

SECTION 11 85 04 – PASSENGER BOARDING BRIDGE

PART 1 - GENERAL

1.1 SUMMARY

- A. This specification pertains to the apron drive passenger boarding bridges (PBBs) to be furnished and installed as part of this project.
 - 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.
 - 2. The aircraft parking requirements for each PBB can be seen in the contract drawings.
- B. Products Supplied But Not Installed Under This Section
 - 1. None
- C. Products Installed but Not Supplied Under This Section
 - 1. 400Hz Ground Power Unit
 - 2. Preconditioned Air Unit
 - 3. Preconditioned Air Hose & Hose Management System
 - 4. Potable Water Cabinet
 - 5. Roof Top Heating Ventilation and Cooling (HVAC) Unit
 - 6. Electric Baggage/Wheelchair Lift
 - 7. Vehicle Docking Guidance System (VDGS)
 - 8. Ramp Information Display System (RIDS)
- D. Unless noted otherwise on the drawings, the work shall include everything necessary or incidental to complete the installation including wire raceway (conduit), raceway fittings, outlet boxes, pull boxes, terminal cabinets, 120-volt AC power circuits, and insulated ground cables. Such equipment shall be furnished and installed as Division 26 electrical work. The Contractor shall furnish all necessary information to other contractor(s) to ensure that a proper conduit system will be installed. Provide accurate as-built drawings indicating all installed conduit and junction boxes.
- E. The Contractor shall cooperate with all other contractors engaged in this project and shall coordinate the passenger boarding bridge installation so that all work will proceed in a manner which is in the best interests of the project.
- F. It is the purpose of this specification to require the furnishing of highest quality materials, equipment, and workmanship. The work shall be in accordance with this specification and conform to the designs, layouts, and descriptions on the drawings.

1.2 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 11 85 01 - PRECONDITIONED AIR HANDLING UNITS
- C. Section 11 85 03 - AIRCRAFT POTABLE WATER CABINET

- D. Section 11 86 00 - AIRCRAFT GROUND POWER CABLE
- E. Section 11 86 01 - OVERBRIDGE DEVICE
- F. Section 11 86 02 - SOLID STATE FREQUENCY CONVERTER
- G. Section 11 86 04 - CABLE HOISTS
- H. Section 11 86 05 - GSE BATTERY CHARGERS
- I. Section 11 86 80 – AIRCRAFT VISUAL DOCKING GUIDANCE SYSTEMS
- J. Section 11 86 85 – RAMP INFORMATION DISPLAY SYSTEMS
- K. Section 23 74 13 – PACKAGED OUTDOOR CENTRAL-STATION AIR-HANDLING UNITS

1.3 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
 - 4. National Fire Protection Association (NFPA-415)
 - 5. Life Safety Code (NFPA-101)
 - 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
 - 12. American Society for Testing and Materials (ASTM)
 - 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
 - 21. Bolts—Standard ASTM-A307
 - 22. Bolts—High Strength SAE-J429 Grade 5 and 8
 - 23. IECC 2021, Section C408: Maintenance information and system commissioning
 - 24. DFW Design Criteria Manual
- B. In the event of conflict between a reference and another reference or this specification, request clarifications. All responses are final, and will be at no additional cost to the Owner.

1.4 DEFINITIONS

- A. The term "Owner", shall include the Owner, or his authorized representative.
- B. The term "Architect" shall refer to SmithgroupJJR/Corgan as defined in Division 1.
- C. The terms, "Seller", "Contractor", "Provider" and "Manufacturer" as referred to herein, are synonymous.
- D. 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.

1.5 SUBMITTALS

- A. Each PBB shall have a standalone submittal package.
 - 1. Fixed walkways, when present, shall be included in the associated PBB submittal under a separate tab/section.
 - 2. Gates will multiple PBB shall have a submittal for each bridge.
 - 3. Ancillary equipment (PCA, PWC, 400Hz, etc) for each PBB should be included in each passenger boarding bridge submittal with separate tabs/sections for each.
- B. Drawings, sketches, details, and materials shall be submitted in the English language, with United States Units, including dimensions, volumes, weights, and forces. The use of the metric or SI units is not acceptable.
- C. Delegated Design Submittals:
 - 1. Short circuit study & calculation
 - a. Upon completion of the installation of the PBB, a study shall be completed with the final "as built" information in coordination with the building electrical contractor for a complete evaluation up to the disconnect(s). Disconnects may include manufacturers panel, or external fused/non-fused disconnects as indicated in the design drawings.
 - 2. Arc Flash Analysis
 - a. Upon completion of the installation of the PBB, an analysis shall be completed with the final "as built" information in coordination with the building electrical contractor for a complete evaluation up to the disconnect(s). Disconnects may include manufacturers panel, or external fused/non-fused disconnects as indicated in the design drawings.
- D. Bid-Submittals: The following submittals shall be included with bid.
 - 1. NFPA 415 certificates and manufacturer's compliance statement per 1.12.C.9.
 - 2. 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.
 - 3. Proposed PBB models with manufacturer's standard cut sheets for proposed models.
 - 4. Foundation loads for each passenger boarding bridge model proposed.
 - 5. UL/ETL Certification per 1.06.C.

- E. 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
 - c) Plan drawings showing foundation locations and details. Any change to aircraft position(s) must be approved by the Owners Project Manager.
 - 2) Load Sheets for each bridge shall be provided
 - 3) 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) Floor cover edging details, including, lines of demarcation between floor cover material and hard surfaced floor at wall areas and treatment at doors and thresholds
 - 4) 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.
 - m) Horizontal
 - 5) 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.

- 6) Electrical:
 - a) Large electrical schematic drawings (11"x17" sheet size minimum).
 - 7) 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.
 - 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.
 - g. 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.
- F. 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.
- G. 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.
 - a. Provide two (2) bound copies, and three (3) electronic copies (external hard drive) 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.
 - 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.
- H. 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.
- I. Pre-Final Completion Submittals: The following submittals shall be submitted and approved prior to 14 days before final completion.
 - 1. As-Built Drawings. Provide field edited redlined project drawings showing deviations from design documents.
 - 2. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and have been registered with the manufacturer.
 - 3. Field Commissioning Report: A completed field commissioning report as specified herein. Utilize approved form.
 - 4. Training Rosters. Provide training roster with trainee names, dates and types of training, as well as durations.
 - 5. All original software packages and documentation, registered in the Owner's name.
 - 6. Hard copies as well as electronic (compact disk or flash card) copies of all final programs loaded into all machinery under this contract.
 - 7. Training external hard drives.

1.6 QUALITY ASSURANCE

- A. 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.
 - 1. NFPA Compliance:
 - a. Comply with applicable portions of NFPA 70 and NFPA 415 for components and completed and installed products.
 - 2. NEMA Compliance:
 - a. Motors, enclosures and electrical accessories shall comply with NEMA standards and be so rated.
 - 3. UL Compliance:
 - a. 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.

- B. 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.
- C. Qualified manufacturers and installers will have completed no less than five (5) jobs of similar size and scope within the last five (5) years.
- D. 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.
- E. 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.

1.7 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.

1.8 PROJECT/SITE CONDITIONS

- A. This is a new construction. It shall be the responsibility of the responding Contractor to verify all conditions and dimensions which pertain to this work.
- B. 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.

1. 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.
- C. 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.

1.9 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.

1.10 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 24 months from the date of substantial completion. Date of substantial completion 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, per Division 01 Specification Section 01 77 00.01 – Closeout Procedure- System Acceptance. 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.
1. Any equipment items or sub-systems requiring repair or replacement during the Owner's 30 day operational test specified in Section 3 of this specification will be provided a new warranty start date of the date that the item or subsystem was repaired or replaced.
- 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.

1.11 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 three (3) training sessions of eight (8) hours classroom instruction and eight (8) hours hands-on instruction for eight (8) personnel, and operator's training shall consist of a minimum of six (6) classes at two (2) hours duration each hands-on instruction for eight (8) 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 EXTRA MATERIALS TO BE SUPPLIED

- A. Towbar
 1. Manufacturer shall provide the Owner with one (1) Tow bar.
- B. Jackstand
 1. Manufacturer shall provide the Owner with one (1) A-Frame.
- C. Laptop
 1. Manufacturer shall provide the Owner with one (1) new laptop.
 2. Laptop shall be equipped with the necessary software and interconnecting cables for maintenance staff to interface and troubleshoot. Source code is not required.

PART 2 - Products

2.1 GENERAL

- A. The aircraft passenger boarding bridges covered by this specification 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.
- B. 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.
- C. As shown on the drawings and described in these specifications, the Passenger Boarding Bridge installation work will include the following major components:
 - 1. Fixed Walkway (if specified, or indicated on the project drawings)
 - 2. Passenger Boarding Bridge
 - a. Rotunda Entry Corridor
 - b. Rotunda
 - c. Ventilator
 - d. Telescoping Tunnels (2 or 3 tunnel as specified)
 - e. Dog Legs (Pantographs)
 - f. Horizontal Drive System
 - g. Vertical Drive System
 - h. Rotating Aircraft Cab with Operator Control Console
 - i. Canopy Closure to Aircraft
 - j. Automatic Leveling System
 - k. Service Door, Landing, Service Stair
 - l. Baggage Slide
 - m. Electric Baggage/Wheelchair Lift
 - n. A-tunnel HVAC duct
 - 3. Passenger Boarding Bridge Control System(s)
 - 4. Passenger Boarding Bridge Electrical System(s)
 - 5. Passenger Boarding Bridge Communication System(s)
 - 6. Equipment Interfacing with Passenger Boarding Bridge
 - a. Roof Top Mounted HVAC Unit
 - b. 400 Hertz Ground Power Unit (Point of Use)
 - c. Preconditioned Air Unit (Point of Use)
 - d. Potable Water Cabinet

2.2 MANUFACTURERS

- A. Passenger Boarding Bridges & Fixed Walkways

1. JBT AEROTech – FMC Jetway
2. TK Airport Solutions
3. Substitutions: as approved by engineer

B. Ancillary Equipment

1. P&W Quality Machine Inc.
2. PAGE
3. Substitutions: as approved by engineer

2.3 FIXED WALKWAY

- A. 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.
- B. The fixed walkway shall be designed, furnished, and installed so as not to impose any load on the terminal building.
- C. The contractor must provide all required supports and haunches for final support of existing walkways.
- D. Coordinate base plate with details as indicated on the construction documents. Field verify details prior to manufacture.
- E. Field verify all dimensions prior to manufacture.
- F. 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.
- G. Walkway design shall meet the same design requirements as the apron drive passenger loading bridges.
- H. Walkways shall be equipped with handrails, both sides, to match "A" tunnel rails.
- I. Exterior and interior construction and finish to match PBB tunnels.
- J. 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'.

