ATTACHMENT “A”

Steel Apron Drive Passenger Boarding Bridge

- PLC Controlled
- Electro-Mechanical
PLC CONTROLLED
APRON DRIVE PASSENGER BOARDING BRIDGE
ELECTRO MECHANICAL

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SPECIFICATION
CORRUGATED, PLC CONTROLLED
APRON DRIVE PASSENGER BOARDING BRIDGE

A. GENERAL

This specification describes the corrugated walled; Programmable Logic Controller (PLC) controlled, Apron Drive Passenger Boarding Bridge with standard equipment.

The Apron Drive Passenger Boarding Bridges (hereafter referred to as PBB) covered by this specification shall be designed to extend from a terminal departure lounge doorway to the aircraft boarding door. The design shall enable passengers to walk between the terminal and the aircraft in a protected environment. The complete assembly shall be protected against inclement weather conditions, both when sealed against an aircraft and when parked with the weather door closed.

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

The bridge shall consist of the following components:

- Fixed Walkway (if required)
- Rotunda Entry Corridor
- Rotunda
- Telescoping Tunnels (2 or 3 as required)
- Vertical and Horizontal Drive Column Assembly
- Rotating Aircraft Cab
- Automatic Leveling Device
- Service Door, Landing and Service Stair
- Canopy Closure to Aircraft

The aircraft passenger loading bridge shall include the following options:


2. Emergency Lighting: Battery powered emergency lights are provided above the tunnel ramps and in the cab. These lights are separately wired and will stay on in the event of a power outage.

3. Lighted Mushroom Button: The emergency stop pushbutton is lit when depressed.

4. PLC Controls
5. Console Floodlight: A floodlight is mounted above and to the left of the console to increase illumination of the control console. The floodlight switch is located on the console.

6. Closed Circuit TV Surveillance (CCTV): This includes a 5" (127 mm) diagonal monitor showing the apron area near the drive wheels. The image is sent by a rotunda mounted camera.

7. Heavy Duty Hardware on Service Door.


9. Maintenance Ladder with Cage: Ladder to mount onto the landing side of the largest tunnel. This enables maintenance personnel to climb from the landing up to the top of the tunnel and cab for maintenance reasons. The top of the ladder has a safety cage. The ladder and cage shall be galvanized.

10. Roof Handrails: Handrails on the roof of the largest tunnel are provided in the Vertical Drive area. This protects maintenance personnel from falls while servicing the Vertical Drives. Handrails are non removable and have no swing gates. The handrail shall be galvanized.

11. Telephone provisions

12. Rotating Amber Strobe Light

13. Gate Sign: Provide 3 sided photocell controlled gate sign with proper gate number. Color, type, and location to be approved by HAS. This is a 24" (610 mm) three sided gate sign with 360° visibility. The gate numbers are 24" (610 mm) high and the gate number, letter, color, and background lens are specified by HAS. The gate sign is highly visible to approaching aircraft from any angle at a distance. The gate sign is lit for visibility at night.


15. Bridge Cool console controls.

16. Full "A" Tunnel Right Side and Left Side Handrail: A Smooth, continuous aluminum handrail is provided along the right and left sides of the "A" tunnel. This option is not available in the "B" or "C" tunnels.

17. Transition Ramp Covering: Black ribbed rubber minimum 1/4" (6.4 mm) thick shall be supplied as the ramp covering.

18. Carpet: Provide and factory install carpet in the tunnels and rotunda area of the passenger boarding bridge.


20. 737 Spacer Cut Out: A small cutout on the PBB cab spacer is provided to miss the pitot tube on 737 aircraft.
21. Canopy Hood
22. 2 Quadrant Joystick
23. Minimum 1/2 Inch roof insulation
24. Aircraft Closure Cab Rotate Interlock: This prevents the cab from being rotated either right or left while the aircraft closure is deployed. This does not prevent the PBB from being driven in reverse.
25. Solid Tires
27. Ventilator: A minimum 1500 cfm ventilator is mounted on the cab bubble roof which exhausts hot air from the PBB. The damper is gravity operated. The exhaust fan control is console operated.
28. 400Hz Interlock
29. PCA Interlock
30. Simplex Unican 1000-1, or COH approved equal service door lockset. This is a five button Combination lock with interior and exterior door knob and removable core.
31. Cab Floor De-icer: This heats the cab floor to melt any accumulation of ice and snow. The on/off switch is mounted on the console. The de-icer is self-regulating when on. This option includes a 1/4" (6.4 mm) aluminum plate floor. This material will not absorb moisture or rot. The aluminum plate is covered with the standard ribbed rubber floor covering.

**B. DETAILED DESCRIPTION**

1. **The Rotunda Assembly**

The Rotunda assembly shall be made up of a corridor, rotunda, and support column. The assembly shall be designed so that no loads or vibrations shall be transmitted to the building.

The rotunda assembly shall be designed as the terminal-end pivot for the PBB’s vertical and horizontal motion. As the main pivot for the PBB, the rotunda assembly allows the PBB to swing a total of 175 degrees, 87-1/2 degrees clockwise and 87-1/2 degrees counterclockwise from the corridor centerline.

