wheel bogie) during operation. Provide additional mirrors as necessary such that operator has full view of wheel bogie and service stairs during bridge operations.
   a. Mirror frames and brackets shall be galvanized.

3. The operator’s position in the control cab shall be designed so as to permit the operator to position the loading bridge with the outer door open or closed. Suitable enclosures, guard rails, etc. shall be provided to protect the operators 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 outer door open.

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

5. The loading bridge shall be provided with a caged, OSHA approved roof access ladder accessed from the service stair platform. All items to be galvanized steel.

6. OSHA approved handrails will be installed atop 1/2 the outer most tunnel section to provide fall protection to personnel working on drive motors, etc. All remaining tunnel section(s), as well as any fixed walkway installed, shall be equipped with full length OSHA compliant fall protection. Handrails, ladders, cages, brackets, etcetera shall be galvanized steel.

7. OSHA and NFPA approved emergency lighting shall be provided as a means of safe exit in the event of a power interruption. They shall provide sufficient illumination throughout the PBB as specified herein.

8. Suitable OSHA compliant guards shall be provided for all sprockets, gears, chains, fans, belts, and other moving parts located where operating or maintenance personnel may make accidental contact with them. Warning decals shall be added where applicable.

9. Exposure of operating and maintenance personnel to electric shock hazards shall be minimized by provision of suitable interlocks, grounding means or protective devices.

10. Guards or enclosures shall be provided for all exposed portions of electrical equipment.

11. Elevating devices shall be protected from uncontrolled movement or actuation in the event of a power source failure of any type.

12. Electrically operated lifting devices shall be equipped with brakes to lock the system in the event of power failure or malfunction.

13. All pinch and shear points, sharp edges and protruding objects must be eliminated wherever possible and practical. If elimination is not possible, adequate guarding must be achieved to prevent injury and/or damage exposure.
14. All stairs, ladders, scaffolds, platforms, and handrails shall comply with all applicable OSHA requirements.

15. PBB design shall eliminate wherever possible all tripping hazards. Possible tripping hazards such as transition ramps (nosings), gutters, etc. shall be identified. Transition ramps shall be identified by using a durable, one-inch, yellow (OSHA Alert Yellow) trim band at the beginning of such ramp or hazard. Interior rain gutters shall be painted with alternating yellow/black safety striping the entire length. Other methods of striping may be acceptable, but shall be submitted for approval prior to installation.

16. All carpeting shall have edge strips to prevent fraying.

17. Wheel bogey safety hoop systems shall be provided. Design shall provide for minimal ground clearance and should be adequately rugged to prevent false alarms. Should the PBB drive into a fixed object or other object, it shall activate a safety circuit and shut down the PBB horizontal drive system. Suitable warning messages shall be displayed at the operator's console.

E. Equipment Safety

1. Sharp edges, projections and hinged devices with hazardous characteristics shall be avoided in the design and construction of the loading bridge. Suitable edge detailing shall be provided where necessary.

2. When in operate mode, all equipment shall be designed to be fail safe and bridge motion controls (i.e. horizontal and vertical travel, cab rotation) shall require the operator to apply constant pressure to remain engaged (dead-man).

3. All operating mechanisms, i.e. horizontal and vertical drive, cab rotation, etc. shall be designed so that the drive mechanism is locked when power fails or is shut "off".

4. Positive mechanical stops shall be provided to prevent dangerous over travel when any component might become disengaged from its guiding or restraining component.

5. Externally mounted cab mirror(s), both sides, shall be provided for viewing the apron area from the operator’s position. Provide additional mirrors as necessary such that the operator can fully view the wheel bogey area and service stairs during operation.
   a. Mirror frames and brackets shall be galvanized.

F. Noise and Vibration

1. The maximum average sound level and loading bridge vibration limits shall comply with the requirements of S.A.E. ARP 1247, current revision.

G. Technical and Performance Requirements

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

2. In determining the design factor of safety, weld efficiencies as designated by the American Welding Society or applicable design codes shall be used.

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

4. All lifting devices shall be designed to AISC standards, (except wire rope) with a minimum factor of safety of 5 based on ultimate strength.

5. The unit shall be designed with sufficient structural rigidity so that deflections due to load, wind, and motions of working parts do not create interferences, cause malfunctioning of the equipment, or present any safety hazards to personnel, aircraft, or the unit itself.
6. In the case of standard component or component assemblies used by the end product manufacturer, certification of the application by the component manufacturer will constitute structural acceptability of such components.

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

8. The wheels used on the equipment shall be of a type and size which will not damage or cause undue wear to the surface over which they will normally operate. The tires must be capable of supporting the design load of the passenger boarding bridge, roof load, snow load, and all ancillary equipment. The tires must be capable, under dead load and/or roof load, including snow loads, of operating satisfactorily without operational degradation.

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

10. The passenger boarding bridge(s) submitted shall be designed not to exceed 1 in 12 (8.33%) tunnel slope when servicing any aircraft in the fleet mix designated for the gate where the PBB is to be located; however, the PBB shall be capable of achieving a minimum of 12% slope without causing damage to the PBB or ancillary equipment, including PCA or 400 Hz equipment, for maintenance or irregular operation activities.

11. The bridge floor structure shall be designed to accommodate a dynamic load of 40 pounds per square foot over the total floor area.

12. The roof shall accommodate snow loads of 25 pounds per square foot over the total roof area, or as otherwise required by code, whichever is greater.

13. The bridge, when in use at any extended length, shall accommodate, while maintaining operability, a wind load of 12.5 pounds per square foot and a wind velocity of 60 M.P.H. from any direction without loss of stability or control.

14. In conditions of sustained wind loads greater than 60 M.P.H., the bridge will be stowed. At wind loads above 60 M.P.H., the bridge, when retracted to the stowed position, shall accommodate a wind load of 25 pounds per square foot and a wind velocity of 90 M.P.H. from any direction.

15. The bridge shall be able to accommodate the added loads of 400 HZ ground power and preconditioned air equipment, including appurtenances, including dynamic operational loads presented by the PBB and these additional equipment items. These loads may be applied in total or in part, singularly or simultaneously. The design shall be based on the combination, which imposes the most adverse loading.

16. The bridge when maintained in accordance with the manufacturer’s O&M manual by Airport maintenance personnel trained by the manufacturer as indicated herein, shall provide a useful service life of 20 years minimum.

H. Environmental Considerations

1. The bridge shall function satisfactorily and in accordance with these specifications under ambient temperatures from -40 degrees F to 125 degrees F with winds up to 60 miles per hour on wet, iced, or snow laden apron surfaces.

2. The entire bridge is to be weatherproof.

3. Equipment and controls that are exposed to the weather are to be of a weatherproof type or housed in weatherproof boxes.

4. PBB shall be equipped with external tunnel roller ice scrapers to remove ice from the tracks prior to contact with the rollers.

5. Externally mounted electrical panels and/or cabinets shall be equipped with space heaters to control condensation as indicated herein.
6. Electro-mechanical drive systems shall have suitable protective coverings over motors, chains, sprockets, actuator arms, linear actuator arms, etc., to both protect operating personnel and passengers, as well as to protect the systems themselves from exposure to weather elements or traffic abuse.

7. The structure shall be designed to resist the accumulation of debris or water in low points and/or pockets in the structure. Dimpled drain holes or suitable covers will be provided where necessary. Drain holes shall be located so as to drain collection points with the bridge in any normal attitude. Scupper drains from the internal gutters shall carry moisture clear of the structure and shall be sized to eliminate blockage. Welding and drilling operations after application of prime coats shall be prohibited.

8. Where access holes have been created to gain access to components of the PBB, or where pockets otherwise exist, that could trap or accumulate debris, such pocket or opening shall be suitably covered with screw attached covers.

9. All parts shall be resistant to, or protected from corrosion caused by contaminated turbine fuel or moisture blown or splashed from the ground. Provisions shall be made to resist electrolytic corrosion where conditions tend to cause this corrosion. Fasteners shall be of corrosion resistant material or plated to prevent corrosion.

10. All edges of marine grade plywood are to be sealed with an approved APA sealer prior to installation.

11. All panels containing VFD inverters shall be equipped with space heaters as necessary for optimum VFD operations.

I. Service and Access

1. The design shall stress simplicity, ruggedness and ease of maintenance. All systems shall be designed to operate with a minimum of routine maintenance using long life components sealed or self-lubricating mechanisms, etc.

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

3. Access doors, covers, and protective guards shall be designed for quick removal or opening.

4. Access panels shall be hinged, pinned, etc., to prevent loss from the unit. Large panels of over 4 feet, in both height and width, which are normally removed only for heavy maintenance, i.e., major component overhaul or removal, may be designed to be removed from the equipment when hinging or pinning is not practical.

5. 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.

6. All hinge doors shall be provided with devices to secure them either in the open or closed position such that they will not be blown by jet blast or ambient winds.

7. Stops or buffers shall be installed so that the doors, when open, do not mark or scratch the paint work.

8. Major assemblies and components shall be capable of being disconnected and removed from the equipment without the necessity for extensive disassembly of other components. A design goal shall be that any major component should be able to be removed and reinstalled in a period not to exceed eight man-hours. All components/assemblies exceeding 80 lb. for two person-handling or 30 lb. for single person handling, require mechanical assistance and shall be provided with lift eyes, forklift guides, etc.

9. Fastener heads and nuts shall be provided with adequate clearance for wrenches or drivers.
10. The design of the unit shall be such that only ordinary common hand tools and test equipment are required in routine maintenance operations and special tool requirements for overhaul/heavy repair work is kept at a minimum.

11. The equipment compartment shall be designed so as to provide easy access to the controls, relays, valves and other components within the enclosure. Provisions shall be made for ready adjustment, servicing, or replacement of these and other components frequently replaced or serviced.

12. Maintenance service points and access covers shall be located and positioned in such a manner that a minimum time and effort are required during servicing operations. There shall be no interference to the servicing or draining of lubricants to or from any assembly or component by frame members or other obstructions.

13. Any special tools or test equipment designed solely to service, overhaul or test performance of the loading bridge shall be identified in writing and submitted as specified.

14. Pressure lubrication fittings shall be provided at all points where heavy loads, close tolerance, relative rotary or linear motion of parts occurs. Where access to fittings are difficult, a lubrication panel should be utilized.

15. Components shall be protected from mechanical, electrical, and corrosion damage and malfunctions due to rain, snow, ice, sand, grit, deicing fluids, and other contaminants.

16. All chains and belt drives shall have provisions for adjustment, and once adjusted, a positive means of retaining this adjustment, as well as OSHA compliant covers or guards.