2.4 PASSENGER BOARDING BRIDGE

A. Safety Provisions

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.
5. 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.
6. Positive mechanical stops shall be provided to prevent hazardous over-travel where any component might become disengaged from its guiding or restraining component.
7. 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.
8. 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.
9. 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.
10. The loading bridge shall conform to the requirements of the National Fire Protection Association (NFPA) "Standards of Construction and Protection of Aircraft Boarding Walkways," NFPA-415, latest edition.
 - 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.
11. 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.
12. 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.
13. The PBB shall comply with all applicable Life Safety Codes in effect at the time of manufacture.

B. 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 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. See other camera requirements in individual airline specification sections.
2. 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.
3. 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.
4. 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.
5. OSHA approved handrails will be installed atop the outer most tunnel section to provide fall protection to personnel working on drive motors, etc. The other 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.

6. Additional handrails, ladders, cages etcetera shall be provided as necessary to gain OSHA compliant and protected access to any roof located equipment requiring access. There shall be no need for maintenance personnel to utilize portable ladders or the like.
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 (i.e., electrical, or pneumatic).
12. Electrically operated lifting devices shall be equipped with brakes to lock the system in the event of power failure or malfunction.
13. Vertical drive units shall be equipped with a redundant safety locking device and/or safety brake to prevent the bridge from dropping in the event of a vertical drive system failure. The safety locking device shall be designed for a positive mechanical stop of the lifting system.
14. 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.
15. All stairs, ladders, scaffolds, platforms, and handrails shall comply with all applicable OSHA requirements.
16. 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 indicated 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.
17. All carpeting shall have edge strips to prevent fraying.

C. 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.

D. 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.

E. 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, preconditioned air equipment on the roof, and potable water cabinet on the side of the lift column 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.

F. Environmental Considerations

1. The bridge shall function satisfactorily and in accordance with these specifications under ambient temperatures from -25 degrees F to 120 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. Electro-mechanical drive systems shall have suitable protective coverings over motors, chains, sprockets, actuator arms, linear actuator arms, etcetera, to both protect operating personnel and passengers, as well as to protect the systems themselves from exposure to weather elements or traffic abuse.
6. 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.
7. 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.
8. 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.
9. All edges of marine grade plywood are to be sealed with an approved APA sealer prior to installation.

G. 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 bumpers 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.
17. All hydraulic components, if present, shall be provided with drip pans to prevent the dripping of hydraulic fluid onto the ramp.

H. Rotunda Entry Corridor

1. The minimum inside height of the entry corridor shall be 7 feet, 7 inches and the minimum inside width shall be 4 feet, 4.5 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.

I. 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 operational and ultimate swing limits shall include a position sensor located in the rotunda ceiling that shall be accessible from the rotunda interior and a physical limit switch mounted at the support column. The physical limit switch located on the support column shall be an ultimate limit, serving as backup to the operational limits defined by the position sensor. Together the sensor and limit switch shall provide three levels of safety for bridge swing (side-to-side) motion: 1) Approach: Bridge speed shall be reduced when within 1 to 2 degrees of the operational limit. 2) Operational Limit: Bridge motion shall be stopped when operation limits are reached. A Yellow warning Text message shall be displayed at the PBB controls informing the operator that an operation swing limit has been activated. Additionally an audible alarm shall sound while the bridge is at the limit and the Joystick is

- active. Motion in the opposite direction shall remain enabled. 3) Ultimate Limit: Bridge 3-phase power shall be disconnected and a red fault text message displayed at the PBB controls. Should the bridge pass through the operational swing limits, the ultimate swing limit shall trip and stop bridge motion. The ultimate limit switch shall be normally set 2 to 3 degrees past the point where the operational limits are set. Should the ultimate swing limit be reached, maintenance personnel will be required to move the bridge.
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.
 - a. A slat-type cab curtain shall be provided in accordance with the following specifications:
 - 1) Allow for the rotation of the cab 87.5-degrees to the left of and 87.5-degrees right of the boarding bridge tunnel center
 - 2) Protective cover installed over cab and rotunda curtains
 12. Threshold plates shall have chamfered edges to reduce tripping hazards.
 13. The rotunda shall be connected to the terminal building or fixed walkway using both interior and exterior flashing. Flexible exterior flashing material shall be installed between the rotunda and the terminal or fixed walkway. Metal flashing shall be used in the interior to cover any gaps between the rotunda and the terminal or fixed walkway.
 14. Slope, over-travel and operational swing limits shall be located on the rotunda assembly. Slope limits shall be adjusted to up to 10 percent (5.71 degrees) for both up and down slopes. This limit shall be adjustable to meet local operating conditions and requirements.
 15. The corridor interface between the rotunda and the terminal building shall have a minimum inside clear width of 4'-4.5" and a minimum clear height of 7'-7" for a minimum of 15 inches. The corridor design shall allow installation of flexible weather seals and floor threshold to the face of the building.
 16. Existing ground connections shall be reconnected after installation or relocation of all PBBs.
 17. Rotunda and support column configurations shall be available to permit rotunda floor heights as low as 3 feet 6 inches (1.07m) above the surface of the supporting foundation.

J. Telescoping Tunnels (2 or 3 tunnel as specified)

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 as follows:
 - 1) Minimum width, wall-to-wall 57.5 inches
 - 2) Minimum interior height 84 inches
 - 3) Minimum inter-tunnel ramp width 53.5 inches
 - 4) Minimum corridor width 52.0 inches

- c. All bridge/walkway sub-flooring shall be fully sealed, 3/4 inch thick, marine grade plywood or galvanized flat steel panels. Substitutes for marine grade plywood are not acceptable. All flooring shall be securely fastened with fasteners suitable for this purpose. Supplier shall insure that adjoining plywood sheets are supported and fastened to a common member to provide smooth, even joints. Steel panels shall be formed, welded and sealed. Sub-flooring is not required if a smooth metal floor surface is provided. The metal floor needs to be supported such that it prevents the washboard effect.
- d. The Jet bridge manufacturer will procure the flooring material. The product needs to be glued, (no peel and stick will be accepted) and shall be installed as outlined in the attached Scope of Work. Yellow "nosing" shall be installed on the leading edge of all transition ramps.
- e. Transition ramps with both fixed and hinged sloping sections shall accommodate the differences in floor elevations where telescoping tunnel sections overlap. Slope of the transition ramps shall not exceed 1:16 (3.6 degrees) relative to the tunnel floors. The fixed transition ramp sections shall comprise sloping floor areas within the tunnels to minimize the slope of the hinged transition ramp sections. Handrails shall be provided on both sides of the tunnels in the ramp areas. The handrails for the A-tunnel transition ramp fixed section shall be attached to the tunnel walls. The B-tunnel handrails shall be attached to the tunnel header.
- f. High pressure laminated wallboards with blacktrim shall be used.
- g. Insulation
 - 1) The ceiling shall be fully insulated to have a minimum average R value of 7.5.
 - 2) The tunnel wall shall be insulated to have a minimum average R value of 8.5.
- h. Flexible seals are to be used between the tunnel sections to provide a weather-tight seal preventing entry of blowing dust, rain, or snow.
- i. 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.
- j. The exterior sides of the boarding bridge shall be constructed of no less than 14 gauge flat steel panels. The Supplier shall detail panel specifications in the proposal. The tunnel sides are to allow for 100% insulation throughout.
- k. The exterior roof and sides shall be constructed of a minimum of 18 gauge steel panels. All tunnels shall have flat or crowned roofs that are designed to facilitate positive water drainage. Corrugated roofs will not be approved.
- l. Roof drainage and seals between tunnels shall be designed and constructed to prevent leakage of water runoff onto carpeted areas in the interior of the bridge. Special attention is required in the areas of hinge joints, telescoping tunnel sections, at the top and bottom of rotating portions (rotundas and cabs) and at canopies over aircraft doors.
- m. All external metal shall be a uniformly smooth surface and free of all mill scale, rust and dirt before painting. A primer coat of epoxy primer shall be applied followed by one finish coat. A total nominal minimum prime and paint thickness of four mils when dry is required.
- n. Electrical cable conveyance and management:
 - 1) The telescoping tunnels shall be equipped with an exterior electrical cable conveyance system. The cable system shall be accessible to maintenance personnel for inspection at all PBB positions and operating conditions. Access to the cable conveyance system shall not impede passenger traffic or bridge operation. The cable conveyance system shall be capable of supporting a combination of cables and hoses.

2. PBB Pre-Cool Plenum:

- a. Provide a minimum 60"Hx12"WX12"D dual wall insulated PBB precool 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.

K. Cable Carrier System

1. Dog Legs (Pantographs)

- a. 4" aluminum "dog legs" may be used. Separate "dog-legs" shall be provided for:
 - 1) PBB & ancillary equipment power cables.
 - 2) Data and communications, and hose routing.

2. Side Trolley

- a. The TK side trolley cable carrier may be used. The side trolley shall be provided for:
 - 1) PBB & ancillary equipment power cables.
 - 2) Data and communications, and hose routing.