Slope, over-travel, and operational swing limits shall be located on the rotunda assembly. Slope limits shall be adjustable up to 10% (5.71°) for both up and down slopes. This limit shall be adjustable to meet local operating conditions and requirements.

The ultimate over-travel swing limit switch shall be located on the support column. This shall be an ultimate limit, serving as backup to the operational limits. The trip plate for the ultimate limit switch shall be located on the rotunda and shall be adjustable to meet local conditions. When the switch is actuated, all control power is cut off. When the switch is tripped, the PBB can only be moved by
Maintenance Personnel using the by-pass switch in the control console.

The rotunda frame shall be equipped with rubber-bumper-type, mechanical stops to prevent over-retraction of the telescoping tunnel sections.

The operational swing limit shall be a potentiometer located in the rotunda ceiling and shall be accessible from inside. It serves to provide three levels of safety for bridge swing (side-to-side) motion:
1. Text messages activate at the operator console as swing limits are reached.
2. Audible alarms sound at the operator console as ultimate swing limits are reached.
3. Bridge motion is stopped when operational or ultimate swing limits are reached.

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.

a. The Corridor: The corridor shall be the interface between the rotunda and the terminal building or fixed passageway. The inside clear width of the corridor shall be a minimum 1334 mm or 4 ft. 4-1/2 inches. The clear height shall be a minimum 2311 mm or 7 ft. 7 in.

The design of the corridor shall accommodate installation of flexible exterior weather seals and interior metal flashing and floor thresholds.

b. The Rotunda: The rotunda floor remains stationary and level at all times and provides a smooth transition between the terminal and telescoping tunnels. Flap type seals provide weather protection between the rotunda and the hinged telescoping tunnel section.

c. The Support Column: The support column shall be the structural support for the PBB. The support column rests on a foundation that shall be supplied by others. The support column shall be custom built to meet specific site conditions. There shall be limited adjustment for height once the column shall be built. The standard anchor bolt pattern for the Apron Drive PBB shall be pattern #7.

Proposer must field verify terminal floor height prior to manufacturing support columns.

An electrical disconnect panel, mounted on the rotunda support column, provides the electrical disconnects, transformers – if required, and circuit breakers, as required, to adapt and distribute the specified, customer-provided 3 phase supply power to the various PBB electrical systems. The disconnect panel’s heavy duty, stainless steel enclosure shall be a NEMA 4X (IP65) rated enclosure. The disconnect panel shall be equipped with an interior dead front door, accessible only with a tool or a key. This panel shall allow for the addition of multiple ancillary equipment options, such as PC Air and 400 Hertz, in a variety of power source options. It shall be possible, for instance, to provide a single power feed or separate power feeders into the disconnect panel.

2. The Telescoping Tunnels

a. The telescoping tunnels, A (smallest), B (mid-size on three tunnel PBBs, largest on two tunnel PBBs) and C (largest, three tunnel PBB only), shall be rectangular in cross section. Bridges shall be available in 2 tunnel or 3 tunnel configurations. The tunnels with the largest cross section shall be closest to the aircraft. The tunnel walls shall be constructed of a minimum 14 gauge steel corrugated plate.
b. Transition ramps shall accommodate the difference in elevation where telescoping tunnel sections overlap. The tunnel floor shall slope as it approaches the transition ramps to minimize the slope of the transition ramps. The transition ramps shall have a slope, with respect to the tunnel centerline, of approximately 3 degrees. Handrails shall be provided on both sides of the tunnel transition ramps.

c. Minimum interior clear dimensions for both A2 and A3 PBBs shall be as follows:

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<th>Dimension</th>
<th>Minimum Value</th>
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<tr>
<td>Minimum Floor Width</td>
<td>1473 mm or 4' - 10&quot;</td>
</tr>
<tr>
<td>Minimum Interior Height</td>
<td>2134 mm or 7' - 0&quot;</td>
</tr>
<tr>
<td>Minimum Inter-tunnel Ramp Width</td>
<td>1422 mm or 4' - 8&quot;</td>
</tr>
<tr>
<td>Minimum Corridor Width</td>
<td>1334 mm or 4' - 4 ½&quot;</td>
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d. The telescoping tunnels shall be equipped with an exterior under-the-bridge-mounted electrical cable conveyance system. The cable system shall be accessible to maintenance personnel for inspection or cable changes at all bridge positions and operating conditions. Access to the cable conveyance system shall not impede passenger traffic or bridge operation. The cable conveyance system shall be capable of supporting a combination of cables and hoses. The system shall be capable of supporting a cross-sectional area totaling 7742 square mm or 12 square inches, which shall consist of 2 each 3871 square mm or 6 square inch areas.

The system shall be capable of supporting a combination of cables and hoses totaling 17.86 kg/m or 12 pounds per foot.