J. Materials, Parts and Processes

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

2. All material 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.

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

4. All bolted, screwed, and threaded fastenings shall incorporate adequate locking devices. Safety wire shall be incorporated in critical applications.

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

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

7. (BASE BID) All intersecting steel shall be continuously welded between the top and bottom of panels and either continuously or spot welded along the sides where the panels interlock with each other. Automotive metal panel epoxy or other approved sealant shall be used to completely seal all seams if not continuously welded.

   a. (ADDITIVE ALTERNATE) All intersecting steel planes, e.g. side to top, side to bottom, of exterior steel sections of the passenger boarding bridge shall be 100% welded. No caulk or sealant shall be used to provide weather seals.

8. Components must be installed per the manufacturer’s recommendations. Modification of the component which could affect its performance must be approved in writing from
the manufacturer of the component. Any modified component should be identified as
such to the Owner for purposes of interchangeability.

9. All components shall be chosen to be within their manufacturer’s published ratings
under the most severe conditions of operation. This shall include, but not be limited to
the following:
   a. Mechanical Components: Speed, torque, force, environment, lubrication
      means, and expected service life of chains, belts, sheaves, sprockets, shafts,
      bearings, gears, etc.
   b. Electrical Components: Voltage, current, load characteristics, and duty cycle of
      electrical components.
   c. Others: For components proprietary to the manufacturer, design shall conform
to established industry practices.

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

K. Maintainability
1. The bridge shall be designed to emphasize simplicity, ruggedness, and ease of
maintenance. There shall be no special tools required for routine maintenance.
2. Attention shall be given to the design of each component and assembly to minimize
the number of routine maintenance items on the bridge.
3. Components shall be selected and assemblies shall be designed to facilitate
troubleshooting and to minimize repair or replacement time.
4. Access panels enclosing areas requiring maintenance shall be large enough to permit
accomplishment of the task required.
5. Where practical, components shall be built in subassemblies for ease of replacement
and shall be designed to be installed or removed by one person.
6. Where the weight of a component requires mechanical assistance, the component
shall be provided with lifting eyes or other suitable hoisting arrangement.
7. Drawings, sketches, details, and all materials/equipment shall be submitted and
provided in the English language and systems of measure, including, without
limitation, dimensions, volumes, weights, threads, forces, fasteners, devices, panels,
labels, signs, notices, communications etcetera. The use of metric or SI units is not
acceptable.
8. All parts having the same manufacturer’s part number shall be directly and completely
interchangeable with each other with respect to installation and performance.
9. All components and assemblies incorporated into the loading bridge shall be designed
and manufactured to dimensional tolerances which will permit future interchangeability
and facilitate replacement of parts.
10. The individual parts and components of each unit shall be of the same original
manufacture and part number. Minor component parts need not comply with the
above, provided interchangeability and safety are not compromised.

L. Workmanship
1. High standards of workmanship and methods shall be employed in the manufacture of
the passenger boarding bridge. Particular attention shall be given to metal finishes to
assure freedom from blemishes, defects, burrs and sharp edges. Quality of welding,
painting, riveting and alignment of parts shall be maintained.
2. All welds shall be of adequate length, area and strength to sustain the design load.
Welds shall be reasonably uniform in appearance and cross section, and shall be free
of cracks, inclusion, porosity, cavities, and other physical and metallurgical defects.
Welds shall not be ground in order to improve appearance except as required for flush
surfaces or non-structural parts. All welding performed in the fabrication, assembly
and/or mounting of the passenger boarding bridge shall be accomplished by an
appropriately licensed certified welder.
3. Assembly screws, bolts, studs, and other threaded fasteners shall be
corrosion-resistant material or plated to prevent corrosion. All fasteners shall be tight
and shall retain tension in service.
4. All wires and lines subject to chafing shall be provided with some means of protection.
Acceptable anti-chafing devices include grommets, flexible sleeves or jackets, and
other approved materials.

M. Identification and Markings
1. All instruments, relays, circuit boards, pumps, motors, controls, etc. and instructions
shall be suitably identified with permanent, non-fading placards, or pictographs
impervious to the effects of weather, oil, cleaning solvents, aircraft hydraulic fluids, fuel
and other effects of normal operation for the life of the equipment without deterioration,
fading, or loosening.
2. Placards shall be in sharp color contrast in large enough letters to be easily read from
the operator's position indicating the function, direction and/or identification.
3. A metal nameplate shall be riveted to the equipment specifying manufacturer's name
and/or trademark, manufacturer's part or model number, manufacturer's serial
number, date of manufacture, and equipment's rating.
4. Circuit breakers shall be labeled as to the circuit that they feed.

N. Fixed Walkway
1. Where indicated on the aircraft parking layout, fixed walkways are to be installed
between the rotunda entry corridor and the terminal building exit. Construction of the
fixed walkway shall be substantially identical to that of the bridge tunnels, and shall
meet the same applicable specifications.
2. The fixed walkway shall be designed, furnished, and installed so as not to impose any
load on the terminal building.
3. The contractor must provide all required supports and haunches for final support of
new walkway.
4. Coordinate base plate with existing field conditions. Field verify details prior to
manufacture.
5. Field verify all dimensions prior to manufacture.
6. The minimum inside height of the fixed walkway shall be 7 feet, 6 inches and the
minimum inside width shall be 5 feet, 7 inches.
7. Walkway design shall meet the same design requirements as the apron drive
passenger loading bridges.
8. Walkways shall be equipped with handrails, both sides, to match "A" tunnel rails.
9. Exterior and interior construction and finish to match PBB tunnels.
10. One 120V convenience receptacle, GFCI style, should be installed for every 25' of
walkway, with a minimum of one being installed on any walkway over 10'.

O. Rotunda Corridor
1. The minimum inside height of the corridor shall be 7 feet, 6 inches and the minimum
inside width shall be 4 feet, 4 inches.
2. A polished aluminum diamond plate threshold plate with a non-slip surface shall bridge
the gap between the terminal building and the adjacent fixed walkway or between the
terminal building and the rotunda corridor.
3. Interior and exterior flashing shall be installed between the terminal building and the adjacent fixed walkway or between the terminal building and the rotunda corridor to effect a weather-tight connection. Interior flashing shall be stainless steel or painted metal to match bridge interior color. Exterior flashing shall be NFPA-415 compliant weather resistant fabric.

4. The design of the rotunda and connecting corridor shall accommodate a terminal door sized 4'-0" x 6'-10" or as otherwise may be existing.

5. Provide extended corridors where indicated on project documents.

P. Rotunda
1. The rotunda is to be supported on an independent support column. It shall allow the telescoping tunnels to swing through an arc of 175 degrees (87.5 degrees clockwise and 87.5 degrees counterclockwise).

2. The rotunda support column shall not be anchored or secured to the terminal building, nor shall it transmit any live or dead loads or vibrations to the terminal building.

3. Coordinate base plate with details as indicated on the construction documents. Field verify prior to manufacture.

4. Field verify column dimensions prior to manufacture.

5. The rotunda shall be equipped with adjustable limit switches (to be set at time of installation) to control the swing angles of the bridge tunnels. If the limit switch is activated by the bridge, the bridge shall be prevented from traveling further, but will not be prevented from driving off of the limit in the opposite direction.

6. The opening between the rotunda and the hinged telescoping tunnels shall have a complete weatherproof seal.

7. The side coiling curtain barrel assemblies shall be covered to protect them from the weather. These covers shall be hinged to allow easy access to curtain assemblies. Hinges shall be full length stainless steel.

8. The rotunda floor shall remain level regardless of the movements of the bridge tunnels.

9. The rotunda shall include positive bird nesting prevention features.

10. Weather seals shall be provided at curtains to prevent wind blown dust, rain or snow from entering bridge interior.

11. Curtains, seals and covers shall provide complete protection from the exterior elements. There shall be no visible gaps or daylight apparent through the rotunda.

12. Threshold plates shall have chamfered edges to reduce tripping hazards.

Q. Telescoping Tunnels
1. The telescoping tunnels shall be rectangular in cross section and hinged for vertical motion at the rotunda.
   a. The telescoping tunnels shall permit servicing of all commercial jet aircraft as required by the aircraft parking layout such that the slope of the tunnels does not exceed 1 in 12 (8.33%), with the exception of the transition ramps.
   b. The minimum inside width of the tunnels shall be 4 feet, 10 inches and the minimum inside height shall be 6 feet 11 inches.
   c. Flexible seals are to be used between the tunnel sections to provide a weather-tight seal preventing entry of blowing dust, rain, or snow.
   d. Where the telescoping sections overlap, ramps shall be provided to accommodate the difference in elevation. The ramps shall have yellow chamfered edges and handrails on both sides. Ramps shall have floor coverings as indicated in the finishes section.
e. All tunnels shall have flat roofs to prevent the collection of water. Corrugated roofs will not be approved. Flat roofs should be designed to facilitate positive water drainage.

f. Provide NFPA-415 fire rated glass view panels where indicated on the PBB drawings.

R. Drive Column

1. The drive column assembly shall provide the force to swing, extend or retract, and raise or lower the bridge. This assembly shall be electro-mechanical.

2. The motors and mechanisms for vertical, horizontal, and radial motion shall be integral parts of the drive and lift column assembly and operate in a smooth and quiet manner.

3. The assembly shall be designed to permit simultaneous vertical travel, horizontal travel, and steering to permit expeditious movement to the aircraft.

4. The vertical lift speed as measured at the cab bumper shall be 2.5 - 3.6 FPM nominal.

5. The drive system shall permit the unit to be extended/retracted and rotated to any point within its operating envelope and shall permit these movements at variable speeds between 0 and 90 FPM. Maximum speed shall be limited to 85-90 FPM. Control of the drive system shall be such as to provide smooth starts and stops and positive fail safe braking. The brakes shall remain effective with power removed from the unit.

6. Axles, wheels and tires shall be operated within their respective manufacturer's recommendations. Tire footprint loads shall be limited to 200 P.S.I.

7. Wheel/Tire assemblies shall be solid rubber tire tread on forged steel wheels as manufactured by Trelleborg or approved equal. Drive assembly shall operate satisfactorily as specified in the construction documents on wet, iced, or snow laden ramp surfaces.

8. Provide a 2" wide reference stripe on each inner column tube indicating upper and lower travel limits.

9. The assembly shall be electro-mechanical driven and the following requirements shall be met as applicable:

a. Vertical Drive—Hydraulic

1) The lift mechanism shall consist of two (2) extra capacity hydraulic rams. Each assembly shall be independent of the other and capable of supporting the bridge under full design load. An adjustable rate pump and cylinder system shall provide the necessary lift speed measured at the aircraft cab bumper.

