

SECTION 11 85 01 – PRECONDITIONED AIR HANDLING UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Work Includes: Designing, manufacturing, testing, furnishing, installing and commissioning Central PCA Air Handling Units rated as indicated herein, with single output and dual output units, as indicated, to provide preconditioned air for both heating and cooling commercial aircraft.

1.2 RELATED SECTIONS

- A. Drawings, General Provisions of the Contract, including General and Special Conditions, as well as Division 1 and General mechanical and electrical materials and methods of installation apply to work of this section.
- B. Section 118504 - Passenger Boarding Bridge.

1.3 DEFINITIONS

- A. The terms "Central PCA Air Handling Unit (AHU)", "PCA Unit", "Unit", and "PCA" as used within this specification, shall be construed to mean the components, sub-components and sub-systems that constitute a complete, operable, and maintainable Central PCA Air Handling Unit, including all ancillary equipment, such as air hoses, hose couplings, hose storage devices, etc.
- B. PCA Unit shall be capable of serving the following aircraft:
 - 1. Class I: PCA unit shall be single output units capable of serving the following aircraft: Regional Jets, including EMB 145, CRJ-200 & CRJ-700.
 - 2. Class II: PCA unit shall be single output units capable of serving the following aircraft: All Class I aircraft as well as CRJ-900, EMB 170, EMB-175, EMB-190, EMB-195, DC9-50, MD 80/90, B-717, B-727, and B-737/3/4/5/6/7/8/9/Max.
 - 3. Class III: PCA unit shall be single output units capable of serving the following aircraft: All Class I & II aircraft as well as B-757/2/3, A319, A320, and A321.
 - 4. Class IV: PCA unit shall be single output units capable of serving the following aircraft: All Class I, II & III aircraft as well as B-767/3/4, single PCA port aircraft.
 - 5. Class V: PCA unit shall be dual output units capable of serving the following aircraft: All Class I, II, III and IV aircraft as well as all B-747, B-777, B-787, A330 & A340.

1.4 GENERAL REQUIREMENTS

- A. The PCA unit and all components thereof shall be constructed in accordance with all codes and standards and local laws and regulations applicable to the design and construction of this type of equipment, which are generally accepted and used as good practice throughout the industry, including without limitation, NFPA, Underwriter's Laboratories, 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.

- B. The Manufacturer shall be a qualified source, who has been regularly engaged in the engineering, manufacturing and installation of commercial aviation PCA equipment and components for a minimum of three (3) years and with a minimum of fifty (50) units installed.
- C. Qualified manufacturers will have completed no less than two (2) jobs of similar size and scope within the last three (3) years.
- D. Manufacturers are required to satisfy all requirements of this specification. Should the Manufacturer desire to deviate from any portion, either because the specification is in error, violation of any law or regulation, or is in need of modification to permit a more satisfactory functional and economical design, they must submit a written request for such deviation. The Manufacturer shall not contract, purchase or cause to be delivered, equipment which does not meet all requirements of this document as specified, without obtaining prior written approval.
- E. 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 PCA units. 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.
- F. The Manufacturer shall furnish and install all necessary equipment and incidentals to provide a complete operable and maintainable unit.
- G. Should alternate mounting configurations or physical attributes, other than those specified herein, or indicated on the project drawings, be proposed, manufacturers shall submit alternates for approval prior to bid date. Alternate mounting, configurations, or attributes shall be provided at no additional cost to the Owner.
- H. EMI/RFI: Unit shall be designed so as not to affect aircraft radio/navigation equipment. It shall be applicable throughout the entire aircraft radio frequency range. Provisions shall be designed into the unit to protect it from voltage fluctuations which might result from the operation of aircraft radio frequency equipment.
- I. PCA air handling units shall be designed, fabricated and installed in such a manner so as not to interfere with the OEM operational capabilities of the PBB, including retraction, extension, rotation and elevation, nor shall the units interfere with any walkway or building structure. Ensure, based on the aircraft parking plan and facility layout, that the units meet these requirements.