3. The Service Access

A service door, landing, and stair leading to the apron shall constitute the service access. The service access shall be located on the right hand side of the cab end of the PBB to provide access between the PBB bridgehead and apron for authorized personnel

a. The service door shall be steel, half wire-glass, hollow core, and meet or exceed the ¾ hour fire rating per ASTM E152. The minimum door shall be 762mm or 2 feet 6 inches wide and 2032 mm or 6 feet 8 inches high. The door shall be equipped with medium-duty commercial-type hardware and automatic door closure. The door opens outward onto the landing.

b. The service stair landing shall be parallel to the adjacent tunnel floor. It shall be made of hot dipped galvanized steel, open mesh grating. The landing shall be protected on the open sides by galvanized steel handrails which shall be designed to meet OSHA standards.

c. The service stair shall be equipped with self-adjusting risers and open mesh steel treads. All steps shall have an equal rise. The tread width shall be 711mm or 28 inches and the maximum tread depth shall be 241 mm or 9-1/2 inches. The service stair shall be protected on each side by handrails which shall be designed to meet OSHA standards. The entire service stair assembly shall be constructed from galvanized steel. The service stair shall be accessible to ramp service personnel at all operational heights and positions of the PBB.

d. 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 photo cell controlled.
4. The Control Station

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.

a. The control console shall be located in the operator compartment and shall be protected from the outside environment.

The control console shall contain a Human Machine Interface (HMI) consisting of a graphical display providing the operator with control interfaces, bridge set up displays, maintenance / diagnostic information, wheel position information, and fault / limit / status messages as described in the following sections. PBB functions and information systems shall be controlled using a Programmable Logic Controller (PLC). The PLC system used shall comply with IEC 1131.

The PLC shall be designed to allow networking of the boarding bridges and appropriately equipped ancillary equipment, such as pre-conditioned air units and 400 Hertz converters, to a common remote monitoring station using Ethernet protocols and appropriate hardware.

The operator shall be able to select one of the optional preprogrammed languages for display on the HMI. 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 the current operating session is logged off. At log on, the default language shall return to the screen.

b. Security. An Operator Key shall be required to access PBB operations or maintenance activities. Passwords, such as a maintenance password, shall be used to control access to bridge functions, set ups, maintenance and diagnostic screens. Other security and access options are available.

c. Controls: All bridge motion controls shall be momentary, contact-type (deadman) pushbuttons or joystick. All of the motion controls shall be designed to be relative to the function of the PBB being controlled, i.e., raise and lower functions, the “raise” push button will be located above the “lower” push button.

i. Operator Key Switch: A three position, master key switch shall be used to select “OFF”, “OPERATE” or “AUTO” (automatic leveling). The key may be removed only in the “OFF” or “AUTO” positions.

ii. Joystick: A lever arm or “joystick” controls horizontal motions: extend / retract and left / right. As the control stick is moved progressively from the neutral position, bridge speed increases proportionally with the position of the joystick.

An interlock prevents the PBB from being driven forward when the aircraft closure shall be deployed.

iii. Manual Floor Adjustment: Push button switches for raising and lowering the cab end of the PBB.
iv. Cab Rotate: Push button switches for cab rotation, left or right

v. Canopy Closure: Push buttons for independent adjustment of the left and right side of the bellows-type aircraft closure.

vi. Emergency Stop: An emergency push button switch for discontinuing all bridge operations. This button shall be labeled “Stop”.

5. Control Interfaces and Indicators

An Operator Key shall control the PBB operating mode. The three modes available from the Operator Key shall be “Auto” for Autolevel Mode, “Manual or Operate” for manual operation, and “Off” to discontinue bridge operations.

a. Autolevel: Turning the Operator Key to “Auto” shall initiate the autolevel sequence. The Autolevel arm extends toward the aircraft, and the system performs an automatic check of the Autolevel to verify that the aircraft sensor has made contact with the aircraft and that the Autolevel control system is functional. Upon completion of the verification process, a message shall be displayed indicating that the PBB is in Autolevel Mode.

When in the autolevel mode, the PBB shall be allowed only vertical travel. In autolevel mode, the PBB shall automatically follow the vertical movement of the parked aircraft.

To exit autolevel mode, the Key Switch shall be turned to the Off position or to Manual Mode.

Upon activation of the autolevel mode, the canopy, cab rotation and horizontal travel become inactive.

b. Manual Mode: Turning the Operator Key Switch to the Manual / Operate position enables all bridge movements – extend/retract, vertical, floor movement, and cab rotation – provided there are no faults or tripped limits. In the 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 HMI panel shall be displayed indicating the PBB is in Operate Mode.

An infrared sensor shall slow the bridge as it approaches the aircraft when in operate mode.

c. Off Mode: All PBB functions shall be disabled in the off mode, except lighting.

d. Cab Floor Auto/Manual: Depressing the Cab Floor Auto Manual button shall allow control of the cab floor to be toggled between the automatic and manual modes of operation. Indicator lights shall display which mode is active.

Upon selection of manual mode, two additional pushbuttons 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 up direction. Touching the Down button shall lower the right side of the cab floor.