2) The lift cylinders shall be equipped with internally mounted velocity fuses that prevent the bridge from descending in the event of fluid loss or other system failure. The hydraulic circuit shall be designed so that the bridge can be lowered manually in case of a power failure.

3) Mechanical stops in the cylinders shall be provided to prevent over-travel of the lift column. The system shall not be damaged if the bridge is raised or lowered into the cylinder stops.

b. Hydraulic - Design

1) The hydraulic fluid shall be fire resistant, have low toxicity, and have biodegradable properties.

2) The hydraulic fluid shall allow satisfactory operation of the drive column under ambient temperatures of -40°F to 140°F with winds up to 60 miles per hour and meet the requirements of MIL-H-5606, latest edition. The
3) The system should have shutoff valves installed to facilitate changing of components such as filters, pump, and hoses without draining the system.

4) The hydraulic fluid desired will be specified by the controlling specification. A nameplate stating the type of hydraulic fluid used and the total tank capacity shall be installed adjacent to the reservoir filler neck. The hydraulic fluid shall be manufactured by Pennzoil Products.

5) The preferred maximum pressure required by an operation is 2000 psi or less.

6) Maximum allowable flow velocity (Ft/Sec) through any hose, tube or pipe shall be determined from the following table:
   
   (a) Suction: 04
   (b) Pressure - Continuous Duty: 15
   (c) Pressure - Intermittent (up to 50% Duty): 25
   (d) Pressure - Infrequent (up to 20% Duty): 40

7) In cases where pressure drop due to tube and hose length becomes excessive with the flow specified above, such tubes and hoses shall be made of a larger diameter to reduce the pressure drop.

8) Hydraulic components shall be protected from flaws in excess of manufacture’s published ratings.

9) The hydraulic fluid reservoir shall have a minimum reserve of 25% of displaced hydraulic fluid, making the capacity equal to 1.25 times the total maximum displaced volume of the hydraulic components including that contained in the hydraulic lines, accumulators, and cylinders. The reservoir design is to include the following:
   
   (a) Weatherproof breather with 10 micron filtering, having air flow capacity adequate to maintain essentially atmospheric pressure in the reservoir under maximum flow conditions.
   (b) A magnetic drain plug is to be incorporated in a sump located at the return end of the tank. The tank should be arranged such that the sump and drain are at the lowest point.
   (c) Full range fluid level indicator with adequate protection from breakage and located in an easily observable area.
   (d) A strainer type filler neck with attached cap is required.
   (e) The tank outlet to the pump and the major return port are to be located at opposite ends of the tank and one inch (25.4 mm) above the tank bottom. Any pump case, seal leakage, or other gravity drains are to be returned to the top of the tank with the actual discharge below that level at which oil should be added to the tank to prevent aeration.
   (f) An access opening to allow full access to interior for cleaning. Access cover is to be gasketed and fastened leak tight.
   (g) Reservoir to be thoroughly cleaned and protected from contamination during assembly of the unit. Material and construction to conform to commercial quality and adequately protected against corrosion. Coated tanks are unacceptable. Items such as strainers, check valves, relief valves, filters, or any other item requiring periodic inspection or repair shall not be
located inside the tank, but outside where they can be serviced easily.

10) The hydraulic system should include a “high” and “low” side hydraulic filter, spin-on design, with a minimum 10 micron filtering capacity. A low pressure filter canister of micron size to be determined by pump manufacturer shall be located between the tank and pump system. Easy accessibility to the clean out port shall be provided.

11) Pumps are to be chosen so that their capacity will meet peak demands within manufacturers’ capacity ratings of flow, pressure, and RPM. Where system reliability and/or pump manufacturers’ specifications require it, a boost pump and low pressure filter with a differential pressure indication will be provided.

12) The system pump(s) and components are to be protected by a relief valve(s) which have a capacity equal to or greater than pump capacity. Relief valve(s) shall dump directly to tank.

13) The hydraulic fluid temperature during continuous operation shall not exceed 150°F (66°C) on a 115°F (46°C) day and in no case shall exceed the hydraulic system components manufacturers’ recommendations.

14) Dynamic pressure surges, spikes, and fluctuations shall be minimized with use of accumulators if necessary. Pre-charge information tags shall be attached adjacent to charge fitting.

15) The material for all hydraulic lines shall be specified. Flexible lines shall be made of hydraulic fluid resistant material. The lines shall be protected and supported from chafing and binding. Hydraulic lines shall be routed so that, where possible, structural members will provide protection. Lines shall be supported so that fittings, tubing and hoses are separated from engine exhaust systems, and are not subject to damage from heat, external loads, and vibration. If necessary, heat barriers or shields shall be installed. Lines shall be protected from kinking and abrasion.

16) All hydraulic fittings will be in accordance with SAE J514. If flared, the 37° (0.646 rad) flare with “B” nut and sleeve is to be used. Flared copper seats are not to be applied to fittings for sealing purposes.

17) All pipe threads are to be joined with a suitable pipe sealant.

18) Hydraulic systems are to incorporate such devices as hydraulic fuses, pilot check valves, holding valves, accumulators where necessary, and interlock systems to eliminate uncontrolled action of mechanisms (i.e., the fall of the bridge, etc.) in the event of energy failure. Manual actuation of systems shall be provided to return systems to a safe condition should energy failure occur.

19) Test port locations shall be provided at points in the hydraulic system requiring access for pressure adjustments and troubleshooting. Each port shall be plugged with a 1/4 in. NPT plug.

20) The hydraulic tank filler and breather and lines shall be located away from heat sources to prevent oil from splashing onto hot surfaces in the event of overflow, leak or component failure.

21) Hydraulic hoses shall conform to the quality of the SAE 100R1 through 100R7, per SAE Standard J517, as applicable.

22) All components which are capped when received from suppliers shall have the protective caps left in place until connection is made to each port.
23) When charging the hydraulic system with oil, the manufacturer shall take steps to ensure that the oil is free from contamination. The supply container shall be protected from water and dirt contamination during storage. All transfer containers and fittings shall be thoroughly cleaned and dried prior to use to prevent contamination from dirt, water, and other fluids.

24) The manufacturer shall operate all segments of the hydraulic system for a period of one hour to thoroughly circulate the hydraulic fluid, remove the hydraulic filter element, examine for contaminants, and replace with a new element. This shall be repeated until the used filter shows no evidence of contaminants. In the case of dead end lines to actuators, provisions for bleeding shall be made and measures shall be taken to ensure that fluid not normally being re-circulated shall be made to do so during the cleansing period to ensure that all fluid, lines, and components are clean.

25) Pressure vessels such as air receivers shall comply with all applicable requirements of the ASME Unfired Pressure Vessel Code, Section VIII. Such equipment shall bear an ASME “U” Code Label and certification.

26) Manufacturers shall furnish sufficient details of their proposed hydraulic system to allow an engineering evaluation.

c. Horizontal Drive—Electro-Mechanical

1) An electrical mechanical drive system shall provide extend, retract, swing, and steer capabilities at variable speeds up to 90 feet per minute. This two-wheeled system shall operate on solid tires. Both wheels shall be independently driven by AC gear motors with solid state silicon controlled rectifier (SCR) controls. The entire system shall be contained within the bridge and require only AC power.

2) A dynamic braking system shall allow the bridge to come to a smooth, controlled stop. Spring actuated brakes shall be located on each drive motor and lock the bridge in place whenever electrical power is cut off by moving the control lever to the neutral position or when there is a power failure.

3) The horizontal drive motors shall be equipped with brake releases. Connection lugs shall be provided to allow the bridge to be towed in the event of power failures.

d. PBB's shall provide for "conventional steering" as well as "point & go" steering. The PBB shall be shipped selected to conventional steering, but mode shall be selectable through a password protected maintenance screen. PBB shall stay in last mode selected unless changed by authorized personnel.

S. Aircraft Cab with Operator's Station

1. The aircraft cab with operator's station shall be designed to rotate a minimum of 125 degrees, a minimum of 92.5 degrees counterclockwise and 32.5 degrees clockwise on bridges with right-side service stairs and a minimum of 92.5 degrees clockwise and 32.5 degrees counterclockwise on bridges with left-side service stairs from the tunnel centerline to facilitate alignment with multiple aircraft parking configurations. The rotation speed shall be between 2 and 2.5 degrees per second. The cab shall be enclosed to provide maximum security and protection from the outside environment throughout the docking and passenger loading operation.

   a. All cab rotate motors shall be provided with VFD inverter drives suitably rated for the connected load.

   1) Provides smooth start/stop functions.
2. Cab rotation pin assemblies shall be provided with accessible lubrication points and shall be included in the PBB preventative maintenance program.

3. The operator's station shall be located on the left-hand side of the cab and shall be protected from the outside environment as well as passenger interference. It shall consist of a forward facing control console positioned behind a safety glass window. This window shall be of sufficient size to allow the operator to operate the bridge with full view of the aircraft contact area during normal operation, including the auto-leveler, without opening the weather door.

4. The cab shall have sufficient windows to allow the operator to view the ramp area during operation. Also, a round rear view mirror shall be provided on both sides of the cab to allow the operator full view of the horizontal drive wheels (wheel bogie) during operation. Provide additional mirrors as necessary such that operator has full view of wheel bogie and service stairs during bridge operations.
   a. Mirror frames and brackets shall be galvanized.

5. The cab side coiling curtain slats shall be equipped with upper and lower safety glass view panels to allow the operator maximum visibility of the aircraft and ramp during operation.

6. A closed circuit television system shall be provided complete with a 7" color high resolution monitor housed in or near the control console. The camera shall be focused on the drive bogie and service stair so that the operator has an unobstructed view when servicing all aircraft. This monitor shall not be incorporated into the HMI operator's screen.

7. The side coiling curtain barrel assemblies shall be covered to protect them from the weather. Covers shall be hinged to allow easy access to curtain assemblies. Hinges shall be full length stainless steel.

8. Weather seals shall be provided at curtains to prevent wind blown dust, rain or snow from entering bridge interior.

9. Curtains, seals and covers shall provide complete protection from the exterior elements. There shall be no visible gaps or daylight apparent through the cab except at windows and clear curtain slats.

10. The cab shall have weather proof doors to protect the interior of the bridge when it is not in operation. These doors shall be located to the right of the operator's station and have the capability of being locked. These doors shall be double swinging weather doors. The opening shall have a clear width of 44 inches and a minimum clear height of 7 feet 6 inches, and shall be equipped with 1/2 door height wire reinforced safety glass windows to enhance visibility.
    a. Door to incorporate suitable stops to hold open when opened and closed when closed.
    b. Door to be lockable from inside the cab bubble area (non-keyed locking mechanism).
    c. Doors shall utilize a commercial grade door closer such that a minimum of effort is required to open or close the doors.
    d. Doors shall be fitted with three non corrosive hinges per door.
    e. Doors shall be anodized aluminum "store front" finish.