1.5 REFERENCES

- A. 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. FM P7825 - Approval Guide; Factory Mutual Research Corporation.
 - 2. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association.
 - 3. NFPA 70 - National Electrical Code; National Fire Protection Association.
 - 4. NFPA - "Standard on Construction and Protection of Aircraft Loading Walkways No. 415".
 - 5. SSPC-Paint 15 - Steel Joist Shop Paint; Society for Protective Coatings; 1991 (Part of Steel Structures Painting Manual, Vol. Two).
 - 6. AFBMA - Anti-Friction Bearing Manufacturers Association.
 - 7. ARI - Air-Conditioning and Refrigeration Institute.

- a. ARI Standard 410 - Standard for Forced-Circulation Air-Cooling and Air Heating Coils.
 - b. ARI Standard 850 - Commercial and Industrial Filter Equipment.
8. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers.
 - a. ASHRAE 52 - Method of Testing Air-Cleaning Device Used in General Ventilation for Removing Particulate Matter.
9. NEBB - National Environmental Balancing Bureau Agency
10. ATA 101 - Air Transport Association of America - Specification for Ground Equipment Technical Data, 1986.
11. SAE - Society of Automotive Engineers.
12. AISC - American Institute of Steel Construction Code.
13. ASME - American Society of Mechanical Engineers.
14. OSHA - Occupational Safety and Health Act.
15. UL - Underwriters Laboratories.
16. MS-33562 - Military Specification, Connection, Aircraft Ground Air Conditioning, 8", latest edition.
17. IECC-2021, Section C408 - Maintenance Information and System Commissioning
18. DFW Design Criteria Manual

1.6 SUBMITTALS

- A. Bid-Submittals: The following submittals shall be included with bid.
 1. Alternates per 1.4.G.
 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 one year from the date of final completion.
 3. UL Certification per 1.7.E.
 4. Special Tools List: Provide a list of any special tools required to perform any field performable maintenance tasks and programming.
- B. Pre-Manufacture Submittals: The following submittals shall be made as necessary to meet the project schedule, and shall be submitted and approved prior to manufacturing the AHU.
 1. Product data for selected models including specialties, accessories, and the following:
 - a. Central PCA Air Handling Unit (AHU) airflow performance curves with system operating conditions indicated; include: airflow vs static pressure and airflow vs blower horsepower.
 - b. Manufacturer shall submit performance data of the AHU at the design conditions indicated in this Section. Performance data shall include, but not be limited to, air flow, static pressures, temperatures and humidity levels, at points of significance through the unit and at the aircraft inlet, EG/W pressure drop and return temperature, and power requirements of major components as well as entire unit.
 - c. Motor ratings and electrical characteristics including motor and fan accessories.
 - d. Materials, gauges and finishes.
 - e. Dampers, valves, including housings, linkages, and operators.
 - f. Air filter manufacturer's technical product data including dimensions, weights, required clearances and access, flow capacity including initial and final pressure drop at rated air flow, efficiency and test method, fire classification, and installation instructions.
 - g. Certification report of airflow test apparatus by an independent third party such as the National Environmental Balancing Bureau (NEBB) or other approved agency.