When the Operator Key is in the Auto Level position, all cab floor movement shall be disabled. The Cab Floor mode of operation that was selected when the Auto Level mode of operation was energized shall be reactivated when the Auto Level mode is deactivated.
e. Canopy Actuation: The aircraft canopy closure shall be activated by depressing the Canopy Up or Down buttons. Canopy actuation shall be active only in Manual Mode. Therefore, the canopies must be deployed prior to entering autolevel 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.

f. Floodlights: A console button shall be provided to allow control of the three 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. Pushing the Floodlight button will toggle the apron flood lighting on and off.

g. Travel Bell: A momentary console 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 when the PBB moving.)

h. Options: An Options button shall be available on the HMI to allow additional PBB features to be selected. These features may include selections such as floor heating, window heating, additional lighting, etc., and shall be dependent upon customer-selected options.

i. Indicators: The following indicators are present in both autolevel and manual operator key switch modes.

   i.  Vertical Height: The current vertical height of the aircraft measured from apron or ground level. The measurement shall be displayed in feet or meters depending on customer preference.

   ii. Rotational Angle: The rotational angle of the bridge shall be displayed. The zero data point shall be identified when the tunnel centerline shall be positioned parallel to the rotunda corridor centerline. The display identifies angular counterclockwise (left) rotation in positive (+) degrees, and clockwise (right) rotation in negative degrees from the centerline axis.

   iii. Cab Rotation Angle: 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.

   iv. Wheel Position Angle: Zero degrees shall be identified when wheel carriage 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.

   NOTE: There are other indicators not located on the control console. These indicators are as follows:

   v. Flashing Travel Beacon: A flashing amber strobe light shall be mounted under the cab. The light indicates that power shall be on and the bridge may move at any moment.

   vi. Warning Bell: An audible warning bell shall be mounted under the bridge on the
wheel carriage and rings a minimum of (98 decibels at 10 ft. {3048mm}) when the bridge shall be moving horizontally.

j. The HMI Message Display: The HMI provides status and fault information to the operator. Standard HMI messages include the following:

ACF Floor Fault. Level Floor Manually
Autolevel Failure. Turn Key to OPERATE to reset
Cab Left Contactor Weld Fault. Call Maintenance
Cab Left Limit Reached. Rotate Cab Right
Cab Left Ultimate Activated. Call Maintenance
Cab Pot Failure. Call Maintenance
Cab Right Contactor Weld Fault. Call Maintenance
Cab Right Limit Reached. Rotate Cab Left
Cab Right Ultimate Activated. Call Maintenance
Docking Interlock – Please Wait (option sensitive message)
Extend Limit Reached. Retract Bridge
Extend Ultimate Limit Activated. Call Maintenance
Inverter Fault. Call Maintenance
Main Contactor Weld Fault. Call Maintenance
Retract Limit Reached. Extend Bridge

**Retract Ultimate Limit Activated. Call Maintenance**
Slope Down Limit Reached. Extend or Elevate Bridge
Slope Up Limit Reached. Extend or Lower Bridge
Swing Left Limit Reached. Drive Bridge Right
Swing Right Limit Reached. Drive Bridge Left
Swing Ultimate Limit Reached. Call Maintenance
Vertical Down Limit Reached. Elevate Bridge
Vertical Down Ultimate Limit Contacted. Call Maintenance
Vertical Down Contact Weld Fault. Call Maintenance
Vertical Drive Left Overload. Call Maintenance
Vertical Drive Right Overload. Call Maintenance
Vertical Rack. Call Maintenance
Vertical Up Contact Weld Fault. Call Maintenance
Vertical Up Limit Reached. Lower Bridge
Vertical Up Ultimate Limit Reached. Call Maintenance
Wing Root Contacted. Elevate Bridge

HMI Calibrations (Maintenance Password Required for Access)

Height Calibration
Extension Calibration
Wheel Bogie Angle Calibration
Vertical Up Limit Set
Vertical Down Limit Set
Cab Right Limit Set
Cab Left Limit Set
Swing Right Limit Set
Swing Left Limit Set
Extend Limit Set
Retract Limit Set
Change Password

The PBB shall be equipped with an infrared proximity sensor to automatically stop the PBB when it approaches within 2 meters or 6 feet of an aircraft while in the Pre-position mode of operation.

Final docking (approximately 3m to 4m or 10 to 12 feet of travel directly toward the aircraft door) with the aircraft shall be completed manually with the joystick controller.

I. Other Control Console Indicators

i. An amber light indicates the auto-leveling system shall be energized and functioning.

ii. A red light and audible warning indicates the autoleveler sustained travel timer has tripped.

iii. A red light indicates the aircraft canopy shall be down. The canopy must be fully retracted before the PBB can be moved forward.

iv. A message on the HMI and alarm indicate vertical drive column faults.