L. Horizontal & Vertical Drive Systems

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.
7. Wheel/Tire assemblies shall be solid rubber tire tread on 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:
10. Electro Mechanical Drive
 - a. Horizontal Drive (Electro-Mechanical)
 - 1) The tires used on the horizontal drive wheels shall be solid elastomer, specially designed for PBB applications and rated for the applicable load.
 - 2) The horizontal drive system shall use AC gear motors with integral brakes. The AC motors shall be driven by solid state, variable frequency motor controllers for smooth variable speed proportional control operation. The AC drive system shall provide high efficiency, smooth performance, and good component availability. The individual variable frequency drive controller for each drive motor shall provide adjustable speeds from 0 to 90 feet per minute (27.4m/min), and be factory preset to a maximum 60 feet per minute

(18.3m/min). The controller shall be adjustable to provide optimum responsiveness to the horizontal controls. The controller shall provide built-in diagnostics to assist with trouble shooting.

- 3) A steer angle of 200° shall be possible both in place and in motion. The wheel carriage shall steer 110° to the left and 90° to the right of the centered position. Steering speed shall be adjustable between 16° and 42° per second. The steering rate shall be factory set at a maximum 23° per second. The horizontal drive wheel system shall be equipped with mechanical stops to prevent over steer. A wheel position potentiometer shall monitor rotational alignment with the bridge and provide operational steering limits before the mechanical hard stops are contacted. Wheel bogey position shall be indicated on the touch screen at the operator's console.
- 4) A dynamic braking system shall allow the PBB to come to smooth controlled stops. Integral spring-applied, electrically-released brakes shall be provided with each drive motor. The brakes lock the PBB in place when electrical power is disconnected, when the operator control stick is in the neutral position or when operating power is turned off at the PBB controls.
- 5) The horizontal drive motors shall be equipped with manual brake releases to allow the PBB to be towed in the event of power failure. Tow lugs shall be provided at the lower wheel frame. The manual brake release shall automatically reset and re-engage the motor brakes when the PBB drive is engaged.
- 6) Tire Manufacturer:
 - a) Low Profile Trelleborg Tires (solid tires)

b. Vertical Drive (Electro-Mechanical)

- 1) The lift mechanism shall consist of two (2) recirculating ball bearing screw assemblies. Each assembly shall be independent of the other, with individual motors, and be capable of supporting the bridge under full design load and raising and lowering the bridge at an approximate speed of 60 inches per minute +15% measured at the aircraft end of the PBB. The ball nut of this assembly shall be equipped with wiper brushes to remove grit or dirt from screw threads and a self-locking Acme type thread to prevent unit collapse in the event of a ball nut failure.
- 2) The vertical drive motors shall be fitted with spring-applied brakes that release only when electric power is applied and vertical motion, up or down, is signaled from the operator's console or the auto-leveler system.
- 3) The brakes shall hold securely at all elevations, without creeping, whether the bridge is in operation or not.
- 4) The fault detector circuit shall shut down the electrical power to the vertical drive motors and set the brakes independently of the operator. This shall occur if the bridge is in the vertical-operate mode and there is differential motion at the ball screws.

c. PBB's shall provide for "conventional steering" .

- 1) "Point & Go Steering" shall be selectable through a password protected maintenance screen.

11. HYDRAULIC DESIGN:

a. General

- 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 hydraulic reservoir (tank) shall have the capability of being electrically heated during severe weather conditions.
- 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.
 - 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.

b. Vertical Drive (For Hydraulically-Driven PBB)

- 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 pilot-operated check valves that prevent the bridge from descending in the event of fluid loss or other system failure. The hydraulic system 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 vertical lift column. The system shall not be damaged if the bridge is raised or lowered into the cylinder stops.

- c. PBB's shall provide for "conventional steering" as well as "point & go" steering. The PBB shall default to "point & go" steering, but mode shall be selectable through a password protected maintenance screen.

M. Rotating Aircraft Cab with Operator Control Console

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 suitable rated for the connected load.
 - 1) Provides smooth start/stop functions.
 - 2) Equip enclosure with heaters per environmental section.
2. Cab rotation assemblies shall be provided with sealed bearings or an accessible lubrication points and shall be included in the PBB preventative maintenance program.
3. Control console and operator visibility. The cab shall be equipped with a forward facing control console, with a laminated safety glass window providing full forward view of the aircraft interface. It shall be possible to operate the PBB without opening the cab weather doors. Additional visibility shall be provided for the operator by a wire glass window to the left of the operator, a window to the right, and by windows in the weather doors and a wire glass window in the service door. Wire glass vision panels shall be provided in the cab side-coiling curtains. The front window size shall be 31.5 X 24 inches (800mm x 610mm). The left window size shall be 30.5 X 10.5 inches (775mm x 267mm). The right window shall be 32 X 6 inches (813mm x 152mm).
4. The cab shall have sufficient windows to allow the operator to view the ramp area during operation.
5. Mirrors shall be provided to allow the operator full view of the horizontal
 - a. 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.

6. 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.
7. A slat-type cab curtain shall be provided in accordance with the following specifications:
 - a. Allow for the rotation of the cab 92-degrees to the left of and 35-degrees right of the boarding bridge tunnel center
 - b. Provide full visibility of the ramp area in the cab curtain through the use of wire reinforced glass windows of uniform size and shape throughout the curtain
 - c. Protective cover installed over cab and rotunda curtains
8. A closed circuit television system shall be provided complete with a 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.
9. 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.
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 cab except at windows and clear curtain slats.
12. The cab shall have weather proof doors to protect the interior of the bridge when it is not in operation. This door shall be located to the right of the operator's station and have the capability of being locked. This door shall be double inward swinging weather doors. The opening shall have a clear width of 43 inches and a minimum clear height of 7 feet 8.5 inches. The upper portion of each door shall be equipped with a 12 inches wide X 32 inches high (305mm x 812mm) safety glass window to enhance visibility 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.
 - 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.
13. The aircraft end of the cab floor shall be equipped with a full width aircraft spacer (bumper) 122 inches wide. 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. The bumper shall have a dead load strength of 500 lbs, a cold crack minimum of -40°F, and a flame resistance (max) of 2 second flameout. 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 bumper is to be designed to provide a replacement 18" of bumper material from the left-hand side of the bumper (i.e., with respect to the operator's perspective) with a 1" thick bumper material. This provides proper interface with the MD-80 aircraft. The PBB spacer material shall comply with NFPA 415, current edition, requirements.
 - a. Submit bumper details for approval.
14. Adjustable cab floor: The aircraft end of the cab shall be equipped with a cab floor that adjusts to level for various aircraft floor heights and bridge slope angles. The floor shall be

individually actuated and independently adjustable to adapt to aircraft doorsills. The adjustable cab floor shall level automatically and shall be equipped with a manual override control switch. The floor shall be capable of providing a level surface adjacent to the aircraft doorsill for PBB slopes from -10% to +10%. The automatic leveling system shall correct the floor to a slope not to exceed +2% (+1.2°) from level. The maximum slope of the cab floor shall be limited to plus or minus 6.5 degrees (11.4%).

15. 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. The cab floor walking surfaces shall be ribbed rubber.
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.

N. Console 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. The operator's console shall be Owners standard and meet the following specifications:
 - 1) Faceplate cover shall be made of a heat and scratch resistant material
 - 2) All labels shall be integrated into the cover material
 - 3) Non-removable type button faces shall be used
 - 4) Labeling shall be simplified and consistently placed above or below the switches - above if the control is a warning light or push button, below if the control is an on/off switch
 - 5) Labels are to be placed on all sides on multi-directional joystick or set buttons
 - 6) A four quad joystick providing forward, reverse and left and right steering is to be provided
 - 7) An intuitive display for jetbridge cab height
 - 8) The alarm speaker is to be mounted inside the console so the agents are unable to disable the speaker
- e. Smoke detectors in the PCA and Cab (or any other ancillary equipment with a smoke detector, ex. PCA) shall be wired to provide a single point back to the building fire alarm system. This alarm shall trigger a local alarm per airport standards.
- f. Power and control circuit switches or combined power/control circuit switch shall be key operated using a three position (i.e. OPERATE, OFF, AUTO) locking switch device, with a remove core as follows.
 - 1) Power-On Circuit and Control Circuit lock or combination shall be Best #1W6E2, US260

- 2) Operator's Console panel lock shall be Best # 7L6R14, US26D
- 3) One set of CORE keys are to be furnished by the supplier to the Owner prior to installation of Owners cores.
- 4) The operator must be able to remove the key from the switch when the switch is in either the OFF or AUTO position.
- g. The maintenance console shall be equipped to accept a Best Lock removable core.
- h. Control requirements shall include a Human Machine Interface (HMI) touchscreen.
 - 1) All control and display schemes shall be submitted for approval. See submittals section.

2. Indicators.

- a. The following indicators shall be labeled to indicate function and shall be located on the control panel.
 - 1) 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. See airline specific requirements.
 - 2) A wheel position indicator shall show the orientation of the wheels along with the true tunnel centerline, regardless of the cab's rotational position.
 - 3) An amber light to indicate that the auto level function is energized and operating.
 - 4) An auto level malfunction shall be indicated with a red light and shall be accompanied by an audible warning.
 - 5) A swing limit reached shall be indicated with a red light and shall be accompanied by an audible warning.
 - 6) 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.
 - 7) A red light shall indicate a lift column malfunction has occurred.
 - 8) A light shall indicate if the adjustable cab floor is in the automatic or manual mode.
 - 9) A red light shall indicate when the 400 Hz aircraft cable is deployed.
 - 10) An green light shall indicate when the 400 Hz SSFC or PCA units are operating, red shall indicate faults, amber shall indicate standby.
 - 11) 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.
 - 12) Any condition that causes an audible alarm shall be displayed.
 - 13) Video control monitor.
 - 14) Display requirements shall be met with a Human Machine Interface (HMI).
 - a) All control and display schemes shall be submitted for approval. See submittals section.