- h. AHU air flow control, capacity control and defrost control.
 - i. Flexible hoses, clamps, rigid ducts and mounting brackets.
 - 2. Shop Drawings: Provide schematics and interconnection diagrams, indicate front and side views of enclosures with overall dimensions and weights shown; conduit/cable entrance locations and requirements; and nameplate legends. Differentiate between manufacturer-installed wiring and field-installed connections. Include appurtenances such as hose baskets, ducts, pushbuttons, etcetera.
 - 3. Installation Details: Provide complete installation details including, without limitation, installation details of all appurtenances. Show installed configuration as well as any pertinent details regarding interface to other equipment and systems, include electrical connection service points.
- C. Pre-Ship Submittals: The following shall be submitted and approved prior to shipping AHUs to the project site:
 - 1. Factory Test Reports: Indicate factory tests and results and inspection procedures.
- D. Pre-Substantial Completion Submittals: The following submittals shall be submitted and approved prior to 14 days before substantial completion, unless otherwise noted herein.
 - 1. Operation and Maintenance Manuals.
 - 2. Training Program: At least 60 days prior to substantial completion, a training program summary, course syllabus, instructor qualifications, and copy of the training manual shall be submitted for review and approval.
 - 3. Field Commissioning Report: Submit proposed field commissioning report for approval. This approved form shall be utilized for the final field commissioning as specified in Section 3.
- E. Pre-Final Completion Submittals: The following submittals shall be submitted and approved prior to 14 days before final completion.
 - 1. As-Built Drawings. Provide field edited redlined project drawings showing deviations from design documents.
 - 2. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and have been registered with the manufacturer.
 - 3. Field Commissioning Report: A completed field commissioning report for each installed unit as specified herein. Utilize approved form.
 - 4. Training Rosters. Provide training roster with trainee names, dates and types of training, as well as durations.
 - 5. Original software and documentation registered in the Owner's name.
 - 6. Hard copy and electronic version (USB drive or electronic submittal) copies of all programs and settings loaded into equipment provided hereunder.
- F. Equipment submittals shall be submitted to the engineer of record for review prior to manufacturing of equipment.
- G. Performance based design submittals
 - 1. Short Circuit Study and Equipment Evaluation Reports.
 - 1) Equipment shall comply with requirements of Section 260575 – Overcurrent Protective Device Short-Circuit Study.
 - 2) Equipment supplier shall perform short circuit calculations based on available fault values as determined by Division 26 studies and submit for review and compliance.
 - 2. Coordination Study and Equipment Evaluation Reports.

- 1) Equipment shall comply with requirements of Section 260576 – Overcurrent Protective Device Coordination Study.
 - 2) Equipment supplier shall perform coordination studies based on available values as determined by Division 26 studies, and submit for review and compliance.
3. Arc-Flash Study Report.
- 1) Equipment shall comply with requirements of Section 260577 – Overcurrent Protective Device Arc-Flash Study.
 - 2) Equipment supplier shall perform overcurrent protective device arc-flash studies based on available values as determined by Division 26 studies, and submit for review and compliance.

1.7 QUALITY CONTROL

- A. ARI Compliance: Air filter equipment shall comply with ARI 850.
- B. ASHRAE Compliance: Air filters shall comply with ASHRAE Standard 52 for method of testing and for recording and calculating air flow rates.
- C. NFPA Compliance: Comply with applicable portions of NFPA 70 and NFPA 415 for components and installed AHUs.
- D. NEMA Compliance: Motors, enclosures and electrical accessories shall comply with NEMA standards and be so rated.
- E. UL Compliance: AHUs shall be UL, or ETL listed and shall be labeled by a nationally recognized testing laboratories at the time of bid. Submit verification with bid submittals.

1.8 DELIVERY, STORAGE, AND PROTECTION

- A. Lift and support AHUs with the manufacturer's designated lifting or supporting points.
- B. Provide AHUs which do not require disassembly and reassembly because of movement into the final location and follow manufacturer's written instructions.
- C. Deliver equipment as a factory-assembled AHU whenever practical for shipping purposes with protective crating and covering.
- D. Store equipment and material in suitable facilities until delivery, installation, and acceptance.
- E. Coordinate the delivery acceptance of this equipment at the job site. Receive, offload, store and protect this equipment until such time as it has been installed and final accepted.
- F. Properly dispose of all waste including, but not limited to, packaging, crates, etcetera.