6. The Maintenance and Set-Up Screens

a. HMI Screens: The PBB shall be designed to provide a quick method for programming the PLC to accept new operational parameters. The Maintenance / Set-up Screens shall allow maintenance personnel to complete initial set-up or reprogramming of the PBB operational parameters directly from the PBB control console without the use of additional programming devices. These screens provide for Preposition and Location Set up, Status Calibration, and initial Bridge Operational Limit Set Up.

b. Status 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:

i. Feet/Meter 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 either a Feet or Meter linear measurement read-out.

ii. Calibrate Height: The Calibrate Height sub-screen provides the ability to establish a vertical data point that shall be used as the base for calculation of the vertical height measurements displayed on the screen. Upon selection of this sub-screen, the operator must position the PBB to a level height. The vertical height between the apron and top of cab spacer shall then be physically measured and the data input into the PLC using the touch keys of the HMI panel.

iii. Bridge Limit Set-up: The Bridge Limit Set-up sub-screen shall be used to establish the specific gate operational limits of PBB movement. These limits include cab rotate right, cab rotate left, bridge swing left, bridge swing right, bridge extension, bridge retraction, vertical up, and vertical down limits. Moving the PBB to the desired limit of travel and touching the appropriate touch key completes the setup of each of these limits.
c. Log Off: To log off, the Operator Key shall be turned to the OFF position or push the OFF button on the HMI. This will return the HMI to the opening logon screen.

7. The Utilities

a. A high speed communication / networking cable consisting of 3 bundles of 4 pair each category five, 24 gauge communications cable shall be provided.

b. Utility outlets (unswitched 120 volt, 1 phase, 15 amp) shall be located on left wall of the cab, adjacent to the operator’s control console and in the rotunda corridor. An additional 15 amp GFI duplex outlet shall be provided on the drive column wheel carriage cross beam where it shall be accessible to maintenance personnel at ground level.

8. Control Features and Interlocks

a. 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.

b. When the operator selects the Auto Level mode, or Logs Off the control system, all basic bridge operational controls shall be inoperative.

c. Basic functional logic of the PBB shall be programmed by the manufacturer. This logic resides in non-volatile memory.

The software acts 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 HMI, turn on warning lights, sound an alarm and/or stop the bridge as necessary.

PBB motions shall be protected by two levels of limits. First level limits 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 HMI.

A second level of limits prevents physical travel that may damage the PBB or endanger personnel. The limit devices interrupt the main line input power to all bridge control circuits except lighting. The PLC monitors the limit fault. The error and instructions shall be displayed on the HMI. Maintenance personnel shall be required to resolve the fault and reset the PLC to allow further PBB operation.

A motion-enable 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.

9. The Aircraft Cab

a. The aircraft cab shall be designed to rotate 125 degrees. Rotation shall be 92-1/2 degrees counterclockwise and 32-1/2 degrees clockwise from the tunnel centerline.
b. The cab shall rotate at a speed of 145 degrees per minute (2.41°/sec). Limit switches and physical stops shall control the rotation limits.

c. The cab shall be equipped with a forward facing control console. The console shall be located behind a laminated safety glass window. Operation of the PBB can be accomplished without opening the cab weathering door. Additional visibility shall be obtained through the wire glass vision panels in the cab side-coiling-doors and windows located in front, left and right of the operator. The front window size shall be approximately 813 mm x 610 mm or 2’8” x 2’. The left window size shall be approximately 279 mm x 775 mm or 11” x 30-1/2”. The right window shall be approximately 813 mm x 152 mm or 2’8” x 6”.

d. Double swinging weather doors shall be installed on the right side of the operators control console to secure the PBB from unauthorized access, and seal the interior of the PBB from adverse weather conditions when the door shall be closed. The minimum clear width of the weather door shall be 1101 mm or 43 3/8 inches, and the minimum door height shall be 2349mm or 7 foot 8 ½ inches. The upper portion of each door shall be equipped with a safety glass window approximately 305 mm x 812 mm or 1 foot 0 inches wide x 2 foot 8” inches high.

e. A full width spacer shall be located at the aircraft end of the cab floor. The spacer material, which meets the fire protection specifications of NFPA-415-1997, shall be sufficiently flexible and non-abrasive to prevent scratching or other damage to the aircraft fuselage.

f. The aircraft end of the cab shall be equipped with a cab floor that adjusts to level for various aircraft floor heights. The floor shall be individually actuated and independently adjustable to adapt to all narrow-body or larger aircraft doorsills. It shall be designed to 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%. No portion of the cab floor shall exceed 8.33% slope in the direction of expected passenger traffic. The automatic leveling system corrects the floor to a slope not to exceed 0.5% (0.3°) after a threshold slope not to exceed 2% (1.2°) has been reached.

g. A double hinge floor shall be included in the system to provide a smooth transition between the level floor and the tunnel section. The transition floor provides a smooth platform.

The maximum slope of the floor shall be limited to plus or minus 6.5 degrees (11.4% or 1:8.78). There shall be no raised surfaces, which may introduce a tripping hazard to the passenger. Adjacent surfaces shall be at the same level regardless of the position of the cab floor or the PBB.

h. Two exterior floodlights shall be provided to illuminate the apron directly ahead of the PBB. A floodlight shall be provided to illuminate the drive column wheel carriage. This light shall be located under the tunnel section.

i. A weatherproof fluorescent fixture shall be provided outside the cab swinging weather door to illuminate the cab-aircraft interface.