O. Canopy Closure to Aircraft

- 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 horizontal width of the canopy opening at the aircraft interface shall be at least 10 feet (3.05m).
7. 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.
 - a. The canopy fabric must conform to the following specifications:
 - 1) Color – See Finishes
 - 2) Base Material - Polyester
 - 3) Minimum Fabric Weight - 5.0 oz./SY
 - 4) Vinyl Coated - Minimum Finished Coated
 - 5) Material Weight - 24.0 oz./SY
 - 6) Tongue Tear Strength - 190/190 lbs
 - 7) Trapezoid Tear Strength - 50/60 lbs
 - 8) Grab Tensile Strength - 375/350 lbs/in
 - 9) Strip Tensile Strength - 300/275 lbs/in
 - 10) Adhesion (min.) - 10 lbs/in
 - 11) Hydrostatic Resistance - 500 psi
 - 12) Cold Crack Minimum - -40°F
 - 13) Flame Resistance (max) - 2 second flameout
 - 14) Lining - 2 inch foam
 - 15) NFPA-415 Certification - Yes
8. The canopy will be designed to provide a removable 18" long canopy pad from the lower left-hand side of the canopy (i.e., with respect to the operator's perspective). This provides proper interface with the MD-80 aircraft.
9. A metal canopy hood is to be installed to protect the canopy in the retracted position. At no time shall the hood come in contact with the aircraft.
10. Supplier is required to submit a sample of fabric and associated specifications with proposal.
11. 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.
12. Any exposed arms, struts, etcetera should be covered.

P. Automatic Leveling System

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. The system shall stop vertical travel and sound an audible alarm in the event the system does not neutralize within a pre-set adjustable distance (1 inch to 4 inches). The audible warning device will be installed at the console and at the rotunda, or walkway, whichever is closest to the terminal door. Provisions to allow an external audible device shall be made in case there are requirements to have the device at the gate counter.
4. 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.
5. The control circuitry shall include an adjustable 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 distinctively 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.
6. 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.
7. A remote audible alarm shall be located 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.

Q. Service Door, Landing, Service 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'-3" wide by 6'-7" 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 #4 finish, 16 gauge stainless steel cover plate with horizontal brush marks along with weather stripping on the jambs and header and a vertically adjustable bottom weatherstrip.
3. The door shall be equipped with an electronic keypad keyless lockset conforming to FAR 107.14 security requirements. Security system shall match airfield standard.
 - a. The door shall be equipped with electronic access conforming to FAR 107.14 security requirements.

- 1) Service door options:
 - a) 30 inch (762mm) high stainless steel kick plate shall cover the lower inside and/or outside portions of the door.
 - b) Door shall incorporate hold open devices to hold door open in high wind conditions and due to forces associated with a sloping bridge.
 - c) Maglock style doors shall be equipped with exterior pull handle and interior pushplate as necessary.
 - d) Equip door exterior with gutter or drip diverter for overhead condensation.
 - e) Equip with weatherproof exterior adjustable heavy duty door closer
 - f) Confirm all details with the tenants prior to manufacturing.
 4. The service stair shall be equipped with self-adjusting risers and open mesh steel treads made from galvanized steel channel sections with open serrated grating (similar to Grip Strut™) providing high-traction, high-drainage walking surfaces. All steps shall have an equal rise. The tread width shall be 28 inches (711mm) and the maximum tread depth shall be 9.5 inches (241mm). The length of the stair stringers shall be selected depending on the operational height range of the PBB. The service stair shall be protected on both sides by handrails compliant with OSHA standards. The entire service stair assembly shall be constructed from hot-dip galvanized steel. The service stair shall be accessible to ramp service personnel at all operational heights and positions of the PBB.
 5. A visual modesty shield shall be provided beneath the service stair landing. Design shall prevent the accumulation of rain or snow.
 6. A maintenance access ladder (with safety cage) along with full "C" tunnel roof safety railings and safety tie-off cables on "A" and "B" tunnels shall be provided. All safety systems shall comply with OSHA standards without limitations. All ladders, cages, and handrail assemblies shall be galvanized metal.
 7. PCA Units are mounted under of the "C" tunnel.
 8. Service stair and landing illumination. An exterior rated 60 watt incandescent light fixture shall be provided on the exterior of the PBB above the service stair and landing to illuminate the service access. The light shall be controlled by a light switch provided on the interior wall of the PBB adjacent to the service stair access door.
 9. Service landing illumination control options:
 10. A photo cell shall operate the service access light automatically during darkness, with an interior light switch that shall override the photo cell to shut off the light.
- R. Baggage Slide
1. New baggage slides are indicated on the drawings. Where indicated on the drawings, provide and install new baggage slides.
- S. Electric Baggage/Wheelchair Lift
1. New baggage lifts are indicated on the drawings. Where indicated on the drawings, provide and install new baggage lifts as indicated by the manufacturer instructions .
 2. All bridges shall have a dedicated power circuit with circuit breaker for wheelchair lifts. Single phase, 120V, 20A. Terminate in a junction box to be located under the cab of the PBB.
 3. Wheelchair lifts shall be interlocked with the PBB to prevent PBB horizontal motion anytime the lift is deployed. Display deployed status on operator's console.
- T. Potable Water Cabinets
1. A new potable water cabinet shall be provided by the manufacturer or passenger boarding bridge installer. This potable water cabinet shall be mounted to the left side lift column of the apron drive passenger boarding bridge.
 2. Refer to the potable water cabinet specification for the cabinet and hose requirements.

3. Passenger boarding bridge manufacturer disconnect enclosure shall provide a separate circuit breaker to supply power to the potable water cabinet
4. The passenger boarding bridge manufacturer shall provide a new mounting bracket that can be attached on the left side of the passenger boarding bridge adjacent to the lift column. This bracket shall be painted to match the color of the lift columns. The design and mounting requirements shall be the responsibility of the passenger boarding bridge manufacturer.
5. A potable water cabinet water hose shall be provided that can be routed from the potable water cabinet back to the building face for connection to the building plumbing system. This hose can be pre routed through the doglegs, or installed in the field.
6. The potable water cabinet shall be interlocked with the passenger boarding bridge to prevent the passenger boarding bridge from moving while the doors are open and the hose is extended.

2.5 CONTROLS

- A. 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:
1. With the PBB in the "Off" mode, all controls shall be inoperative.
 2. Spring-loaded wheel brake(s) shall be automatically set whenever controls for horizontal travel are not actuated by the operator. The drive system shall have provisions to manually release the brakes to permit towing of the unit in the event of a power failure.
 3. The vertical lift column safety stops are to be automatically engaged whenever controls for vertical travel are not actuated by the operator.
 4. With the 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.
 5. With the PBB in the "Operate" mode, the Auto-Leveler shall be retracted and become inoperative.
 6. The control circuits shall be designed and wired so that it is impossible to select opposite motions simultaneously, e.g., extend and retract or raise and lower travel.
 7. Two limit switches, one 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.
 8. Limit switches shall prevent movement of the bridge beyond specified Rotunda operating parameters as specified in these Specifications.
 9. A 6-inch diameter alarm bell located under the aircraft cab shall sound continuously whenever the bridge is in drive mode of operation.
 10. 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.
 11. 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.
 12. Vertical travel limit switches shall be provided to prevent travel of the vertical lift columns into the mechanical stops.
 13. Horizontal travel limit switches shall be provided to prevent travel of the tunnels into the mechanical stops.
 14. Cab rotation limit switches shall prevent over rotation (left or right) of the cab into mechanical stops.
 15. 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.
 16. Drive forward and cab rotate controls shall be locked out when canopy is down on the aircraft.

17. Forward or reverse "drive" controls are locked out by their respective extend or retract switches.
 18. 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.
 19. 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.
- B. The operator shall be able to pre-position the bridge to the approximate height of the aircraft serviced while raising or lowering the bridge in the manual mode. A vertical height indicator shall be provided.
- C. The control station or operator compartment shall be located at the aircraft end of the PBB. It provides the operator with a control console, service utilities, and control interlocks required for PBB operation. The control station shall be positioned on the left side of the cab and oriented to position the operator facing forward in full view of the aircraft during bridge operations. It provides the optimum PBB maneuvering visibility without obstructing passenger traffic flow. An operator of average height shall have an unobstructed view of the boarding bridge cab spacer to position it at the aircraft fuselage during bridge operations.
1. Control console: The control console shall be located at the control station in the operator compartment and shall be protected from the outside environment. The control console shall include a Graphical User Interface (GUI) touchscreen, joystick and pushbutton controls; and a cabinet containing the main programmable controller for the PBB plus terminal blocks, relays and related electrical components necessary for full, safe control of the PBB.
 2. Programmable Logic Controller (PLC): PBB functions and information systems shall be controlled using a Beckhoff Programmable Logic Controller (PLC). The PLC system used shall comply with IEC 61131
 3. Graphical User Interface (GUI): The control console shall include a Graphical User Interface (GUI) on a 10.4 inch (264mm) touchscreen graphical display that provides the operator with a means to login, control interfaces, bridge set up displays, maintenance and diagnostic information, wheel position information, fault/limit/status and warning messages and fault history as described in the following sections.
 4. Networking with gate equipment: The PLC shall be designed to allow Modbus TCP/IP networking of the boarding bridges and appropriately equipped ancillary equipment, such as pre-conditioned air (PCA) units and ground power units (GPU), to a common remote monitoring station using Ethernet protocols and appropriate hardware.
 5. Controls: All bridge major motion controls shall be momentary contact type pushbuttons or joystick located on the control console. All major motions shall only occur while a control is maintained in the active position ("deadman" functionality). All of the motion controls shall be designed to be relative to the function of the PBB being controlled. For example, "raise" push button shall be located above the "lower" push button.
 - a. Horizontal drive control: Bridge movement in the horizontal (forward/reverse propulsion and left/right steering) shall be controlled by a four-quadrant variable control stick (Joystick). Forward/reverse propulsion shall be controlled by fore/aft motion of the control stick and steering shall be controlled by right/left motion of the control stick. A wheel position indicator on the GUI shall display the direction of drive. Speed shall be proportionally controlled: as the control stick is moved progressively from the neutral position, wheel speed increases proportionally with the position of the control stick. The control stick shall have a momentary "dead man" type trigger that when depressed shall enable PBB horizontal motion after a 3-second delay. During the 3-second delay the travel warning bell at the horizontal drive shall sound

and an amber indication shall be displayed at the console to inform the operator to wait to drive. After the 3-second delay period is complete and the trigger remains depressed a green indicator on the console shall indicate that drive is enabled.