1.9 ROYALTIES AND LICENSE FEES

- A. The AHUs 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 one (1) year 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, per 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.
- 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 OPERATION AND MAINTENANCE MANUALS

- A. Provide electronic copies, as approved by the airport, of the approved, comprehensive Operation and Maintenance Manual for each model PCA unit fourteen (14) days prior to Substantial Completion.
- B. The content of the manuals shall be limited to information and data that specifically apply to products provided and shall include routine normal and special operating instructions and sequences. Also included shall be routine maintenance procedures and guides for troubleshooting, disassembly and reassembly instructions, and recommended spare parts list including current prices and sources.
- C. Wiring diagrams and schematics shall be incorporated into the manuals to clearly show features such as controls, switches, instruments, points of connection, and indicators by name and location.
- D. Operation and Maintenance Manuals: Include in ATA 101 format a general description, theory of operation and specification, schematics and wiring diagrams, start-up instructions, installation and maintenance procedures, parts list, recommended spare parts list, troubleshooting guides, controls and accessories information.
 - 1. Special Tools List: Provide a list of any special tools required to perform any field performable maintenance tasks.
 - 2. Spare Parts List: Provide manufacturer's recommended spare parts list.
- E. Maintenance Materials: See Division 01 Section 017846 "Extra Stock Materials" for requirements related to this section.

1.12 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 two (2) classes of four (4) hours classroom instruction and four (4) hours hands-on instruction for eight (8) personnel, and operator's training shall consist of a minimum of four (4) sessions of one (1) hour duration each, hands-on instruction for eight (8) personnel.

- B. Operator training shall be completed no later than seven (7) days prior to beneficial use. The manufacturer shall provide maintenance training within 30 days of beneficial use. At least 60 days prior to substantial completion, a training program summary, course syllabus, instructor qualifications, and copy of the training manual shall be submitted for review and approval.
- C. Training shall be conducted at the installation site property at the direction of the Owner.
- D. Provide Owner a minimum of seven (7) days notice prior to conducting any training.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. AHU:
 - 1. JBT AeroTech - Jetway Systems
 - 2. Northern Air Systems
 - 3. Cavotec Inet (Dabico)
 - 4. MCM Engineering
 - 5. Twist Aero
 - 6. Substitutions: as approved by engineer
- B. Hose Storage / Management System
 - 1. Twist Boom Air
 - 2. Substitutions: as approved by engineer

2.2 BRANDING

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

2.3 SCHEDULES

- A. Provide quantities and types of equipment as detailed on the project drawings.

2.4 GENERAL DESCRIPTION

- A. The manufacturer shall provide a new, compact, light-weight, low-noise and insulated AHU that can be mounted under the Passenger Boarding Bridge (PBB), such that the operational characteristics of the bridge are unrestricted and the bridge's structural integrity is

uncompromised. It is the Engineer's intent to have the AHUs mounted under the "A" tunnel, at the rotunda end of the PBB.