11. The aircraft end of the cab floor shall be equipped with a full width aircraft spacer (bumper). The spacer shall be of a material that will retain its flexibility during constant usage regardless of the temperature and must be non-abrasive to prevent scratching or other damage to the aircraft fuselage. The spacer shall provide safe and secure human support when stepped upon. The color of the bumper shall be safety yellow. Appropriate designed and fabricated cut-outs shall be provided to accommodate all
design aircraft devices, including without limitation, the door of the A300, MD80 and B737 series aircraft pitot tubes without violating NFPA 415, current edition, requirements. The PBB spacer material shall comply with NFPA 415, current edition, requirements.

12. The outer most end of the cab shall be equipped with an adjustable floor. The floor shall be actuated and independently adjustable to adapt to the slope of the aircraft door sills. It shall be designed to level automatically and be equipped with manual override control. The floor shall be capable of providing a level surface adjacent to the aircraft door sill for passenger loading bridge slopes from -12% to +12%. No portion of the cab floor shall exceed 8.33% slope in the direction of the expected passenger traffic. All actuators and the like, exposed to passenger view shall have removable painted metal covers installed. Paint shall match PBB color.

13. The floor shall be double hinged and shall provide a smooth transition between the level floor and the tunnel section. This transition floor shall provide a smooth platform sloped approximately in the direction of passenger traffic flow. There shall be no raised surfaces that may introduce a tripping hazard to the passengers. Adjacent surfaces shall be the same level regardless of the position of the cab floor or the passenger loading bridge.

14. Passenger Boarding Bridge Identification Signs shall be supplied by the manufacturer for each bridge identified in the construction documents. These three sided illuminated triangular signs are mounted to the top of the jetbridge end cab and are visible from any angle by the pilots as they approach the gate area. The gate number is approximately 2'-5" high with a readable distance of 600 feet or more. The aluminum-fabricated structure will be painted to match the color of the passenger boarding bridge, and will have 1/4" thick acrylic sign faces with surface sprayed color. The letters will be masked during the spraying process and, when removed, the translucent acrylic will be revealed. Approximate size of the sign faces will be 4'-5&1/2". This sign will require out-door weatherproof detailing.
   a. Coordinate sign face colors and fonts with the Owner.
   1) Submit details and obtain written approval before proceeding.
   b. Gate signs shall be activated by an adjustable photoeye. Power shall be distributed from a circuit breaker located within the electrical control cabinet. Accessible switches that could be inadvertently turned off will not be allowed.

15. Vinyl Gate No. decals shall be installed on the terminal side of all PBB wheel bogies.

16. Operator's station shall be equipped with an operators platform for the operator to stand on while rotating the cab. This prevents the operator from having to walk while also attempting to operate the bridge.

17. Control console doors/lid shall be interlocked to drop main power in the event they are opened. These limit switch interlocks shall be defeatable by maintenance staff.

18. Control console doors/lid shall have hold open devices.

19. PBB Pre-Cool Plenum: Provide a minimum 60"Hx12"WX12"D dual wall insulated PBB precool/heat plenum in the end of C-Tunnel (or outermost tunnel). Provide and install a brushed aluminum diffuser on the interior of the PBB. Utilize a 10" inlet port, or as necessary to coordinate with PCA equipment which it will be utilized with. Coordinate with the PCA manufacturer. Locate such that plenum is not blocked when the PBB is in the stowed position as shown on the contract documents.
   a. Provide control console located pre-cool controls.

20. Subfloors in the cab area of the PBB, including the porch area outside the double doors shall be provided with aluminum sub-floors. Plywood is not allowed.

T. Controls and Indicators
1. Controls
   a. The operator's control console shall be designed to allow accurate operation by personnel possessing no special skills and trained by the manufacturer or manufacturer-certified trainers, in accordance with the manufacturer's operation manual.
   b. A placard outlining the bridge operating instructions shall be displayed in a prominent location in the cab of each bridge so as to be easily visible to the Operator while operating the bridge.
   c. All motor controls shall be motion oriented. For example, in raise and lower functions, the "raise" push-button will be located above the "lower" push-button, etc.
   d. All controls necessary for the operation and control of the loading bridge are to be located on the control console and grouped on control console faceplate in functional groups and labeled as to its function. The following controls shall be located on the control console:
   e. Graphical User Interfaces (GUI), also referred to herein as an HMI (Human Machine Interfaces), shall be 15" high resolution color.
      1) Access to controls shall be by entering an access code utilizing the HMI interfaced to the PLC. Coordinate access codes with Owner.
      2) A "Power On" push-to-start button.
      3) An illuminated "Emergency Stop" push button. E-stop shall not interrupt power to PBB lighting circuits; it shall, however, activate the Auto-level alarms and illuminate in the event that it is depressed while auto leveler is in "Auto".
      4) A four quad "Joy Stick" shall control forward, reverse and steering functions. The steering rate shall produce smooth and reasonable steering, speed, acceleration, and deceleration. The speed of travel shall be proportional to the movement of the joy stick.
      5) Two individual push-buttons marked "Raise" and "Lower" for controlling the vertical travel of the bridge.
      6) Two individual push-buttons marked "Rotate Left" and "Rotate Right" for rotating the cab.
      7) Push-button(s) to control the adjustment of the left and right side of the bellows-type aircraft closure.
      8) A switch to control the floodlights that illuminate the ramp area under the aircraft and drive column undercarriage.
      9) A switch to control the light in the cab.
     10) A switch to change the adjustable cab floor operation from automatic or manual.
     11) A push-button switch to control the adjustable cab floor while in the manual mode.
     12) PBB pre-cool start and stop pushbuttons.
     13) Prepositioning: The PBB will be equipped with a PBB Preposition pushbutton.
         (a) End user will be required to enter their aircraft fleet mix and to fit test aircraft and program the preposition.
         (b) Operator can select Preposition mode, select aircraft, verify ramp is clear, and then press and hold the preposition button. While the preposition button is depressed, the PBB will drive to the
pre-programmed position. At any time during the Preposition operation, should the operator release the preposition switch, the PBB will immediately come to a stop.

(c) Aircraft proximity sensors shall stop PBB prepositioning if the PBB approaches aircraft to a user adjustable limit.

f. Control requirements shall include a Human Machine Interface (HMI) touch screen.
   1) All control and display schemes shall be submitted for approval. See submittals section.

2. Indicators. The following indicators shall be labeled to indicate function and shall be located on the control panel.
   a. A cab floor height indicator shall show when the cab floor elevation is at the proper height (theoretically correct) for each aircraft to be serviced. Indication shall be capable of displaying in units of feet and inches. Display shall be in the units of feet and inches.
   b. A PBB extension/retraction length shall be displayed which shall show the current operational length of the PBB measured from the centerline of the rotunda to the outermost face of the aircraft spacer (bumper). Indication shall be capable of displaying in units of feet and inches.
   c. A wheel position indicator shall show the orientation of the wheels along with the true tunnel centerline, regardless of the cab’s rotational position.
   d. An amber light to indicate that the auto level function is energized and operating.
   e. An auto level malfunction shall be indicated with a red light and shall be accompanied by an audible warning.
   f. A swing limit reached shall be indicated with a red light and shall be accompanied by an audible warning.
   g. An amber light shall indicate when the aircraft canopy closure is in the down position (aircraft closure must be retracted before the bridge can be moved). Green shall indicate up, red shall indicate canopy down and the key selector switch to ON.
   h. A red light shall indicate a lift column malfunction has occurred.
   i. A light shall indicate if the adjustable cab floor is in the automatic or manual mode.
   j. A red light shall indicate when the 400 Hz aircraft cable is deployed.
   k. An green light shall indicate when the 400 Hz unit or PCA units are operating, red shall indicate faults, amber shall indicate standby.
   l. Any operator correctable condition that prevents the PBB from operating with the Key switch in the ON position should be displayed in an approved manner.
   m. Any condition that causes an audible alarm shall be displayed.
   n. Display requirements shall be met with a Human Machine Interface (HMI) touch screen.
      1) All control and display schemes shall be submitted for approval. See submittals section.

U. Aircraft Canopy
   1. The outermost end of the cab is to be equipped with an accordion-type bellows closure. Both sides of the closure shall be independently adjustable to provide a weather-tight seal against the most critical aircraft contours. When fitted against the
aircraft fuselage, the closure shall enclose both the open aircraft door and doorway. Pressure sensitive limit switches shall be incorporated into each side of the closure actuator mechanisms, as necessary, to prevent excessive pressure on the skin of the aircraft. The aircraft contact point of the closure shall be a soft material to prevent scratching or damage of any kind. The closure is to be non-abrasive, highly tear resistant, and weather resistant as well as able to remain elastic and flexible in extreme cold and hot climates and meet the requirements of NFPA-415, latest edition.

2. To maximize UV protection and increase service life, the assembly shall be two ply, the outer ply will be a rugged, polyester fabric while the inner ply will be a NFPA 415 compliant material.

3. The material for the outer ply shall meet the following minimum requirements:
   FIBER-Polyester, DENIER-1000, COUNT-18 x18, TEAR (LBS/IN)-242/213, TENSILE (LBS/IN)-439/441.

4. The material for the inner ply shall meet the following minimum requirements:
   FIBER-Fiberglass-Satin Weave, DENIER-, COUNT-, TEAR (LBS/IN)-50/45, TENSILE (LBS/IN)-300/275.

5. A minimum two (2) inch thick cushion pad shall be provided at the point of contact between the canopy and the aircraft fuselage to prevent damage to the aircraft skin and cabin or cockpit windows. Canopy supports in the leading edge of the canopy shall be padded to prevent contact with the aircraft. This padding shall be firmly attached in such a manner to prevent its slipping, turning, twisting, or distortion from normal usage. It shall be possible to replace the padding in sections without removal of the entire canopy.

6. The closure must be capable of mating with all aircraft from BAE-146/RJ-85 through B757, B767, B777, B747 and Airbus aircraft compatible. This shall be a minimum requirement. Additionally, the manufacturer shall review the aircraft parking planning drawings and shall ensure that all canopies shall mate properly to all indicated aircraft, irrespective of gate position.

7. The closure when in its retracted position shall be protected by a hood or other device to prevent water and/or debris from laying in the folds of the closure material when the bridge is not in use.