- b. Vertical drive control: Push button switches shall be provided that raise and lower the PBB.
- c. Cab rotation control: Push button switches shall be provided that for cab rotation, left or right, shall be available at the control console.
- d. Emergency stop: The control console shall be equipped with an illuminated red mushroom type push button switch for discontinuing all bridge movement in an emergency. Two additional illuminated emergency stop switches accessible to ground personnel shall be installed, one at the lower end of the left vertical drive column and one at the lower end of the service stairs.
- e. Closed-circuit TV (CCTV) monitor: A 5 inch (125mm) diagonal color monitor shall be mounted in the control console that continuously displays a camera image of the PBB horizontal drive wheels area. The CCTV camera shall be mounted at a location that provides a clear view of the wheels area.

D. 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.

2.6 OPERATION AND CONTROL LOGIC

- A. Operator log on and security: An Operator, Maintenance or Administration Password shall be required to access PBB operations or maintenance activities. An operator shall be required to log on at the GUI using a valid password to operate the PBB, to include enabling or disabling the automatic leveling mode. Passwords shall be used to control access to bridge functions, set up, maintenance and diagnostic screens and password maintenance. The PBB shall have three levels of passwords:

- 1. Level I – Operator Passwords. Up to forty-two (42) operator passwords shall allow access to all aircraft docking functions.
- 2. Level II – Maintenance Passwords. One (1) maintenance password shall allow access to all operator and maintenance/setup functions.
- 3. Level III – Administrative Password. One (1) administrative password shall allow access to all Level I and II functions plus allow the administrative user to view and edit passwords.
- 4. Operator log on options:
 - a. A three position, master key switch shall be used to select “OFF”, “OPERATE” or “AUTO” (automatic leveling) modes. The key may be removed only in the “OFF” or “AUTO” positions.
 - b. A three position, master switch with no key shall be used to select “OFF”, “OPERATE” or “AUTO” (automatic leveling) modes.
 - c. Both a keyed (or non-keyed) master selector switch plus operator log on shall be required to operate the PBB.
 - d. A card swipe system shall be used for operator log on. The customer must specify in detail the card swipe system to be used and its required input power and control interface.

- e. Both a keyed (or non-keyed) master selector switch plus a card swipe shall be required to operate the PBB.
- B. Log Off: To log off, the Operator shall touch the Logoff touch button on the GUI. This will return the GUI to the opening log on/password screen.
- C. PBB Operation Modes: The controls shall provide auto level, operate and logged off modes that shall be selected using touch buttons on the touchscreen.
 - 1. Auto Level: Selecting the "Auto Level Mode" touch button shall initiate the auto level sequence. The auto level arm extends toward the aircraft, and the system shall perform an automatic check (test nod) of the auto level system to verify that the aircraft sensor has made contact with the aircraft and that the auto level control system is functional. Upon completion of the verification process, a message shall be displayed indicating that the PBB is in "Auto Level Mode". When in auto level mode, the PBB shall allow only vertical travel; canopy, cab rotation and horizontal travel become inactive. In auto level mode, the PBB shall engage the auto level system and automatically follow the vertical movement of the parked aircraft. To exit auto level mode and return to manual mode, the operator must touch the auto level mode touch button and enter a valid password.
 - 2. Operate: Logging on using a valid password, or exit auto level mode using a valid password enables all bridge movements – extend/retract, vertical, floor movement, and cab rotation – provided there are no faults or activated limits. In operate mode, all bridge movement shall be initiated by the operator. The appropriate pushbuttons shall be lighted to indicate those functions available, and a message on the GUI panel shall be displayed indicating the PBB is in Operate Mode.
 - 3. Logged Off: The operator must touch the "Logoff" touch button to exit the Main Screen and return to the Log on Screen. All PBB functions except lighting shall be disabled.
- D. Languages: The operator shall be able to select one of the optional preprogrammed languages for display on the GUI. English shall be the standard default language, unless otherwise specified. Up to three (3) additional languages can be programmed into the PLC as options. Once a language has been selected, all messages shall be displayed in the selected language until a different language is selected on the log on screen.
- E. Cab Floor Adjustment: The cab floor of the PBB shall be both automatically and manually adjustable to align the floor level with the aircraft doorsill. Touch buttons on the GUI shall allow control of the cab floor to be toggled between the automatic and manual modes of operation. Text on the touch button shall display which mode is active.
 - 1. Upon selection of cab floor manual mode, two additional touch buttons become active enabling the manual movement of the cab floor up or down. Touching the Up button shall move the right side of the cab floor in the upward direction. Touching the Down button shall lower the right side of the cab floor. When the PBB is "Auto Level Mode", all cab floor movement shall be disabled and the touch buttons shall NOT be visible. The Cab Floor mode of operation previously selected when the auto level mode of operation was energized shall be reactivated when the auto level mode is deactivated.
- F. Canopy Closure Control: The bellows-type aircraft closure canopy shall be powered for extend and retract operation. The control console shall contain GUI touch buttons to control extension and retraction of the canopy.
 - 1. The aircraft canopy closure shall be capable of dual activation of both sides of the canopy simultaneously or independent activation of the right or left sides of the canopy in the up or down directions. A GUI touch button shall be provided to select either independent adjustment of the left and right sides of the aircraft closure or simultaneous operation of both sides. Canopy actuation shall be active only when the PBB is in Operate Mode. When

the PBB is in Auto Level Mode both canopy touch buttons shall be not visible. Therefore, the canopies must be deployed prior to entering auto level mode. The left and right side canopy actuator motors shall be independently controlled by limit switches that sense both the pressure against the aircraft, and operational range limits to provide positioning of the canopy to the aircraft and prevent over extension or retraction of the canopy closures.

- G. Floodlights Control: A GUI touch button shall be provided to allow control of the apron floodlights that shall be located on the underside of the PBB. These floodlights shall be positioned to illuminate the apron for a distance of approximately 10 m or 30 feet forward of the PBB, and around the wheel carriage area. Touching the Floodlight touch button will toggle the apron flood lighting on and off.
- H. Travel Bell Control: A momentary GUI touch button shall be provided to allow manual activation of the travel warning bell. When touched, the travel bell shall be activated until the button is released. (The travel warning bell sounds automatically while the PBB is moving and also during the three-second motion delay period.)
- I. More Controls" Button: A touch button labelled "More Controls" shall be available on the GUI to allow additional PBB features to be selected and controlled. These features may include selections such as floor heating, window heating, additional lighting and others dependent upon customer-selected options and features.
- J. Maintenance Button: A GUI touch button shall be provided that shall access maintenance functions available at the GUI. The maintenance touch button shall function only when a maintenance or administrative password has been entered during log on. The maintenance button shall provide access to:
 - 1. Calibration
 - 2. Limits Setup
 - 3. Options Selection
 - 4. Diagnostics
 - 5. Save and Restore Data
 - 6. Passwords (Administrative User Only)
 - 7. Warnings History
 - 8. Faults History
- K. Operational Indicators: The following indicators are displayed on the GUI in both auto level and manual modes.
 - 1. Vertical Height: The current vertical height of the PBB measured from ground level shall be measured and indicated. The measurement shall be displayed as a percentage between 0% (minimum height) and 100% (maximum height).
 - 2. Rotational Angle: The rotational angle of the bridge shall be displayed. The display identifies angular counterclockwise (left) rotation in positive (+) degrees, and clockwise (right) rotation in negative (-) degrees from the centerline axis in reference to a programmed zero position.
 - 3. Cab Rotation Angle: The cab rotation angle shall be measured and indicated. The zero data point shall be identified when the aircraft spacer shall be positioned perpendicular to the telescoping tunnel centerline. The display shall indicate counterclockwise (left) rotation in positive (+) degrees and clockwise (right) rotation in negative degrees from the centerline axis.
 - 4. Wheel Position Angle: The wheel position angle shall be measured and indicated. Zero degrees shall be identified when the drive wheels shall be positioned parallel to bridge telescoping tunnel centerline axis. The display will indicate counterclockwise (left) rotation in positive (+) degrees and clockwise (right) rotation in negative degrees from the centerline axis.