1. The AHU manufacturer shall ensure the unit and the unit's mounting methods are structurally sound and that they do not affect the structural integrity of the passenger boarding bridge. The AHU shall not cause deflections of the passenger boarding bridge tunnel sections or rails. The AHU shall not affect the dynamic operation of the passenger boarding bridge. All steel, rails, brackets, bolts, reinforcing, etcetera shall be provided and installed with the proper ratings for the finished system.
- B. The AHUs shall have a minimum of two (2) distinct assemblies:
1. A control assembly which contains the low voltage logic and control circuits.
 2. A blower/coil unit containing a blower, cooling coils, heating coils, filters, complete motor starting equipment, outlet plenum and condensate drain pan to provide the required cooled or heated air to maintain the aircraft cabin temperature specified.
- C. Each AHU shall be primed and painted to match the color of the newly installed passenger boarding bridge.
- D. Each AHU shall operate properly to serve the full range of aircraft which park at its respective gate position. It shall be the manufacturer's responsibility to review the aircraft parking plans and verify that the units supplied will meet this requirement. Unit sizing indicated in the contract documents shall be considered the minimum sizing of units supplied.
- E. Unit external static pressure shall be defined as the gauge pressure measured at the outlet of the AHU. The AHUs manufacturer shall submit the gauge pressure the AHU can produce at the outlet of the hose and at the aircraft connection through 75' of 14" hose.
- F. The maximum sound level for the AHUs at maximum cooling/heating shall not exceed 85 dBA at a distance of 15' from the unit (external) and 65 dBA inside the bridge (internal).
- G. The AHU components shall operate satisfactorily under ambient temperature conditions of -20° to 128° F including static soak up to 48 hours within this range with or without wind of 50 MPH. All components shall be designed or selected for long service life under such conditions
- H. The AHUs shall not produce or induce objectionable vibrations into the bridge structure. Vibration levels induced by the units and/or its components shall not be injurious to the units or the bridge structure or be harmful or annoying to passengers and employees. The manufacturer shall provide any and all necessary vibration insulation devices required to meet this requirement. The blower wheel and shaft assembly shall be direct coupled to the motor, and shall receive a two (2) plane dynamic balance at maximum RPM and the maximum allowable vibration velocity shall not exceed 0.15 inch/second displacement.
- I. The AHUs shall be designed so as not to affect aircraft radio/navigation equipment. It shall be applicable throughout the entire aircraft radio frequency range. Provisions shall be designed into the AHU to protect it from voltage fluctuations which might result from the operation of aircraft radio frequency equipment.
- J. Where the AHU components are assembled within a unitized enclosure, provide access doors of the hinged and insulated type. Locate as required for proper access to the following:
1. Blower/dampers.
 2. Filters.
 3. Coils.
 4. Motors.

5. Variable Frequency Drives (VFD).
 6. Heating Elements
 7. Smoke Detectors.
 8. BTU Meters.
 9. Automatic Control Valves
 10. Any other item requiring maintenance access at the discretion of the Engineer.
- K. The AHUs shall be supplied with any and all necessary ducts, transition hoses and brackets required to route the discharge air from the AHU to a point above and then to the hose storage device. Such installation method shall ensure that air flow equipment is not restricted or interfered with during any and all PBB operations.
- L. The minimum reliability design requirement for the AHUs shall be to operate between preventative maintenance periods of a minimum of 840 operating hours or 12 weeks, whichever comes first.
- M. The AHU design shall be based on the use of a hydronic cooling coil and a hydronic heating coil combined successively by the supply air passage and operationally by a common control system.
1. Primary and secondary systems shall form the basic unit.
 2. Primary and/or secondary systems within the basic two-system arrangement may be divided into multiple hydronic cooling coils for severe capacity requirements caused by extreme design ambient conditions and/or air flow parameters.
 3. Primary and secondary hydronic cooling coils shall be configured as an upstream coil prior to the blower and a downstream coil following the blower. Automatic Control Valves shall be utilized to maintain the upstream coil at a temperature just above the freezing point of water to ensure optimum condensate removal and minimize the defrost cycle of the downstream coil, as well as minimize the discharge air temperature rise during a defrost cycle.
- N. Automatic Control Valves shall be located at the building face as indicated on the plans and utilized to adjust the flow and distribution of PG/W through the unit.
- O. A digital BTU Meter and associated temperature sensors shall be located at the building face as indicated on the plans and utilized to monitor cooling and heating PG/W flow and monitor BTU consumption during operation and report BTU usage

2.5 PERFORMANCE REQUIREMENTS

A. COOLING:

1. The AHUs shall be designed to automatically maintain a 75°F cabin temperature in all aircraft within its specified class, based on the following design conditions.
 - a. Design ambient temperatures: 97.4°F/67°F Dry Bulb/Wet Bulb.
 - b. Passenger Load: Full (100%), for the largest aircraft in its classification, including full crew.
 - c. Full solar load (bright sunshine).
 - d. Aircraft electrical load: Per aircraft manufacturer's published data.
 - e. One aircraft door open (typically either L1 or L2).
 - f. AHU's supplied with a 30% (by weight) mixture of Propylene Glycol and Water (PG/W) at 20°F.
2. Additional Design Requirements/Parameters:
 - a. The following table lists the American Airlines PCA performance requirements:

Aircraft	Rated Airflow	Press. at end of 65' hose	Air Temp. at end of hose	Electric Heater	AHU Size / Max. gpm / Min. hp / FLA
ERJ140, 145 Std	72 ppm	5"wg	40°F	36kW	30t / 20 gpm / 20 hp / 28 A
CRJ700, 900	85 ppm	12.5"wg	40°F	36kW	30t / 20 gpm / 20 hp / 28 A
E170, 175 Std, 175EW	90 ppm	8"wg	40°F	36kW	30t / 20 gpm / 20 hp / 28 A
A319, 319S	125 ppm	13"wg	32°F	36kW	30t / 20 gpm / 20 hp / 28 A
737-800W, 737- MAX-8	150 ppm	18"wg	40°F	36kW	30t / 20 gpm / 20 hp / 28 A
A320	165 ppm	13"wg	32°F	36kW	45t / 30 gpm / 40 hp / 40 A
A321, 321S, 321 Neo	165 ppm	13"wg	32°F	36kW	45t / 30 gpm / 40 hp / 40 A
B787-8	295 ppm	24"wg	35°F	60 kW	90t / 60 gpm / 60 hp / 75 A
B787-9	325 ppm	26"wg	35°F	60 kW	90t / 60 gpm / 60 hp / 75 A
B777-200	500 ppm	28"wg	35°F	60 kW	120t / 80 gpm / 80 hp / 100 A
B777-300, 300ER	570 ppm	36"wg	33°F	60 kW	120t / 80 gpm / 80 hp / 100 A

b. Based on cabin temperature = 75°F and based on 101.4°Fdb/74.2°Fwb ambient

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

B. HEATING:

1. The AHUs shall be designed to automatically maintain a 70°F cabin temperature in all aircraft within its specified class, based on the following design conditions.
 - a. Design ambient temperatures: 9.3°F Dry Bulb.
 - b. Passenger Load: None (0%), for the largest aircraft in its classification.
 - c. No solar load.
 - d. Aircraft electrical load: 0 BTU/h.
 - e. One aircraft door open (typically either L1 or L2).
 - f. AHU's supplied with a 30% (by weight) mixture of Propylene Glycol and Water (PG/W) at 170°F.
2. Additional Design Requirements/Parameters:
 - a. See American Airlines PCA performance requirement table in section 2.05, A, 2, a.
3. All temperatures, air flow rates, and static pressures denoted in this section must be simultaneously achieved.

2.6 ELECTRICAL REQUIREMENTS

- A. All AHUs shall be constructed in accordance with standard electrical manufacturing processes, and shall comply with all applicable Federal, State, and Local laws, codes and ordinances.