10. The Aircraft Closure

The aircraft end of the cab shall be equipped with a folding bellows type aircraft closure. The closure, when fitted against the fuselage, shall surround both the open aircraft door and the doorway to protect passengers from the elements. The closure shall be designed to accommodate the special door
requirements associated with A-300 type aircraft doors. The closure fabric will not absorb water, shall be highly tear resistant and remain flexible from -31 degrees F (-35 degrees C.) to 127 degrees F (52.8 degrees C.).

a. Each side of the aircraft closure shall be independently actuated to seal against aircraft contours.

b. Pressure sensitive switches shall be incorporated into the closure mechanism to prevent excessive pressure on the aircraft.

c. The contacting seal shall be a soft material to prevent scratching or damage to the aircraft skin. The seals that contact the aircraft shall be segmented and attached to the main closure assembly with Velcro type fastener strips for easy replacement.

11. Automatic Leveling

The PBB shall be equipped with an automatic leveling system. This system allows the PBB to follow the aircraft elevation changes that occur during aircraft loading and unloading. The auto leveling system functions with equal reliability for all aircraft contours. The autoleveler shall be located on the right side of the cab. The autoleveler shall be in full view of the operator at the control console. The autoleveler shall be engaged when the master key switch shall be positioned to “AUTO”.

a. The auto-leveler circuit includes a sustained travel timer. The timer limits autolevel operation to a maximum of six seconds; however, the timer shall be adjustable to accommodate a variable operational range of 1.6 to 6 seconds before a fault condition shall be identified. A fault condition shall be assumed if the operation exceeds the set time limit. Upon sensing of a fault condition, all motor power shall be disconnected and audible and visual alarms shall be energized.

b. The main autolevel sensing switch shall be activated upon a 15-degree auto level wheel rotation.

12. The Drive Column

The drive column provides the vertical and horizontal motion for the PBB. The drive column and control systems shall be designed for smooth, quiet operation. The vertical and horizontal movements can both be operated at the same time.

The drive column shall be divided into two major components: Vertical Drive and Horizontal Drive.

a. Vertical Drive: The PBB shall be moved vertically by means of two recirculation ball bearing screw assemblies. Vertical travel speed is approximately 1097 mm or 3.6 feet per minute.

i. Each assembly shall be independent. Each independent assembly shall be capable of supporting the PBB under full design load. The design shall provide 100% redundancy.

ii. The ballscrew ball nut shall be equipped with wiper brushes to remove grit or dirt from the screw threads.

iii. The ballscrew ball nut shall be equipped with a special thread profile designed to be
self-locking. This feature will support the PBB in the absence of the standard recirculating ball bearings.

iv. The vertical drive motors shall be AC induction motors with integral reducer and brake. The brakes shall be spring applied and electrically released. The brakes hold securely at all elevations whenever electrical power is not applied.

v. A fault detector senses differential motion of the ball screw assemblies. The detector disconnects electrical power from the vertical drive motors if a fault detected.

b. Horizontal Drive: A variable speed, electro-mechanical drive system provides horizontal travel.

i. The solid tires shall be used on the horizontal drive system.

ii. The AC horizontal drive system uses AC gear motors with integral brakes. The AC motors shall be driven by solid state, variable frequency motor controllers. The AC drive system shall provide high efficiency, smooth performance, and good component availability. The controller provides a variable frequency signal to provide adjustable speeds from 0 to 27.4 m or 90 feet per minute. The controller can be adjusted to provide optimum responsiveness to the horizontal controls. The controller provides built in diagnostics to assist with trouble shooting.

iii. A steer angle of 180° shall be possible in place and in motion. Steering speed shall be adjustable between 16° and 42° per second. However, the steering rate shall be factory set at 23° per second.

iv. A regenerative braking system shall be used allowing 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. This shall occur when the joystick is in the neutral position or when normal operating power shall be discontinued.

v. The horizontal drive motors shall be equipped with manual brake releases. These allow the PBB to be towed in the event of power failure. Tow lugs shall be a component of the lower wheel frame.

vi. The horizontal drive wheel system shall be equipped with mechanical stops to prevent over steer. A wheel position potentiometer monitors rotational alignment with the bridge and provides operational wheel bogey limits. Wheel bogie position shall be indicated on the HMI.