8. Any exposed arms, struts, etcetera should be covered.

V. Auto Leveler

1. PBB's shall be equipped with an automatic leveling device which permits the bridge to automatically respond to changes, including small changes, in aircraft door sill height thus maintaining a constant relationship between the floor of the aircraft and the floor of the PBB. It shall not exert stress on the fuselage skin. The leveling device actuating mechanism or rotary sensor which contacts the aircraft shall be located on the right side of the cab in full view of the operator. If the actuating mechanism or sensor is located in the cab interior or other area normally exposed to passenger traffic, it shall be located in a remote area not typically occupied by the passengers, and it shall be adequately protected and shrouded to preclude passenger interference. "DANGER - DO NOT TOUCH" shall be printed in 1/2" red letters on the device or shroud to advise passengers to stay clear. It shall function reliably on each specified aircraft regardless of door location, fuselage contour, and aircraft door sill height. The auto-leveler shall be engaged when the PBB is in the "AUTO" mode.

2. In the event of an auto leveler failure, an alarm shall sound and an "Auto Leveler" Warning light shall flash, at the console to alert the operator. The console alarm shall be a different alarm with a distinct sound so as to distinguish it from other PBB alarms. The audible alarm shall be of sufficient volume to be heard throughout the interior of the PBB.
3. Since the aircraft and PBB are exposed to various wind conditions and jet blast during the servicing period, the auto-leveler actuating mechanism shall be capable of activating within the full range of its horizontal and lateral clearance.

4. The control circuitry shall include an adjustable solid state timer which shall limit the auto-leveler's continuous response in either direction. The timer shall be adjustable from 1.6 to 16 seconds, and shall be preset to 2 seconds, and have a minimum rotation of one revolution and allow a range of adjustment of at least six inches up or down from a neutral position. The circuitry shall include both audible and visual alarms at the operator's console, and a bell or horn in the general ramp area, which shall produce a distinctly different sound from the other alarms on the unit, when the timer interrupts the response to the system. When the timer circuit de-activates the auto-leveler, the vertical lift system shall automatically be de-energized and locked in position, a vertical brake system shall automatically engage, and the audible and visual alarms at both the operator's console and ramp area shall be activated.

5. The auto-leveler actuating mechanism and sensor shall be durable and operate reliably even in the most adverse weather and ramp environment. It shall also be protected against accidental damage.

6. A remote audible alarm shall be located at the exterior wheel bogey and at the rotunda or fixed walkway, at the building interface to alert in the event of an auto leveler fault. This will be in addition to the console located audible alarm.

W. RJ Cab Floor

1. The passenger boarding bridge shall be capable of docking to the Canadair Regional Jet (CRJ), and the Embraer Regional Jet (ERJ), as well as the standard narrow/wide body aircraft mix.

2. The interface between the CRJ aircraft and boarding bridge shall be a smooth transition. The top of the cab floor and the top of the CRJ aircraft step/sill shall be flush. The boarding bridge floor shall not lay atop the CRJ aircraft step/sill, but rather shall abut the aircraft walking surface. The apron drive cab floor shall be an electro-mechanical floor and shall be designed to negotiate the sensors on ERJ and CRJ jet aircraft.

3. The operation of the floor shall be electro-mechanical.

4. The bridge cab floor shall not have any steps, ledges, gaps, or surface protrusions when docked to the specified aircraft. These may present tripping hazards at the bridge to aircraft interface and are not permitted. There shall exist no tripping hazard gaps by design. The use of hand ramps to cover gaps will not be permitted.

5. Bumper must be continuous in all applications. If slots or gaps are utilized to accommodate regional jet handrails, these shall be repositioned so as to be eliminated when servicing narrow body aircraft. The floor shall be designed to eliminate any tripping hazard or shall be equipped with appropriate guards.

6. The bridge cab floor shall be designed to provide positive protection to the CRJ door. The cab floor section that interfaces with the CRJ door shall be free to tip/rotate/move upward so as to prevent damage to the CRJ aircraft door in case of misdock or auto-leveling failure.

7. The canopy closure of the boarding bridge shall form a weather seal around the door of the aircraft specified and shall be constructed so as to clear all aircraft antennas, pitot tubes, etc. The canopy shall be designed to keep all heated probes out of the contact of passengers.

8. Handrails shall be provided to direct and support passengers as they enter/exit the regional jet aircraft. The handrails shall be able to support 400lbs lateral or vertical loading. The handrails shall keep the passengers away from any heated probes on the regional jet aircraft. The handrails shall be affixed to the bridge and shall be easy
to deploy. The handrails shall provide a full barrier system to keep passengers from exiting off of the front of the bridge at any time after the boarding bridge has been docked, and shall meet all applicable OSHA and ADA requirements.

9. The regional aircraft cab floor shall be controlled from the bridge console. The floor shall extend and retract to accommodate the regional jet aircraft steps and sensors.

10. The floor shall be equipped with appropriate sensors to safeguard the aircraft, including, but not limited to slow down sensors for forward motion and cab rotate, sensor strips to prevent damage to stairs, handrails, moveable handrails, etcetera.

11. Floor design shall be capable of completing a docking process safely in a maximum of 1 minute for the typical operator.

X. Safety Shoe

1. A safety shoe shall be required as a precaution to prevent aircraft damage in the event of a failure of the auto-leveler. The safety shoe shall be designed such that the operator places the shoe on the floor of the cab under the aircraft door. In the event the aircraft lowers and the aircraft door makes contact with the safety shoe, the auto-level alarm shall activate, if it is not already, and the PBB shall automatically lower until such time as the door is no longer in contact with the safety shoe. Subsequent contact with the shoe shall have similar results.

Y. Slow and Stop Proximity Sensors

1. The manufacturer shall equip each PBB with a proximity switch system, or comparable, to prevent the bridge bumper from hitting the aircraft, causing damage. At 2’ to 10’ (adjustable) from the aircraft, slow-down circuitry shall be initiated, slowing forward movement to half speed. As the bridge continues to approach the aircraft, stop proximity sensors shall activate, no part of the bumper will be permitted to come within 0” to 2” (adjustable) of the aircraft. Appropriate forward motion and cab rotation in the direction of the aircraft will be locked out to prevent the bridge from contacting the aircraft. Movement away from the aircraft will be unrestricted.

Z. Service Door, Landing, and Stair

1. A ramp service door, landing, and service stair shall be provided at the aircraft end of the bridge for apron access by authorized personnel. The door, landing, and stair shall be positioned on the right-hand side of the cab bubble unless otherwise indicated.

2. The service door shall be a minimum of 2 feet, 6 inches wide by 6 feet, 8 inches high, half wire-glass hollow core, steel door, with a 45-minute fire rating. The door shall open outward on the landing and be equipped with a heavy duty door closure. The door shall include a 30-inch stainless steel kick plate to cover the lower inside portion of the door along with weather stripping on the jambs and header and a vertically adjustable bottom weatherstrip. The door shall be equipped with a heavy duty keyless lockset conforming to to 49 CFR 1542.207(b) security requirements. The lock shall be a Unican 1000-1 lockset. Locks to be equipped with pushbutton security entrance from outside to inside and with rotary knobs inside and outside. The locksets on all bridges shall match and shall have key override functions.

3. The service stairs shall have equally spaced, self-adjusting risers with open mesh non-skid type treads. All steps have equal rise with a minimum tread width of 28 inches, and a minimum depth of 9-1/2 inches. The bottom of the service stair shall be supported by casters with rubber tired cast iron wheels to roll on the apron. Both sides of the stairs shall be equipped with tubular steel handrails of proper height to meet applicable codes. Entire assembly, including, but not limited to, rails, treads, framework, landing, modesty shields, brackets and hardware shall be constructed of galvanized steel.

4. The service landing shall be made of an open mesh, non-skid grating and be completely surrounded by tubular steel handrails of the proper height to meet
applicable codes. The landing shall be level with the cab floor and shall be illuminated by an LED (100 watt equivalent) photocell actuated light, with interior bypass.

5. A visual modesty shield shall be provided beneath the service stair landing. Design shall prevent the accumulation of rain or snow.

6. Service platform handrails shall incorporate industry standard "catering gate" handrail modifications. Catering gates shall utilize stainless steel chains, snap hooks and hardware.

AA. Baggage Slides

1. Existing baggage slides shall be removed and reinstalled on new PBB's at Gates B3, B4, B5, B6 & B12.

2. New baggage slides will be provided for new PBB's at Gates B1, B2, B7, B8, B9, B10, B11 & B14. Provide and install new baggage slides as follows:
   b. 316SS.
   c. P&W Machine @ pwmachine.com.

AB. Electrical System and Components

1. The passenger boarding bridge shall be capable of operating on an emergency power backed up source of 3-phase, 3-wire, 480/277 Volt, 60 Amps service terminating in a panel on the terminal wall adjacent to the rotunda column of the bridge, which shall be provided by others. This power shall remain separate from non-critical load power such as PCA and 400 Hz loads. A thermal magnetic trip circuit breaker panel disconnect for the motor, lighting, and control circuits shall be mounted on the rotunda support column.
   a. The PBB main circuit breaker shall remove all power from all bridge circuits (exclusive of PCA & 400 Hz systems).

2. This panel shall also house thermal magnetic trip circuit breakers for the addition of the preconditioned air and 400 Hz equipment as applicable and as indicated on the project drawings.
   a. Panel shall be NEMA 4X rated 316 stainless steel disconnect panel.
   b. All circuit breakers shall be lockable in the "OFF" position.
   c. All primary disconnecting means shall be suitably rated to be capable of withstanding and interrupting fault currents available at the input.

3. All standard lighting, duplex receptacles, operator controls, and fractional HP motors shall operate on 120 volt, single phase, 60 Hz power. The transformer and separate circuit breakers for lighting and control power shall be mounted in the power control panel.
   a. All circuit breakers shall be lockable in the "OFF" position.
   b. All circuits and systems shall be protected by circuit breakers. Fuses will not be allowed.

4. Disconnect panel shall either be equipped with exterior handles, or shall be guarded such that all circuit breakers can be operated by an operator without having access to energized components.

5. All electrical components, which are exposed to the weather, shall be of a weatherproof type or housed in weather-tight NEMA 3R enclosures, except for main power disconnect(s), which shall be a NEMA 4X stainless steel enclosure. Where dictated by the environment, electrical enclosures shall be equipped with heaters to control condensation.
6. All electrical equipment and methods of installation shall conform to the requirements and recommendations of the American Insurance Association (AIA), the National Electrical Manufacturers Association (NEMA), and the National Electrical Code (NEC).

7. All electrical components utilized shall be recognized by Underwriters Laboratories (UL) or an approved equal testing laboratory.

8. Wiring and installation shall be in accordance with National Electric Code and applicable local electrical codes.

9. Both ends of each conductor shall be color coded or identified. Particular attention shall be given to separating circuits of different voltages, emergency lighting, and telephone lines.