5. An amber indicator lamp and a text message on the GUI shall indicate the auto-leveling system is energized and functioning.
 6. A red indicator lamp and a text message on the GUI and an audible warning shall indicate the auto leveler sustained travel timer has activated, indicating an auto level failure alarm.
 7. An amber flashing indicator on the GUI to indicate the aircraft canopy is down. The canopy must be fully retracted before the PBB can be moved forward.
 8. A red indicator and a text message on the GUI and audible alarm indicate vertical drive column faults.
 9. Flashing Travel Beacons: A flashing amber beacon shall be mounted under the cab. The beacon shall indicate that power is on and the bridge may move at any moment. Two additional flashing amber beacons shall be provided, one mounted at the bottom end of each vertical lift column, that shall flash during the 3-second travel delay period and during PBB horizontal motion.
 10. Warning Bell: An audible warning bell shall be mounted under the bridge on the wheel carriage and shall ring (98 decibels at 10 feet (3.0m) when the bridge shall be moving horizontally and also during the 3-second travel delay period.
- L. GUI Message Display. The GUI shall provide status and fault information to the operator. Standard messages shall include the following:
1. Limit Messages: shall be displayed as yellow warning messages.
 2. Horizontal Extend Limit. Forward motion disabled.
 3. Horizontal Retract Limit. Reverse motion disabled.
 4. Vertical Up Limit reached. Drive PBB down.
 5. Vertical Down Limit reached. Drive PBB up.
 6. Cab Left Limit reached. Rotate cab right.
 7. Cab Right Limit reached. Rotate cab left.
 8. Left Swing Limit reached. Rotate PBB right.
 9. Right Swing Limit reached. Rotate PBB left.
 10. ACF Fault. Level floor manually.
 11. Main contactor not energized. Check interlocks and emergency stops.
 12. Limits Disabled. Use caution while driving the PBB with the Limits disabled.
 13. Slope Up Limit reached. Reverse and up motion disabled.
 14. Slope Down Limit reached. Reverse and down motion disabled.
 15. Slowdown Sensor Activated. PBB in Horizontal Slow-down. Speed reduced by ½.
 16. Main Contactor Disabled. To reset Main Contactor you must log OFF then ON.
 17. Fault Messages: shall be displayed as red fault messages.
 - a. Vertical Up Ultimate Limit. Call Maintenance.
 - b. Vertical Down Ultimate Limit. Call Maintenance.
 - c. Horizontal Extend Ultimate Limit. Retract bridge.
 - d. Horizontal Retract Ultimate. Extend bridge.
 - e. Cab Left Ultimate Limit. Rotate right.
 - f. Cab Right Ultimate Limit. Rotate left.
 - g. Inverter Fault. Log Off, Wait XX Seconds, Log back On. Call Maintenance.
 - h. Vertical Column Fault. Call Maintenance.
 - i. Swing Ultimate Limit. Call Maintenance.
 - j. Auto Level Failure. Reset Auto Level System. Call Maintenance.
 - k. Left Vertical Overload activated. Call Maintenance.
 - l. Right Vertical Overload activated. Call Maintenance.
 - m. Cab Position Sensor Failure. Call Maintenance.
 - n. Main Contactor Weld Fault. Press E-Stop and Call Maintenance.
 - o. Vertical Up Contactor Weld Fault. Call Maintenance.
 - p. Vertical Down Contactor Weld Fault. Call Maintenance.
 - q. Cab Left Contactor Weld Fault. Call Maintenance.
 - r. Cab Right Contactor Weld Fault. Call Maintenance.

- M. Control Features and Interlocks: The following control interlocks shall be provided.
1. Mechanical and logical interlocks shall be provided to prevent damage to control circuits or boarding bridge components by selecting opposite motions simultaneously. For example, depressing an "up" button prevents depressing a "down" button.
 2. When the operator selects the auto level mode, or logs off the control system, all basic bridge operational controls shall be inoperative.
 3. Basic functional logic of the PBB shall be programmed by the manufacturer. This logic resides in non-volatile memory.
 4. The software shall act upon PBB location sensor inputs and operator control inputs to provide valid PBB motions. If a conflict arises between operator inputs and sensor inputs, error routines shall be executed to display messages on the GUI, turn on warning lights, sound an alarm and/or stop the bridge as necessary.
 5. PBB motions that if unprotected could endanger personnel or cause damage to the PBB shall be protected by three levels of limits. First level limits shall provide a slowdown of PBB motion. The second level shall provide warning to the operator and motion interruption. Motions selected by the operator that do not conflict with current limits shall be allowed. Other motions shall be disabled. Information suggesting allowable motions shall be displayed for the operator on the GUI where applicable. A third level of limits shall prevent physical travel. The third level limit devices shall interrupt the main line input power to all bridge control circuits except lighting. The PLC shall monitor the limit fault and the error and operator instructions shall be displayed on the GUI. Maintenance personnel shall be required to resolve the fault and reset the PLC to allow further PBB operation.
 6. A motion-enabled interlock shall require that an operator must initiate any bridge movement by activating a control panel switch. Otherwise, power cannot be applied to the energizing circuitry. As a result, if the PLC should command the bridge to move by sending an erroneous signal, the bridge will not move until a control console switch has been activated as well. Both the PLC command and the motion enable circuitry shall be activated prior to bridge movement.
 7. A non-contact sensor shall slow the bridge horizontal motion as it approaches the aircraft when in operate mode.
 8. An interlock shall prevent the PBB from being driven forward when the aircraft closure canopy is deployed.

2.7 ELECTRICAL SYSTEM(S)

- A. A NEMA 4 (IP65) rated stainless steel heavy-duty electrical disconnect panel, mounted on the rotunda support column, shall provide electrical disconnects, overcurrent protection and transformers – if required - to adapt and distribute the specified, customer-provided 3-phase, 5-wire, 480/277 Volt supply power to the motor, lighting, and control circuits with thermal magnetic trip circuit breakers. The disconnect panel shall be equipped with an interior dead front door, accessible only with a tool or a key. A variety of power source options shall be accommodated where needed: for example either a single power feed or separate power feeds into the disconnect panel shall be accommodated.
1. The PBB main circuit breaker shall remove all power from all bridge circuits (exclusive of PCA & 400 Hz systems).
- B. PBB disconnect enclosure shall have SCCR rating of 35kA or greater.
- C. The passenger boarding bridge shall be capable of operating on an emergency power backed up source of 3-phase, 5-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.

- D. All circuit breakers shall be lockable in the "OFF" position.
- E. All primary disconnecting means shall be suitably rated to be capable of withstanding and interrupting fault currents available at the input.
- F. All standard lighting, duplex receptacles, and operator controls 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.
 - 1. All circuit breakers shall be lockable in the "OFF" position.
 - 2. All circuits and systems shall be protected by circuit breakers. Fuses will not be allowed.
- G. 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.
- H. All electrical components, which are exposed to the weather, shall be of a weatherproof type or housed in weather-tight NEMA 3R enclosures (or better), except for main power disconnect(s), which shall be a NEMA 4 stainless steel enclosure. Where dictated by the environment, electrical enclosures shall be equipped with heaters to control condensation.
- I. 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).
- J. All electrical components utilized shall be recognized by Underwriters Laboratories (UL) or an approved equal testing laboratory.
- K. Wiring and installation shall be in accordance with National Electric Code and applicable local electrical codes.
- L. 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.
- M. Receptacles
 - 1. Receptacles/receptacle circuits shall be protected with ground fault circuit interruption (GFCI) or a residual current circuit breaker (RCCB)
 - 2. Provide at least two (2) 120 volt, 60 Hz, 1-phase, 20 Amp, three conductor, U ground duplex receptacles inside bridge.
 - a. One shall be located in cab section
 - b. One shall be located in the vestibule-end near the terminal door.
 - 3. Provide a weatherproof 120-volt, 60 Hz, 1-phase, 20 Amp, three conductor, U ground duplex receptacle on the drive column of each bridge.
 - 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.
- N. Control console lid, wiring harness should be of sufficient length to allow the panel to be pulled out and turned over, facilitating repairs.
- O. 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.

- P. Grommets and suitable anti-chafe material shall be used where wires are required to pass through structure or other similar relief or opening which exposes the wire to possible chafing. All wiring shall be in conduit (preferably automotive split loom) or spot-tied and shall be routed away from possible pinch points. Wiring shall be adequately supported to protect it from damage due to ice and snow buildup, bumping, kinking, and flexing.
- Q. Quick disconnect fittings, where required, shall be UL or ETL approved.
- R. Lighting
1. All PBB lighting shall be LED type without ballasts.
 2. Interior Lighting
 - a. Interior lighting shall be activated by occupancy sensors when someone enters the cab, rotunda or walkway.
 - b. Interior lighting shall include the lighting in the walkways, tunnels, cab/bubble, and rotunda areas.
 - c. The level of illumination shall average 200 lux at the finished floor level with the weather door closed.
 - d. 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.
 - e. 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.
 - f. 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.
 - g. Walkway Lighting
 - 1) Shall match the interior lighting design requirements.
 - 2) For walkways greater than 10' in length, the lights shall be controlled with two 3-way switches. One shall be located at the exit end of the walkway, and one shall be adjacent to the terminal door.
 - 3) For walkways less than 10" one light switch adjacent to the terminal door will suffice.
 - 4)
 - h. 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.
 - i. 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.
 - j. 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.
 3. Exterior Lighting
 - a. 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.
 - b. 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.

- c. 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 a switch located on the inside wall of the tunnel adjacent to the door.
- S. Electrical interlocks shall be fail-safe design.
- T. 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.
- U. Electrical conductors or cables exposed to weather shall be suitably rated and UL approved.
- V. Flexible cables/conduits shall not exceed 24" except where relational motion is required. All cables and conduits shall be adequately supported.
- W. New PBB's shall be equipped with all miscellaneous power, data, control, etcetera cables/connectors as required by airline specifications.

2.8 COMMUNICATION SYSTEM(S)

- A. CAT 6 cables routed through the passenger boarding bridge cable carrier system shall meet the following minimum requirements:
 - 1. Rated for a minimum of 600V
 - 2. Rated for outdoor use with sunlight resistant jacket when any portion of the cable is not installed in conduit.
 - 3. Rated for High Flex applications
 - 4. Comply with ANSI/TIA-568.2-D Standard
- B. Wireless Access Points
 - 1. Refer to design drawings for quantity and type of cables.
- C. Fire Alarm:
 - 1. Provide stranded CAT6 cable for fire alarm interface.
 - 2. The fire alarm cable shall extend across the PBB and must have sufficient length at the rotunda end of the bridge to allow connection to the terminal building communications J box located on the building face near the passenger boarding door as indicated in project drawings. Provide and install terminations at the building face end of cable.
 - 3. Refer to the design drawings for quantity and type of cables.
- D. Security Cameras:
 - 1. Provide stranded CAT6 cable for security cameras.
 - 2. Refer to the design drawings for quantity and type of cables.
- E. ACAMS:
 - 1. Provide connectivity for ACAMS entry and exit at the service door in the cab of the PBB
 - 2. Separate 4"x4" boxes shall be installed for future card reader installation. One box shall be located inside the cab adjacent to the service door, and the other shall be located on the exterior of the cab adjacent to the service door.

3. The boxes shall be recessed for a flush mounting design, with covers installed that are designed for their uses (interior and exterior).
4. One conduit shall be route to each enclosure for future installation of ACAMS cabling back to the rotunda/terminal building. Provide pull strings in each conduit.
5. Refer to the design drawings for quantity and type of cables .