13. Interior Finishes

The interior finish of the PBB shall be designed to be durable and easy to clean

a. The ceiling shall be made of plank type panels. Each plank shall be approximately 184 mm or 7 ¼ inches wide with a 19 mm or ¾ inch accent between adjacent planks. The planks run perpendicular to the tunnel centerline and continuously from wall to wall. The planks shall be manufactured from a minimum .51 mm or 020 inch thick brushed aluminum finish. Planks located at the ends of light fixtures shall be painted black to match the fixtures.
b. The interior light fixtures shall be designed to be the same width as the plank. The fixtures shall be recessed and blend with the ceiling design.

c. Tunnel and rotunda interior lighting shall be provided by High Output, Energy Saving, Cool White, Single Lamp, Fluorescent Light Fixtures that are powered by instant start electronic ballast's that provide a 1.0 ballast factor. The average light intensity at the floor is 18 foot candles (194 lux). Please note that lighting intensity levels vary significantly with changes in interior color designs. The measurements noted above are based on an interior design that incorporates white wallboard with light colored carpeting and white ceiling.

d. Three-way interior lighting control switches shall be provided at the ingress and egress points of the PBB with one switch located in the rotunda, and one on the wall near the service door at the aircraft end of the PBB. These switches control all interior tunnel, bubble, rotunda and cab floor light fixtures.

e. The aluminum corner molding that finishes the ends of the ceiling plank and the top edge of the wall panels shall be black to match the interior light fixtures.

f. Insulation in the ceiling shall be a minimum of 12.7 mm or ½ inch, black, fire resistant fiberglass.

g. The sub floor in the cab and bubble shall be 19 mm or ¾ inch marine grade plywood, which shall be highly resistant to moisture and moisture damage. The sub floor in the remainder of the bridge shall be a minimum of 19 mm or ¾ inch thick American Plywood Association rated STURD-I-FLOOR Exposure 1. Exposure 1 panels shall be highly moisture resistant. Exposure 1 panels shall be made with exterior phenolic resin adhesive.

h. Ribbed rubber, approximately 6 mm or ¼ inch thick, shall be applied to the floor from the aircraft end of the PBB to the terminal side of the service door.

i. PBB interior floor coverings shall be furnished by the supplier and installed in the factory at the time of manufacture.

j. The tunnel interior wall shall consist of floor-to-ceiling, melamine and plastic wall panels. The panels shall be approximately 1219 mm or 4 ft. on center and shall be supported by clear anodized aluminum trim with a black accent strip. The design allows each panel to be removed individually. The wall structure shall result in an average thermal resistance of 2.6 Ft²oF/BTU (4.5 m²oC/W).

k. The walls of the rotunda pivoting section shall be constructed using a series of a minimum 63.5 mm or 2.5 inch wide, formed galvanized steel slats that shall be connected together to develop a coiling curtain assembly.

l. Wall treatment in the cab pivoting section shall be galvanized steel slats.

m. Interior surfaces and trim exposed to passenger flow shall be painted to meet the customer defined interior color scheme per the following process:

Non Exposed Surfaces:

Surface Preparation
All contaminants shall be removed from the surface in accordance with SSPC-SP1 (Solvent Wipe) requirements and commentaries.

The surface shall be then cleaned in accordance with SSPC SP-3 (Mechanical Cleaning) requirements.

Primer:

One coat of Sherwin-Williams rust inhibitive, “Chromate Free” Kem Aqua 70P (Grey E61A570) primer, or COH approved equal shall be applied at a dry film thickness of 1.1 mils (27 microns).

Interior Exposed Surfaces:

Surface Preparation:

All contaminants shall be removed from the surface in accordance with SPC-SP1 (Solvent Wipe) requirements and commentaries.

The surface shall be then cleaned in accordance with SSPC SP-3 (Mechanical Cleaning) requirement to obtain a 1-4 mil profile. The cab surface shall be dry abrasive blast cleaned in accordance with SSPC-SP 6 (Commercial Blast Cleaning) to obtain a blast profile of 1-4 mils (25-100 microns).

Primer Coat:

One coat of Sherwin-Williams High Build “Chromate Free” Epoxy primer E65AC8/E65RC5, or COH approved equal shall be applied over the prepared surface to a dry film thickness of 2-5 mils (50-125 microns).

Finish Coat:

One single color finish coat of Sherwin-William “Polane H” pigmented Polyurethane, or COH approved equal shall be applied over the primer coat at a dry film thickness of 2-3 mils (50-75 microns). The color shall be selected by the customer.

Roller Flange Protection:

The structural steel flange bars that shall be exposed to roller loading shall be coated with soft graphite impregnated paint. This process produces a roller interface surface that resists cracking and peeling, and absorbs the roller loads while maintaining the corrosion protection and aesthetic appearance of the PBB.

14. Exterior Finishes

All exterior steel surfaces shall be protected from corrosion by the following processes:

Surface Preparation:

All contaminants shall be removed from the surface in accordance with SSPC-SP1
(Solvent Wipe) requirements and commentaries.

The surface shall be then dry abrasive blast cleaned in accordance with SSPC SP-6 (Commercial Blast Cleaning) requirement to obtain a 1-3 mil profile.

Primer:

One coat of Sherwin-Williams High Build Chromate Free Epoxy Primer E65 AC81/E65RC5, or COH approved equal shall be applied over the prepared surface to a dry film thickness of 3-17 mils (75-425 microns).

Finish Coat:

One single color finish coat of Sherwin-William Polane (aliphatic) high solids, catalyzed, pigmented Polyurethane, or COH approved equal shall be applied over the primer coat at a dry film thickness of 2-3 mils (50-75 microns). The color shall be selected by the customer.