10. Five (5) dedicated unswitched, 120 volt, 1 phase, 60 Hz, 15 Amp three-conductor duplex receptacles shall be provided; one located near the operator's console, one in the Rotunda, one weatherproof outlet at the rotunda located disconnect panel, one weatherproof outlet at the wheel undercarriage near one of the lift columns, and one weatherproof outlet at the cab end of the roof. These outlets shall be GFCI protected.
   a. Exterior outlets shall be equipped with extra heavy duty, metallic, while in use - wet cover assemblies such as Red Dot Model CKMUV or equivalent.

11. Control console lid, wiring harness should be of sufficient length to allow the panel to be pulled out and turned over, facilitating repairs.

12. All wiring shall be brought to terminal blocks and/or suitable connectors. The wiring shall be formed and restrained to give a neat appearance. Wire splices shall not be used. Connections shall be made using terminal strips and staked lugs or by patent connectors.

13. 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 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.

14. Quick disconnect fittings, where required, shall be UL or ETL approved.

15. All light bulbs shall be heavy-duty LED type.

16. All receptacles and light switch cover plates to be stainless steel, ANSI No. 4 finish.

17. Electrical interlocks shall be fail-safe design.

18. 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. All exterior located limits switches, potentiometers, or other electrical devices, shall be protected by suitable covers to prevent the accumulation of snow or ice from preventing switch action or causing false switch action, as well as to protect the devices from physical damage.

19. Electrical conductors or cables exposed to weather shall be suitably rated and UL approved.

20. Flexible cables/conduits shall not exceed 48" except where relational motion is required. All cables and conduits shall be adequately supported.

21. Cable carrier systems that expose cables to sunlight, shall require all cables installed within this system to be rated for UV exposure.

22. The bridge shall contain appropriate telephone communications equipment. The provisions shall include a flush mounted "J" box containing two (2) 12-pair CAT-6 communication cable near the operator's position, include faceplate and RJ45 terminations. The communication cables shall extend across the PBB. Provide and install terminations at the cab and building face end of cable.
a. At gates B2, B4, B6 & B10, PBB shall accommodate two (2) phones in the cab. Provide for additional boxes, cabling, etcetera.
b. Accommodate existing building supplied systems.
c. Telephone cabling shall be extended to the wheel bogey and shall terminate in a junction box for the potential future installation of wheel bogey telephones.
d. Remove, reinstall and reuse existing telephones. Phones are VOIP.
e. Assist Owner in testing phone to ensure bridge phones operate correctly.

23. The bridge shall be designed with safety as the first priority; at a minimum, the following control features, interlocks, and warning devices shall be included in the bridge:
   a. With the PBB in the "Off" mode, all controls shall be inoperative.
   b. Spring-loaded wheel brake(s) shall be automatically set whenever controls for horizontal travel are not actuated by the operator. The drive system shall have provisions to manually release the brakes to permit towing of the unit in the event of a power failure.
   c. The vertical lift column safety stops are to be automatically engaged whenever controls for vertical travel are not actuated by the operator.
   d. With the PBB in the "Auto-Level" mode, all manual motion controls shall be inoperative. In this mode, vertical travel shall be regulated by the automatic leveling system.
   e. With the PBB in the "Operate" mode, the Auto-Leveler shall be retracted and become inoperative.
   f. The control circuits shall be designed and wired so that it is impossible to select opposite motions simultaneously, e.g., extend and retract or raise and lower travel.
   g. Two limit switches, one to slow the bridge to half speed and one to halt forward or reverse travel of the bridge when the tunnel extension or retraction limits have been reached.
   h. Limit switches shall prevent movement of the bridge beyond specified Rotunda operating parameters as specified in these Specifications.
   i. A 6-inch diameter alarm bell located under the aircraft cab shall sound continuously whenever the bridge is in drive mode of operation.
   j. An amber colored rotating beacon located under the aircraft cab shall illuminate when the selector switch on the operators' console is in the "Operate" position.
   k. Adjustable slope limit switches shall be added to prevent movement of the bridge in a way that can damage the loading bridge or any auxiliary equipment that is mounted on the bridge.
   l. Vertical travel limit switches shall be provided to prevent travel of the vertical lift columns into the mechanical stops.
   m. Horizontal travel limit switches shall be provided to prevent travel of the tunnels into the mechanical stops.
   n. Cab rotation limit switches shall prevent over rotation (left or right) of the cab into mechanical stops.
   o. Preconditioned air and 400 Hz operating interlocks shall prevent horizontal bridge motion while these units are operating or the 400 Hz aircraft cable is not in the stowed position. Suitable warning indicators shall be provided for each of these conditions.
p. Drive forward and cab rotate controls shall be locked out when canopy is down on the aircraft.

q. Forward or reverse “drive” controls are locked out by their respective extend or retract switches.

r. The bridge shall be fitted with slope vertical limiting switches which shall lock out appropriate vertical and drive functions if operated beyond 10.0% (or as required by airline specifications) slope limits.

s. Adjustable switches shall be provided to limit the swing or rotation of the bridge to prevent contact with the terminal building or other fixed obstruction. This system will stop drive motions in the direction of contact and the system shall incorporate suitable warning lights and buzzers on/or inside the operator’s panel.

24. The following interior and exterior LED lights shall be provided:

a. Interior lighting shall include the lighting in the cab/bubble and rotunda areas. The level of illumination shall be 200 lux at the finished floor level with the weather door closed.

b. Tunnel lighting shall be provided by recessed LED panel fixtures with diffusers. The fixtures shall be 4 feet long and shall be positioned parallel to the tunnel centerline on a maximum of 8-foot centers or less as required to meet specified lighting levels. The lights shall be controlled by two 3-way switches. One shall be located in the control cab and one in the rotunda corridor adjacent to the terminal door. The level of illumination within the tunnels shall be uniform at 200 lux at the finished floor level.

c. Rotunda and bubble area lighting shall be provided in a similar manner, shall meet the same lighting level requirements and shall be controlled from the same tunnel switches.

d. The operator’s console shall be provided additional lighting via recessed LED light fixtures which shall be controlled via a switch on the operator’s console. Provide a minimum of 645 lux at the console faceplate.

e. PBB electrical control cabinets shall be equipped with interior LED light fixtures as necessary to eliminate the controls for maintenance purposes, control via manual switch interior to cabinet.

f. Two exterior LED floodlights shall be provided under the tunnel to illuminate the apron area ahead of the bridge. An additional LED floodlight shall be provided to illuminate the area around the drive column.

g. A sealed exterior type LED fixture shall illuminate the cab area forward of the overhead roll-up door. Level of illumination shall be 200 lux at the finished floor level with the weather door closed.

h. A weatherproof exterior fixture with a 100 watt LED equivalent lamp shall be installed over the service door to illuminate the service stairs and landing. It shall be controlled by an external photocell with interior override switch.

1) Service door landing light shall be automatically controlled via an external photocell. This shall be able to be bypassed with an interior located photocell override switch.

i. Provide emergency lighting with 90 minutes battery backup complete with self-contained charger and automatic on-off control. Emergency lighting shall be incorporated into the normal lighting fixtures, and shall meet illumination requirements of NFPA-101 life safety codes. Wall mounted battery units are not acceptable.
j. All PBB lighting, lamps, bulbs, indicator lamps, etcetera shall be LED type without ballasts.

25. Surge Protective Devices
   a. Unit shall be equipped with a ANSI/UL 1449 compliant SPD, in accordance with directives of the IEEE STD 1100, latest edition and Section 264313.

AC. Finishes and Materials
1. The exterior and interior designs shall be aesthetically pleasing and in keeping with contemporary trends. Where necessary to meet this requirement, and when not in conflict with maintainability standards, enclosures should be utilized to cover unsightly appurtenances.

2. All Interior and exterior systems shall be fitted and trimmed as necessary to present a neat and clean finished product.

3. All finishes shall meet NFPA requirements.

4. Interior
   a. All interior surfaces of the structure shall be cleaned in accordance with SSPC-SP3 or sand/grit-blasted in accordance with SSPC-SP6, as appropriate, and shall be coated with a rust inhibiting primer applied to a minimum 4 mil total dry thickness over the average measured blast profile. Exposed interior surfaces shall be coated with an additional 2 mils of polyurethane finish coat.
      1) Color: Match wall boards.

   b. Interior wall treatment shall consist of floor to ceiling 4-foot-wide laminated phenolic plastic panels, with aluminum trim and recessed black accent strips. Paint all exposed interior metal surfaces to match interior wall panels, except brushed aluminum or bright finish work. Walls shall be fully insulated to include fiberglass fire resistant insulation achieving a minimum R value of 9.5.
      1) Color and finish: TBD.

   c. Ceiling shall be an 8-inch-wide aluminum plank-type ceiling with a 1/2-inch fire resistant insulation blanket on top with an exposed, black backing- minimum combined R Value of 7.5. Planks shall run complete from bridge wall to wall.
      1) Finish: Brushed Aluminum.
      2) Alternate galvannealed ceiling panels will be allowed to the extent remaining applicable specifications are adhered to.

   d. The PBB’s shall be carpeted with heavy commercial non-skid carpeting, or rubber as indicated. Flooring to be supplied and installed by bridge manufacturer in the factory.
      1) Tandus
      2) Abrasive Action II
      3) Color: Charcoal
      (a) Owner will deliver to PBB manufacturer 700 LF of 6’ wide roll good previously purchased. Utilize this and provide whatever additional materials are required. Due to lot differences do not comingle provided carpet with purchased carpet.
      (b) Provide and install all other materials necessary, e.g. adhesives, retaining strips, etcetera.
      4) Heavy Duty 1/4” ribbed rubber flooring to be installed in the cab areas (Interior/Exterior) of the PBB as well as on interior ramps.

   e. Sub-floors shall be constructed of 3/4” fire retardant marine plywood which shall be securely fastened with fasteners suitable for this purpose. Insure adjoining
sheets are supported and fastened to a common member to provide smooth even joints. Any remaining uneveness will be removed with filler. The sub-floor fasteners will not protrude through the exterior tunnel siding.

1) Alternate galvanealed panel subfloors shall be allowable to the extent remaining applicable specifications are adhered to.

2) Cab floors (Interior/Exterior) shall be aluminum.