F. Telephone:

1. The bridge shall contain appropriate telephone communications equipment. The provisions shall include a flush mounted "J" box containing a 4-pair CAT-6 communication cable near the operator's position.
2. The communications cable shall extend across the PBB and must have sufficient length at the rotunda end of the bridge to allow connection to the terminal building communications J box located on the building face near the passenger boarding door as indicated in project drawings. Provide and install terminations at the building face end of cable.
3. 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.
4. Telephone will be provided by others.

G. Remote Monitoring

1. Each passenger boarding bridge shall be capable of being remotely monitored for status, alarms, usage rates, etc.
2. Remote monitoring of the passenger boarding bridge shall include ancillary equipment, including pre-conditioned air unit, ground power unit, etc.
3. Remote monitoring shall be provided via the existing Building Monitoring System (BMS), utilizing an industry standard, architect approved, open communications protocol such as Modbus or BACnet, and shall communicate via an Owner-provided building-located Ethernet infrastructure to an Owner-provided virtual server with a Windows Operating System (Server 2012 or later). The Owner-provided virtual server communicates with the BMS using Tridium Niagara. Bridge cabling shall be CAT-6 in conduit with RJ-45 connectors, by PBB manufacturer. Provide all fittings/connectors at building face as necessary. Test and certify bridge conductors and terminations.
4. Any additional service fees for remote monitoring software shall be clearly identified and submitted to the Owner or Owners representative for review and consideration.

H. Gate Management System

1. The PBB shall contain appropriate JBT iOPS, TKAS iGMS, or approved equal communications equipment, including media converters, hubs, switches, communications cabling, etcetera, as necessary to provide and install a complete PBB Gate Management System (GMS). Provide terminations at the PBB and at the network communications enclosure at the building face as necessary. The Gate Management System shall include the following:
 - a. A customized access-restricted dashboard screen with graphic and detail-level gate information showing real-time gate monitoring data to identify, manage, and resolve issues at any of the monitored gate components.
 - b. The dashboard-based screen shall show a graphical illustration of the selected gate with all data points visible in color-coded status. The dashboard-based screen shall present summary information related to each data point by selecting the data point.
 - c. The dashboard-based screen shall have a detailed component status to identify all applicable data points, alerts, warnings, faults, alarms, etc. associated with the gate in context.
 - d. The system shall be able to show trending information related to specific gate components. The system shall identify faults and their origin on any of the

component data points, and relay that information to the end user application in real-time by way of email, text or phone call or any combination.

- e. The system shall allow end-users to have access to any technical information captured from the system. The system shall provide operational data such as Mean Time Between Failures (MTBF), Mean Time to Recover (MTTR) and Service Availability for analytics and business intelligence purposes.
- f. The system shall provide sorting of data based on user preferences. The system shall provide the ability to search by date for all records in the alarm screen. The system shall provide the ability to extract Alarm Screen details to multiple formats including but not limited to CSV, PDF, XLS.
- g. The system shall maintain a log of all user activity including log-in/log-out information, time stamps, edited fields or records and query information for a period of up to three years.

I. Auto-Dock System

- 1. The PBB shall be equipped with all necessary hardware and software to facilitate fully automated docking and stowing of the PBB.
- 2. The auto-dock system shall be able to link to the existing VDGS unit and to the PBB CCTV system to identify the aircraft model, determine the aircraft door location and completely maneuver to the docked position.
- 3. The auto-dock system must be capable of docking the PBB to all aircraft types. The system must have all necessary safety systems to identify any ground personnel or obstructions prior to and during movement.

J. Owner Equipment Enclosure

- 1. The manufacturer shall provide a 12"x12"x6" NEMA 12 enclosure inside of the cab of each PBB, mounted above the service stair door.
- 2. Each enclosure shall be equipped with a duplex receptacle, with power supplied by a separate circuit breaker inside of the cab control cabinet.
- 3. Each enclosure shall have a 1" conduit pathway provided to it to allow for communications cables to be routed from the dog legs to this enclosure. One CAT6 cable shall be prewired to this enclosure at the factor, coiled for future use by the owner.

2.9 MAINTENANCE AND SET-UP SCREENS

- A. GUI maintenance and Set Up Screens: The PBB shall be designed to provide a quick method for programming the PLC to accept new operational parameters. The Maintenance / Setup Screens shall allow maintenance personnel to complete initial setup or adjustment of the PBB operational parameters directly using the GUI at the PBB control console without the use of additional programming devices or external computer. These screens provide for Preposition and Location Setup, Status Calibration, and initial Bridge Operational Limit Set Up.
- B. Calibrations and Set Up: The following PBB control calibrations and set up operations shall be possible at the GUI touchscreen. A maintenance or admin password shall be required to access these functions:
 - 1. Calibration:
 - a. Height Calibration
 - b. Cab Angle Calibration
 - c. Rotunda/Bridge Angle Calibration
 - d. Wheel Bogie Angle Calibration
 - e. Extension Calibration (optional)

2. Analog Limit Setup:
 - a. Vertical Up Limit Set
 - b. Vertical Down Limit Set
 - c. Cab Right Limit Set
 - d. Cab Left Limit Set
 - e. Swing Right Limit Set
 - f. Swing Left Limit Set
 - g. Extend Limit Set (optional)
 - h. Retract Limit Set (optional)
 3. Password Control:
 - a. Change Passwords (Admin password required)
 4. Adjustable Auto Level Timer (1.0 – 10.0 Seconds)
 5. Optional Features:
 - a. Pre-position Setup (optional): Set Pre-positioning Points
 - b. Others as required
- C. Prepositioning (optional): Prepositioning shall be easily programmed by local maintenance personnel without the use of ancillary programming devices. A maintenance person shall be required to log onto the PBB using a maintenance password. From the Maintenance Set-Up Screen located in the Setup Screen menu, the Preposition Setup Mode of Operation shall be selected. The PBB shall then be rotated, moved vertically, extended, and the cab rotated to the desired aircraft service position. Upon reaching the desired aircraft service position, one of the preposition setup buttons, labeled as specific aircraft types, shall be depressed to program the PLC with the required coordinates for that particular prepositioning location. No other programming shall be required.
- D. PBB Calibration: The Status Calibration screen shall be provided to accommodate input of critical data used in establishing operational parameters for a particular gate location during the initial PBB set-up operation. The calibration includes the following data:
1. Units (feet/meters) selection: A selection shall be provided to allow the linear measurements that shall be displayed on the main screen status display panel to be toggled providing linear measurement readout in either feet or meters.
 2. Height Calibration: This screen provides the ability to establish vertical data points that shall be used as the base for calculation for the vertical height measurements displayed on the screen.
 3. Wheel Bogie Calibration: This screen provide the ability to establish a zero or straight forward calibration point and 90° left calibration point used in determining wheel bogie position.
 4. Cab Calibration: This screen provide the ability to establish a zero or straight forward calibration point and 90° left calibration point used in determining Cab position.
 5. Bridge/Swing Calibration: This screen provide the ability to establish a zero calibration point and a second reference point used in determining Bridge/Swing position.
 6. Length Calibration: This screen provides the ability of setting up two length reference points used in determining Bridge Length.
- E. PBB Limits Set-Up.
1. PBB Height: This gives maintenance the ability of setting Vertical Up/ Down Height Limits anywhere within the operation Vertical range of the PBB with just the touch of a couple touch buttons.

2. Cab Rotation: This gives maintenance the ability of setting Cab Left/Right Limits anywhere within the operational Cab rotation range of the PBB with just the touch of a couple touch buttons.
 3. PBB/Swing Rotation: This gives maintenance the ability of setting PBB Rotation/Swing Left/Right Limits anywhere within the PBB Rotation/Swing operational range of the PBB with just the touch of a couple touch buttons.
 4. PBB Length (Optional): This gives maintenance the ability of setting a PBB Length Extend/Retract Limit anywhere within the Length operational range of the PBB with just the touch of a couple touch buttons.
- F. Password Maintenance. There are three password levels. Operator, Maintenance and Administration.
1. Operator: There are up to forty-two (42) operator passwords available. These passwords give the operator the ability to logon and operate the PBB in Manual and Auto level Mode with full rights to drive the PBB and select Auto level Mode once they are next to an aircraft. The alarm history screen and I/O diagnostic screens shall also be available to operators.
 2. Maintenance: This password gives the Maintenance person the ability of Operating and Configuring the PBB with all Calibration and Limit set-ups and all other configuration screens.
 3. Administration: This password gives the Administrator the ability to Operate, Set-Up and Maintain passwords on the PBB plus access to Alarm History Screen, I/O Diagnostic Screens and all other configuration screens.

2.10 IDENTIFICATIONS, MARKINGS, SIGNAGE & LABELING

- A. 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.
- B. 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.
- C. 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.
- D. Circuit breakers shall be labeled as to the circuit that they feed.
- E. Three Sided Illuminated Sign
1. Passenger Boarding Bridge Identification Signs shall be supplied by the manufacturer for each bridge identified in the construction documents.
 2. 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 hot dipped galvanized or aluminum-fabricated structure shall be painted to match the color of the passenger boarding bridge and shall 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 outdoor weatherproof detailing.