The total exterior finish will provide a minimum dry film thickness of 6 mils (150 microns).

16. Miscellaneous Parts

Surface Preparation

All surfaces shall be dry abrasive blast cleaned in accordance with SSPC SP-6 to obtain a .5 - 1.5 mil (12-38 micron) profile.

Finish Coat:

One coat of Morton International Corvel Zinc Rich, Grey Epoxy Powder 13-7004 baked at 350 deg. F for 35 minutes to obtain a dry film thickness of 3-5 mils (75-100 microns), or COH approved equal

C. Design Criteria

The PBB shall be designed in accordance with good engineering practices and the standards developed and adopted by the passenger boarding bridge industry. Particular attention shall be given to keeping components simple, rugged and easily accessible for routine maintenance, including lubrication, component exchange and ease of adjustment.

All access panels and openings shall be sized to accommodate the component being changed or adjusted, as well as the equipment and personnel necessary to accomplish the work.

1. Structural Loads

a. The PBB will support the following loads. 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. In addition to the dead loads and strain caused by movement, the entire PBB will support:

i. Live load of 40 lbs per sq ft (195 kg/sq M)
ii. A wind load of: Retracted and stowed -- 25 lbs per sq ft (122 kg per sq M), or an approximate wind velocity of 98 mph (158 km per hr). An operational wind load of 12.5 lbs per sq ft (61 kg per sq M) or an approximate wind velocity of 70 mph (113 km per hr).

iii. A roof load of 25 lbs per sq ft (122 kg per sq M).

iv. The structural design provides sufficient torsional rigidity to avoid excessive sway when the PBB shall be brought to a gradual stop.

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

2. Environmental Considerations

a. The PBB will operate satisfactorily under ambient temperature conditions of -25 degrees F (-32 degrees C) to 125 degrees F (52 degrees C), with wind up to 60 mph (97 kph).

b. All components and materials shall be individually and collectively designed or selected for long service life under such conditions.

3. Power Characteristics

a. The PBB operates on 480 volts, 3 phase, 60 amps, 60 Hz “Y” configuration with neutral and separate ground (5 wire). The 480 VAC shall be transformed to 120/230 VAC for lighting and controls. Please note that other voltages found throughout the world can be accommodated.

4. Codes and Regulations

The PBB shall be designed to meet U.S. Codes and Regulations, which have been adopted by the passenger boarding bridge industry.

a. Structural


American Welding Society (AWS) Standards.

Structural Design and Corrugated Steel Panels based on Van Karmon Theory and on buckling studies by Peterson and Card.

b. Material

Structural Steel ASTM-A36
Structural Tube and Shapes ASTM-A500
Steel Pipe ASTM-A53
Steel Sheet ASTM-A570
c. Mechanical: All mechanical components and designs conform to the recommendations and standards established by the Society of Automotive Engineers (SAE) and the American Society of Mechanical Engineers (ASME).

d. Fire Protection: The PBB meets the requirements of the National Fire Protection Association (NFPA) and is listed for compliance with the "Standard on Construction and Protection of Aircraft Loading Walkways", NFPA-415-2002 by ETL, a Nationally Recognized Testing Laboratory (NRTL).

e. Electrical: All equipment and methods of installation conform, where applicable, to the requirements and recommendations of the National Electrical Manufacturers Association (NEMA) and the National Electrical Code (NEC) latest issue.

The PBB shall be listed in the United States by ETL, a Nationally Recognized Testing Laboratory (NRTL) for compliance with:

UL 325 Third Edition: Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.

CSA/C22.2-2471992: Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.


D. Additional Equipment

1. Portable Water Cabinet
   Provide electric reeled/heated portable water cabinet mounted under service stair landing.

   A. Supply minimum 150' hose with fitting for 737 aircraft.

   B. Supply line is to be insulated and have the ability to be drained to prevent freezing during winter months.

   C. Mounting height to be determined during installation.

2. Foundation
   Foundations provided by others. Foundation height is 13'-3" terminal floor to top of foundation. Proposer must field verify height prior to manufacturer. Ramp slope is 1% first 50' and 1.5 thereafter.

E. Manuals

1. Operation and Maintenance Manuals
Six Operation and Maintenance Manuals following the intent of the Air Transport Association (ATA) Specification 101 shall be provided. Included in the manuals shall be preventative maintenance requirements and problem solving procedures.

**F. REQUIRED ITEMS**

The following items must be provided:

1. Pre-wire bridge with input power cabling for 90kVA GPU
2. Pre-wire bridge with input power cabling for 30 Ton PCA unit
3. Cab mounted cable hoist
4. 400Hz console interface controls
5. PCA console interface controls
6. PCA condensate hose 155’- 0”
7. Drive Column Mounted Potable Water Cabinet (Warm Weather or Cold Weather)
8. Rotunda mounted Bag Buddy Lift with cart
9. Additional Cart for Bag Buddy

**G. PLC System**

PLC system may be substituted with like system as approved by the Director.