5. Paint - Ultimate 3-Coat Coastal Paint System
   a. Cab/Interior Exposed Surfaces:
      1) Surface Preparation Process:
         (a) De-burr and remove all weld splatter. Grind excessive / rough welds smooth, and round sharp edges and corners.
         (b) Remove contaminants, oil, grease, dirt, etc. from the surface in accordance with SSPC-SP 1 (Solvent Cleaning) and appropriate SSPC commentaries.
         (c) Dry abrasive blast clean cab surfaces with garnet grit (or equivalent) in accordance with SSPC-SP 6 or better to obtain an angular 1-3 mils profile. If steel is not new or is corroded, blast to SSPC-SP 10 standard.
         (d) Thoroughly clean with dry high pressure clean air to remove dust and grit. Mask all necessary areas before priming.
      2) Prime Operation Process:
         (a) Apply one coat of Organic Zinc Epoxy Primer to the surfaces at a dry film thickness of 3-5 mils per manufacturers' instructions in the Product Data Sheet. Follow all manufacturers' handling application and curing instructions.
         (b) Apply one coat of High Build Epoxy Primer at a dry film thickness of 6-10 mils to the surfaces per manufacturers' instructions in the Product Data sheet. Follow all manufacture's handling application and curing instructions.
      3) Finish Coat Operation Process:
         (a) Apply one coat of High Solids, two components, Aliphatic Acrylic Polyurethane finish paint to a dry film thickness of minimum 2 mils to the surfaces per manufacturers' instructions in the Product Data sheet. Follow all manufacture's handling application and curing instructions.
   b. Tunnel Interior (Unexposed):
      1) Surface Preparation Process:
         (a) Remove contaminants, oil, grease, dirt, etc. from the surfaces in accordance with SSPC-SP 1 (Solvent Cleaning) and appropriate SSPC commentaries.
         (b) Mechanical clean in accordance with SSPC-SP 3 to remove loose scale and contaminants from the surfaces where required.
         (c) Thoroughly clean with dry high pressure clean air to remove dust and grit. Mask all necessary areas before priming.
      2) Prime Operation Process:
         (a) Apply one coat of Alkyd Metal Primer containing active corrosion inhibitors (lead and chromate free) at a dry film thickness of 1.3 - 2.5 mils per manufacturers' instructions in the Product Data Sheet. Follow all handling and curing instructions.
c. Exteriors (All Except Galvannealed Cladding):
   1) Surface Preparation Process:
      (a) De-burr and remove all weld splatter. Grind excessive / rough
          welds smooth, and round sharp edges and corners.
      (b) Remove contaminants, oil, grease, dirt, etc. from the surface in
          accordance with SSPC-SP 1 (Solvent Cleaning) and appropriate
          SSPC commentaries.
      (c) Dry abrasive blast clean exterior surfaces with garnet grit (or
          equivalent) in accordance with SSPC-SP 6 or better to obtain an
          angular 1-3 mils profile. If steel in not new or is corroded, blast to
          SSPC-SP 10 standard.
      (d) Thoroughly clean with dry high pressure clean air to remove dust
          and grit. Mask all necessary areas before priming. The blast
          cleaned surfaces must be primed soon enough to prevent
          corrosion from occurring on the profile.
   2) Prime Operation Process:
      (a) Apply one coat of Organic Zinc Epoxy Primer to the surfaces at a
          dry film thickness of 3-5 mils per manufacturers' instructions in the
          Product Data Sheet. Follow all manufacturers' handling
          application and curing instructions.
      (b) Apply one coat of High Build Epoxy Primer at a dry film thickness
          of 6-10 mils to the surfaces per manufacturers' instructions in the
          Product Data sheet. Follow all manufacture's handling application
          and curing instructions.
   3) Finish Coat Operation Process:
      (a) Apply one coat of High Solids, two components, Aliphatic Acrylic
          Polyurethane finish paint to a dry film thickness of minimum 2 mils
          to the surfaces per manufacturers' instructions in the Product Data
          sheet. Follow all manufacture's handling application, and curing
          instructions.
      (1) Total Minimum Required Dry Film (TDF) for Exterior is 11
          Mils.

d. Exterior Galvannealed Cladding:
   1) Surface Preparation Process:
      (a) Thoroughly clean with dry high pressure clean air to remove dust
          and grit.
      (b) Remove contaminants, oil, grease, dirt, etc. from the surfaces in
          accordance with SSPC-SP 1 (Solvent Cleaning) and appropriate
          SSPC commentaries.
   2) Prime Operation Process:
      (a) Apply one coat of High Build Epoxy Primer at a dry film thickness
          of 6-10 mils to the surfaces per manufacturers' instructions in the
          Product Data sheet. Follow all manufacture's handling application
          and curing instructions.
   3) Finish Coat Operation Process:
      (a) Apply one coat of High Solids, two components, Aliphatic Acrylic
          Polyurethane finish paint to a dry film thickness of minimum 2 mils
          to the surfaces per manufacturers' instructions in the Product Data

e. Painting Notes:
   1) All Except as noted below:
      (a) Imron, Heavy Duty - Arctic White.
   2) Rotunda Column, Inner Lift Columns, Walkway Support Column, Haunch Support and Wheel Bogey:
      (a) Imron, Heavy Duty - Haze Gray #1047.
   3) All colors to be submitted for approval.
   4) All tapped and machined holes must be masked before blast, prime and paint.
   5) Perform body work and/or caulk areas after Epoxy Priming.
   6) Before Top Coating, Epoxy Primer shall be lightly sanded.
   7) Galvannealed, Galvanized, Aluminum, and Stainless Steel parts do not require blasting.
   8) Galvannealed, Galvanized, and Aluminum sheets must be Etched, Epoxy Primed (6-10 mils) and Top Coated with 2 mils of Polyurethane.

1.13 CONTROL

A. The PBB control shall be provided with a programmable logic controller which shall monitor all phases of operation of the PBB. 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. PBB 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.

   1. The practice of sharing the passenger boarding bridge controller, either directly, or through remote I/O racks with the PCA unit controller will not be permitted. Each PBB shall have a dedicated and separate controller.

B. Portable Laptop Computer:

   1. The PBB manufacturer shall provide and configure each portable laptop computer for Local access to each PBB unit controller and each PCA Dx and AHU unit specified.

   2. The PBB manufacturer shall configure each portable laptop computer for Local access to each PBB unit controller, and shall provide all software and interconnection cables required to support local communications, troubleshooting and programming to/ of the PBB controller. This access shall be password protected and shall be fully capable of controlling or modifying PBB unit's current database or control program. All Software shall be licensed and registered in the Owner's name.

      a. Dell Latitude 14" Latitude
      b. Processor: i7.
      c. Memory: 16GB
      d. Screen: 14" HD Color, High Brightness with Camera and Microphone.
      e. Hard Drive: 256GB SSD
      f. Battery: 6-cell Lithium ion battery (65Whr) and AC pack.
      g. Mouse: Built in Pointing Device/Touch Pad.
      h. External Ports: (2) USB 3.0, (2) USB 2.0, HDMI, VGA, (2) RS232, (2) RJ45 Gigabit EthThernet.
i. DVD+/- RW.
k. Wireless LAN: 802.11 compliant.
l. Bluetooth.
m. Graphics Media Accelerator.

3. Portable laptop computer shall include all hardware and software required to support local communications, troubleshooting and programming to/of the PBB controller and PCA Dx Unit’s and AHU controller. This access shall be password protected and unit shall be delivered fully capable of controlling or modifying PBB and PCA Dx/AHU unit’s current database or control program. All Software shall be licensed and registered in the Owner’s name.
   a. Coordinate with PCA manufacturers.

4. Warranty as specified in this Section for the PBB and all items specified thereunder.

1.14 MONITORING

A. The PBB, 400 Hz and PCA systems shall communicate with and be monitored by the Owner’s BMS system - Johnson Controls. Provide networking of PBB, PCA and 400Hz units, and provide any and all PBB mounted cabling, translators, etcetera for a complete monitorable system. Final tie in at building face to be provided by Owner. Test and certify bridge conductors, terminations translators, etcetera as ready for Owner’s use.

1.15 HURRICANE TIE DOWNS

A. Each PBB shall be equipped with hurricane tie down provisions. Tie downs shall be quickly and easily installed without damaging the PBB or marring any finishes.

B. Include all straps, hooks and binders necessary for a complete tie down system. (Ramp anchors are existing).

C. Include a hasp lockable storage box to be installed on the PBB under the C-tunnel or cab area of the PBB to store all tie down components.
   1. Storage container shall be fully enclosed so as to protect the contents from the elements.
   2. Storage container shall be constructed of aluminum or stainless steel and shall be outdoor and coastal weather rated.
   3. The Owner shall provide padlocks for the storage boxes.

1.16 RELATED EQUIPMENT PREPARATION

A. PBB shall be shipped prepared to field install the following equipment as scheduled:
   1. Preconditioned Air Unit.
   2. 400Hz GPU with integral 28VDC power supply.
   3. Cable Hoists.
   4. Equip PBB with power circuit breakers, across the PBB power cables, control conductors, interlocks, etcetera for complete preparation for the added equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. JBT AEROTech - FMC Jetway
B. Thyssen Krupp Airport Systems
C. Substitutions: Per Product Substitution Requirements in Division 1.

2.02 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.

2.03 FACTORY TESTING

A. The manufacturer shall test one of each model (not size) of every PBB to assure compliance with the specifications. Certification test sheets shall be submitted. 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. 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.

2.04 PRODUCT SUPPORT

A. Spare Parts

1. The manufacturer shall maintain an adequate inventory of all proprietary or vendor fabricated or modified parts, especially the long lead time items, for routine maintenance of the unit. All stock shall be maintained, whether or not the unit is in current production, for a minimum of ten (10) years from the date of the last unit manufactured.

B. Field Support Services

1. The manufacturer shall provide supervisory and service personnel, certified by the manufacturer, during the installation of the boarding bridge to assure proper installation.

2. The manufacturer shall provide the Owner with all appropriate Service Bulletins for bridges supplied for a minimum of twenty years from the date of final acceptance.

3. The manufacture shall provide one (1) tow bar compatible with PBB lugs and existing airport tug equipment to allow manually towing of the bridge when it is out of service. Two bar shall be primed and painted safety yellow.

4. The manufacture shall provide one "A" frame jacking stand mechanically suitable for and structurally adequate to support the PBB for maintenance services such as wheel bogey repairs. Jacking stand shall incorporate heavy duty rubber tread wheels to allow towing the stand by existing airport equipment. Each wheel shall be steel with rubber or pneumatic tread and shall be rated for a minimum of 10,000 pounds and shall be suitable for towing at a minimum of 10 M.P.H. Wheels shall be spring loaded such that when the PBB load is placed on the stand, the wheels automatically retract allowing the frame to contact the ramp surface, when the load is removed, the wheels will extend and allow the jack stand to be towed. Jacking stands shall be primed and painted safety yellow.
PART 3 EXECUTION

3.01 GENERAL

A. This specification shall act as a supplement to the Manufacturer’s standard installation procedures only, and in no way shall it be construed so as to limit the installing contractor from providing a complete and operable installation, in accordance with all generally accepted good passenger boarding bridge installation practices, as well as the manufacturer’s written installation procedures. Any reference to the installing contractor or contractor herein shall be construed to mean that entity installing this equipment in the field.