3. Gate signs shall be activated by a photocell. 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.
 4. Match airfield standard colors and fonts.
- F. Vinyl Gate No. decals shall be installed on the terminal side of all PBB wheel bogies.
1. Match airfield standard size, colors and fonts.
- G. Other Signage

2.11 FINISHES

- A. The exterior and exterior design shall be aesthetically pleasing and in keeping with contemporary trends. Where necessary to meet this requirement, and when not in conflict and maintainability standards, enclosures should be utilized to cover unsightly appurtenances.
- B. All interior and exterior systems shall be fitted and trimmed as necessary to present a neat and clean finished product.
- C. All finishes shall meet NFPA requirements.
- D. Interior
1. All interior surfaces of the structure shall be cleaned in accordance with SSPC-SP3 or sand/grit-blasted in accordance with SSPC-SP6, as appropriate, and shall be coated with 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.
 2. Interior Wall Treatment
 - a. Shall consist of floor to ceiling (or as noted) high pressure laminate wallboard, with black trim kick plates.
 - b. Paint all exposed interior metal surfaces to match interior wall panels, except brushed aluminum or bright finish work.
 - c. Color: Nevamar Platinum Gray S6023T, Textured
 3. Ceiling:
 - a. 8" metal plank with flat black recessed filler strips or coil coated galvanized steel panels shall be used as ceiling material. A suitable molding shall be provided along the longitudinal corners of the ceiling finish.
 - b. Color: Brushed Aluminum
 4. Flooring:
 - a. Tunnels:
 - 1) 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.
 - 2) Color:
 - 3) Type:
 - b. Transition Ramps:
 - 1) Ribbed rubber 0.1875 inch (4.8mm) thick
 - 2) Color: verify with owner

- 3) Type: verify with owner
 - c. Cab/Bubble
 - 1) 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.
 - 2) Ribbed rubber 0.1875 inch (4.8mm) thick
 - 3) Color: verify with owner
 - 4) Type: verify with owner
 - 5. Sub-floors
 - a. Shall be constructed of 3/4" fire retardant marine plywood which shall be securely fastened with fasteners suitable for this purpose. Ensure adjoining sheets are supported and fastened to a common member to provide smooth even joints. Any remaining unevenness will be removed with filler. The sub-floor fasteners will not protrude through the exterior tunnel siding.
 - b. Cab sub floors shall be aluminum.
 - c. Other sub-floors as required by floor covering manufacturers.
 - d. See flooring requirements.
 - 6. Cover Plates
 - a. All receptacles and light switch cover plates to be stainless steel, ANSI No. 4 finish.
- E. Exterior
- 1. All exterior surfaces, including support columns and base plates, shall be sand/grit blasted in accordance with specification SSPC-SP6 to a 1-1/2 mil minimum to 2 mil maximum profile.
 - 2. The exterior shall be coated with a rust inhibiting primer applied to a minimum of 4 mil total dry thickness over the average measured blast profile followed by a finish coat of 5-1/2 mil thickness catalyzed polyurethane enamel. The cured dry film thickness of the total system shall achieve a minimum of 8 mils.
 - a. Color: JBT Standard Arctic White
 - 3. All external metal shall be a uniformly smooth surface and free of all mill scale, rust and dirt before painting. A primer coat of epoxy primer shall be applied followed by one finish coat. A total nominal minimum prime and paint thickness of four mils when dry is required.
 - a. Color: Arctic White
 - 4. Anodized aluminum, galvanized or stainless steel trim items, roll-up doors, and cab curtains shall be supplied in their original unpainted bright finish. Machined surfaces shall not be painted unless they are exposed after assembly.
 - a. Dog Legs (Pantagraphs)
 - b. Service Stair & Platform
 - 5. Canopy
 - a. Color: Light Grey
 - 6. Electrical Enclosures
 - a. Stainless Steel (Manufacturers Disconnect)

2.12 Materials, Parts and Processes

- A. 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.
- B. 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.
- C. All parts and materials needed to fabricate, assemble, and finish the equipment shall be furnished by the manufacturer unless otherwise specified.
- D. All bolted, screwed, and threaded fastenings shall incorporate adequate locking devices. Safety wire shall be incorporated in critical applications.
- E. 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.
- F. Specified sections and weld design and application shall be such that heat distortion of plates and members is minimized in the final weldment.
- G. 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. Caulk shall not be used to provide weather seals.
- H. 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.
- I. 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:
 - 1. Mechanical Components: Speed, torque, force, environment, lubrication means, and expected service life of chains, belts, sheaves, sprockets, shafts, bearings, gears, etc.
 - 2. Electrical Components: Voltage, current, load characteristics, and duty cycle of electrical components.
 - 3. Others: For components proprietary to the manufacturer, design shall conform to established industry practices.
- J. Fastener heads shall not be located on rub or wear surfaces unless recessed below the surface.

2.13 Maintainability

- A. The bridge shall be designed to emphasize simplicity, ruggedness, and ease of maintenance. There shall be no special tools required for routine maintenance.
- B. Attention shall be given to the design of each component and assembly to minimize the number of routine maintenance items on the bridge.
- C. Components shall be selected and assemblies shall be designed to facilitate troubleshooting and to minimize repair or replacement time.

- D. Access panels enclosing areas requiring maintenance shall be large enough to permit accomplishment of the task required.
- E. Where practical, components shall be built in subassemblies for ease of replacement and shall be designed to be installed or removed by one person.
- F. Where the weight of a component requires mechanical assistance, the component shall be provided with lifting eyes or other suitable hoisting arrangement.
- G. 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.
- H. All parts having the same manufacturer's part number shall be directly and completely interchangeable with each other with respect to installation and performance.
- I. 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.
- J. 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.

2.14 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.

2.15 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.

PART 3 - EXECUTION

3.1 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.

3.2 INSTALLATION

- A. Install in accordance with Manufacturer instructions.
- B. 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.
- C. PBB Mechanical Erection and Lifting
 - 1. Use of Heavy Equipment
 - a. The use of crane(s), forklifts, 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 exceed 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 operators 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.

D. 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. The installing contractor shall be responsible for mounting the PBB Disconnect Power Panels on the rotunda located mounting brackets.
- b. The installing contractor shall be responsible for providing all PBB terminations to the disconnect panel, and shall coordinate his installation with the Project electrical contractor. Electrical contractor shall provide final building utility terminations to the PBB main disconnect panel.
- c. All cables/conductors shall be neatly color coded and marked.
- d. All original manufacturer rating and labels shall remain intact and unmarred.
- e. All enclosures shall be securely fastened to the stand using approved Manufacturer provided fasteners.
- f. All PBB power cables shall be verified to be in new condition. Damaged cables shall be replaced with OEM cables provided by the Manufacturer.
- g. 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.
- h. All power cables, wiring, and utilities installed the across the exterior "A" and "B" tunnels shall be installed in the utility carrier.

- i. All power cables, wiring and utilities installed across the exterior of the outermost tunnel, shall be contained in conduit and shall be installed on the underside of the bridge.
 - j. Conduits shall be attached to the PBBs using secure clamps or shall utilize bolted or welded mounting brackets.
 - k. All wire/cable terminations shall end neatly in PBB mounted junction boxes.
- 3. Cable Hoist(s)
 - a. The installing contractor shall mount the cable hoist(s) with Manufacturer provided provisions, and shall inspect and verify proper operation.
- 4. The hoist housing shall be securely mounted. All mounting bolts shall be inspected and replaced where missing or damaged.
- 5. Any damage to the cable hoist exterior finish shall be re-painted in accordance with the "Exterior Finishes" section of this scope.
- 6. Up/down limit switches shall be fully functional and shall cutoff control motor operation when the cable is fully deployed or retrieved.
- 7. The three output cable support hooks (sling) are to be in good working condition and shall remain detachable from the aircraft cable. Hoist up/down control is accomplished from an exterior operator control station mounted on the PBB wheel bogie.

3.3 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.
- 2. PBB Lubrication
 - a. Ensure that all grease fittings are functional and that grease points have been properly purged of old grease material and foreign material by displacing old material with new material.
 - b. Perform all other OEM recommended lubrication of moveable areas throughout the PBBs. Only OEM approved lubricants shall be utilized. Chains containing old grease and/or foreign debris shall be fully degreased and re-lubricated. All residual grease and oil displaced or drained onto the PBBs shall be thoroughly cleaned. Lubrication shall include, but shall not necessarily be limited to, the following:
 - 1) Rotunda thrust bearing.
 - 2) Wheel bogey thrust bearing.
 - 3) Lift column screws.
 - 4) Cab rotational guide chain.
- 3. Door Locks and Keys
 - a. Set proper stations code, as defined by stations personnel for service stair door.
 - b. Turn over all keys to stations personnel.

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 (480Volt) 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.
5. 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.
 - a. Rotunda mounted slope limits shall be set to prevent operational PBB slopes from exceeding 10.0 percent.
 - b. Tunnel travel limits ("full extend/retract" and "slow down") shall be set to safely meet each gate's operating requirements.
 - c. Oversteer limits for the wheel bogie assembly shall ensure that oversteer conditions cannot be encountered.
 - d. 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.
 - e. Ensure that the cab rotation limits are functional and that the cab cannot exceed safe rotations.
6. 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 interior lighting function properly with occupancy sensors.
 - f. Ensure that all other electrical systems, including all travel alarms, operation bell, indicator lights, and warning beacons or strobes are functioning properly.
 - g. Test smoke detector interlocks to ensure they are functioning as designed.

3.4 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.
 6. The manufacturer shall provide a qualified representative on site for at least 30 days after the date the terminal is opened for commercial passenger traffic to assist with operational issues and electromechanical difficulties encountered.
- 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 term "Beneficial Acceptance" shall be defined as the time that the bridge is installed and available for The Owner use, but prior to the correction of items listed on discrepancy list. In other words, The Owner derives the 'benefits' of using the system prior to "Final Design Acceptance". Warranty and training requirements shall be based on "Beneficial Acceptance".
- D. "Final Design Acceptance" of the unit is contingent upon the Manufacturer satisfactorily correcting all items that the Owner believes to be non-complying with this specification.
- E. After the "Manufacturer" corrects all discrepancies identified during the initial operational demonstration, and after the gate opens for commercial operations, a 30 day test period under normal operating conditions will commence. During this time frame, the bridge must operate trouble free and the "Manufacturer" must demonstrate that the bridge meets the design and performance requirements of this specification. The Owner will have the option of restarting the 30 day test if at any time during the test, additional non-complying specification discrepancies or faults are detected.
- F. Final acceptance of the boarding bridge is contingent upon the Manufacturer satisfactorily correcting all items that the Owner believes to be non-complying with this specification, and the satisfactory completion of the 30 day operational demonstration.
- G. 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.

3.5 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. Install phone, provide building face terminations and verify proper operation.

3.6 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.

3.7 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.

3.8 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. All other items listed on the approved Field Commissioning Report.
- B. Demonstrate complete functional operation of equipment to the satisfaction of the Owner.

END OF SECTION 11 85 04