B. Installations shall be performed in strict compliance with the Manufacturer’s written Installation Procedures.
   1. Manufacturer shall submit a copy of their Installation Procedures for approval, prior to installation.

C. Remove and re-install any previously installed terminal door security/control devices required for PBB remova/installation.
   1. These services shall be subcontracted to the local Owner approved Security System Contractor. Assist as necessary and pay for all services.

3.02 PASSENGER BOARDING BRIDGE INSTALLATION

A. Any and all damage sustained by the new PBB caused by equipment used for the lifting, transportation, movement, staging, or otherwise, of the new PBB, assemblies, or components shall be the responsibility of the contractor.

B. PBB Mechanical Erection and Lifting
   1. Use of Heavy Equipment
      a. The use of crane(s), fork lifts, and/or other heavy equipment throughout the project shall be detailed in advance with and approved by appropriate Aviation Authority offices. Equipment used shall not exceeded maximum allowable airfield heights.
      b. Heavy equipment capacity and operator experience shall be adequate to ensure safe and efficient lifting of the PBB systems, assemblies, and/or components.
      c. Damage to the terminal building, apron, foundations, and/or PBB shall be the complete responsibility of the installing contractor.
      d. Paint damage to PBBs and related assemblies shall be minimized, and where occurring, shall be repaired in accordance with the "Exterior Finishes" section of this section.
      e. Heavy equipment operator's shall be fully trained and certified to operate equipment in their control.
   2. Rigging
      a. Original Manufacturer designed PBB lifting lugs shall be utilized for rigging and handling of PBB systems, assemblies, and/or components. Where lifting lugs are not present, approved straps, cradles, chains, couplings, cables, and/or fixtures shall be utilized.
      b. Where applicable, lifting tools shall be of the proper strength rating and shall have current certifications.
   3. Tunnel/Drive System Assembly Installation
      a. The assembly of PBB vertical and horizontal drive assemblies shall be accomplished using safe and approved practices. All assembly shall be
accomplished using new installation bolts/fasteners in accordance with manufacturer's specifications in the originally designed quantities.

b. Any structural modifications necessary to allow the correct use of fasteners shall be accomplished in a safe and professional manner. All welds, where necessary shall be complete, continuous, and in compliance with AWS standards, and shall be performed by certified welders. Contractor's performing welding operations shall submit copies of the welder's certifications.

c. PBB structural support integrity shall not be compromised.

d. The complete tunnel assembly shall be pinned to the fixed rotunda assembly using manufacturer supplied hinge pins.

e. If hinge pins, hinge pin plates, and/or associated welds show any damage, they are to be replaced.

f. Ensure that the hinge pins are properly greased and installed without causing any damage or deformation to the pins.

C. Electrical Requirements

1. Miscellaneous Electrical Requirements

a. All field terminated wiring, interior and exterior, shall be checked for damage and improper or unsafe installation. Damaged wires and cables shall be replaced. All replacement wiring and components shall be UL approved and shall be selected and/or sized in accordance with NEC based upon the intended use.

b. Wiring shall be color coded in accordance with existing wiring and Manufacturer's specifications and shall be easily traced.

c. Wiring shall be neatly routed in secured harnesses and shall be labeled.

d. All electrical enclosures shall be UL approved, and NEMA rated.

e. The installing contractor shall be responsible for all PBB related electrical inter-connects, component/assembly wiring, and PBB electro-mechanical system functions, unless specifically identified otherwise.

f. All exterior or otherwise exposed conductors/cables shall be installed within conduit unless required for flexibility to be a flexible cable and then exposed cables shall be limited to 48", unless mechanical requirements dictate otherwise.

g. All electrical devices/conduits shall be properly secured. Beam clamps will not be allowed.

2. Main Power Electrical Disconnect Assembly

a. All cables/conductors shall be neatly color coded and marked.

b. All original manufacturer rating and labels shall remain intact and unmarred.

c. All enclosures shall be securely fastened to the stand using approved Manufacturer provided fasteners.

d. All PBB power cables shall be verified to be in new condition. Damaged cables shall be replaced with OEM cables provided by the Manufacturer.

e. All cables shall be safely routed between PBB junction boxes, utility carrier and the main PBB disconnect. All cables shall be secured to PBBs in accordance with Manufacturer's instructions.

f. All power cables, wiring, and utilities installed across the exterior "A" and "B" tunnels shall be installed in the utility carrier.
3.03 PASSENGER BOARDING BRIDGE SETUP

A. PBB Mechanical Setup

1. Limit Switches
   a. All mechanical stops, limit switch mounting brackets, mechanical limit switch "trip tabs", and associated fasteners shall be inspected, repaired, secured, and/or replaced, as applicable, prior to final operational testing of PBB electrical systems. Limit switch mounting brackets shall be structurally sound and straightened, if necessary, to ensure proper alignment of limit switches. Where adjustable or sliding stops are utilized, slide tracks shall be securely attached to PBB structures and lock bolts, adjustment threads, etc. shall be fully functional.

B. PBB Electrical System Setup

1. All wiring and electrical connections shall be safely completed in accordance with national, state, and local electrical code by qualified electricians.

2. Tunnel interconnects and primary electrical system wiring (480 Volt) shall be checked and maintained as per the original manufacturer's design.

3. PBB electrical setup procedures shall be accomplished by the Contractor in accordance with Manufacturer's installation instructions and any pertinent service bulletins.

4. Limit Switches
   a. PBB electrical limit settings shall be set to conform to the structural design limits of the PBBs and in accordance with aircraft parking requirements.
   b. Rotunda limit switches (swing limits) shall be adjusted to prevent the PBBs from being capable of swinging into Ground Support Equipment (GSE) staging areas, the terminal building, or adjacent PBBs.
c. Rotunda mounted slope limits shall be set to prevent operational PBB slopes from exceeding 10.0 percent.
d. Tunnel travel limits ("full extend/retract" and "slow down") shall be set to safely meet each gate's operating requirements.
e. Oversteer limits for the wheel bogie assembly shall ensure that oversteer conditions cannot be encountered.
f. Ensure that the column travel limits and/or height indicator assembly is installed and functional so as to prevent damage to the vertical drive column assembly. Ensure that height indicator functions/limits are calibrated.
g. Ensure that the cab rotation limits are functional and that the cab cannot exceed safe rotations

5. Electrical System Inspection
   a. Test the auto-level system for proper operation prior to PBB use. Verify auto-level travel response time and time-out relay function. Ensure that the limit switch is in good working order.
   b. Ensure proper function of the canopy deployment system. Verify proper unit operation to ensure that excess canopy pressure on the aircraft will not occur. Ensure that canopy deployment speed is consistent on both sides and that no binding occurs.
   c. Perform a comprehensive operational inspection of all 480-Volt drive systems to ensure proper operation and condition.
   d. Ensure that all lighting circuits and lights are functioning as designed. Bulbs and ballasts shall be checked and replaced if non-operational. All bulbs should be the same style.
   e. Ensure that all other electrical systems, including all travel alarms, operation bell, indicator lights, and warning beacons or strobes are functioning properly.

3.04 INSPECTIONS
   A. Manufacturing Representative
      1. Manufacturer's representative shall be on site, as necessary, during the installation of the equipment, as required to ensure the equipment is properly installed in accordance with the Project Specifications.
      2. Manufacturer's representative shall be present during preliminary equipment installation inspection.
      3. Manufacturer and/or contractor shall diligently pursue the completion of all punch list items.
      4. Manufacturer shall notify the Owner when the equipment installation is considered ready for a final inspection.
      5. Manufacturer's representative shall be present during final inspection.
   B. The Owner will not accept the boarding bridge until it has been inspected to verify that the installation, function and quality of the PBB meet The Owner's standards. Any deficiencies and/or violations shall be immediately corrected by the Manufacturer at no additional cost to the Owner and shall be re-inspected.
   C. The Manufacturer shall be responsible for providing all necessary test, measuring and recording devices required to demonstrate the boarding bridge's compliance with this specification.

3.05 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
3.06 INTERFACE WITH OTHER WORK

A. The Contractor shall cooperate and coordinate his work with the 400 Hz, PCA, and related equipment installations including ancillaries.

B. The Contractor shall coordinate with the 400 Hz, PCA, and related equipment for the provisions for or installation of all necessary infrastructure prior to final factory painting of the passenger boarding bridge. The intent is to eliminate site welding/painting after final factory painting.

C. Installation of units shall be coordinated with other trades and activities associated with the project and site.

D. Remove and reinstall phones. PBB installer shall provide building phone service terminations and shall verify proper operation.

3.07 EXAMINATION

A. Verify/perform the following items or tasks.
   1. Verify all cables and conductors are properly terminated.
   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. Perform full passenger boarding bridge and related equipment operational non-interference test.

3.08 CLEANING

A. Clean 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.

D. Wash exterior of bridge.

E. Clean all windows, wallboards, windows and interior surfaces.

3.09 STARTING EQUIPMENT AND SYSTEMS

A. Complete approved field commissioning report, including, but not limited to the following:
   1. Verification that the bridge swings to the right and left, and that the swing limits switches function as required.
   2. Verification the bridge “raises” and “lowers”, and that the vertical limit switches function as required.
   3. Verification that the rack limit switches function as required (if present).
   4. Verification that the vertical drive brakes function as required (if present).
   5. Verification that the bridge “extends” and “retracts”, and that the extend and retract limit switches function as required.
   6. Verification that the cab rotates, and that the cab rotation limit switches function as required.
   7. Verification that wheel alignment matches the gauge.
   8. Verification that the canopy extends and retracts as required and that the canopy interlocks function as required.
   9. Ensure that the bridge “autoleveler” functions, and it alarms after it times out.
10. Ensure that the “floor leveling” works as required.
11. Verification that the bridge “slow down” and “bumper proximity switches” function as required.
12. Ensure all lights, outlets, fans and other accessories function as required.
13. Ensure that all alarms, interlocks, emergency lighting and other safety features functions as required.
14. Ensure that the door locks work.
15. PBB OEM Lubrication.
16. Building interlock systems for PCA and SSFC units.
17. All other items listed on the approved Field Commissioning Report.

B. Demonstrate complete functional operation of equipment to the satisfaction of the Owner.