- B. Input Voltage Rating: 480V, 3 phase, 60 hertz.
- C. The AHUs shall be provided with a built-in, main circuit breaker of suitable size that provides an electrical disconnecting means for the AHU and protection from short circuits. This circuit breaker shall be lockable in the OFF position for maintenance purposes.
 - 1. All primary disconnecting means shall be suitably rated to be capable of withstanding and interrupting fault currents available at the input.
- D. Placards:
 - 1. Each unit and its operating controls shall be placarded with permanent type metal or engraved phenolic type placards as follows:
 - a. Data Plate:
 - 1) Each unit shall bear a data plate on the inside of the cabinet containing the manufacturer's data as follows:
 - a) Manufacturer's name, address, phone number.
 - b) Model number.
 - c) Serial number.
 - d) Date of manufacture.
 - e) Electrical Information required by the NEC.
 - b. Electric Component Identification:
 - 1) All electrical components shall be identified by placards affixed adjacent to the component. Control switch placards shall also identify the function of the switch.
 - 2) All wire terminations shall be permanently identified in accordance with wiring diagrams and schematics on the "as built" drawings or in the manuals. Cloth wire markers are not acceptable.
 - 2. Adhesive type placards are not acceptable for these requirements.
- E. Wiring, Motors and Electrical Components
 - 1. All wiring shall be permanently identified. Wrap around adhesive style wire markers will not be permitted. Numbers are to be located one inch from the end of each termination point. If the wires are to be stamped, they must be numbered the full length with indelible ink, with the numbers no more than four inches apart, and the number shall be visible at all terminating points. Wires are to be numbered in a logical sequence. Manufacturer shall indicate all wire numbers on electrical drawings.
 - 2. All circuits shall have suitable overload protection. Each conductor shall be sized to have current carrying capacity as allowed by the National Electrical Code (NEC) equal to or greater than the capacity of the circuit breaker provided in its circuit. Circuit breakers shall be grouped in convenient locations and suitably marked for size and function. Logical grouping of circuits is anticipated. Protection devices shall be sized to protect wiring and motors from damage due to overload and prevent electrical or mechanical damage to associated PCA unit components in the event of failure of one of the components. Each electric motor shall have a suitable magnetic starter providing over-current and under-voltage protection, and each motor circuit shall be separately protected by fuses or circuit breakers. Optional and add on components shall be considered in sizing and in the number of conductors provided. Spare wires shall be provided as necessary.
 - 3. All wiring shall be terminated on terminal blocks and/or suitable connectors. The wiring shall be formed and restrained to give a neat appearance. Common wiring splices shall not be used. Connections shall be made using terminal strips and staked lugs or by patent connectors.

4. Grommets and suitable anti-chafe material shall be used where wires are required to pass through structure or other similar relief or opening which exposes the wire to possible chafing. All wiring shall be in conduit (preferably automotive split loom) or spot-tied and shall be routed away from possible pinch points. Wiring shall be adequately supported to protect it from damage due to ice and snow buildup, bumping, kinking, and flexing.
5. All meter panels and any components containing printed circuit boards or solid state electronics shall be shock mounted or as otherwise approved by component's manufacturer.
6. Electrical interlocks shall be fail-safe design.
7. Electrical devices including switches, relays, wiring, and terminals when located in an area exposed to weather, shall be of weatherproof design or protected by weatherproof enclosures.
8. Weatherproof schematics shall be installed on the interior of the controller door. Schematics shall include all wiring and devices and shall include all wire numbers. Schematic shall be impervious to grease, water, ice, or other elements that they may be exposed to in an aviation maintenance environment on an active apron with the doors open.
9. All exterior conductors/cables shall be in conduit. Exposed cables will only be allowed where required due to flexibility needs and then will be limited to a maximum of 48".

F. Ampacity.

1. Each AHU unit shall operate satisfactorily, at full load, with the following electrical circuits provided. Each unit's minimum circuit ampacity, calculated in accordance with the NEC, shall not exceed the ampacity of the circuits provided.
2. a. Class III: RLA=52A, MCA=65A, MOP=70A.
3. b. Class IV: RLA=77A, MCA=97A, MOP=100A.
4. c. Class V: RLA=96, MCA=120, MOP=125A.

2.7 CONTROLS

A. Controller:

1. The AHU shall be provided with a single board controller that is compatible with, or the same as, the central plant control system which shall monitor all phases of operation of the AHU. The controller shall be based on a 32 bit microprocessor and utilize flash memory technology to store operation parameter information. Operational parameters of controller shall not be affected by loss of 60 Hz power to controller. PCA manufacturer shall provide with their bid a detailed description of the controller, type of graphics and software, sequence of operation, types and number of control points, and limitations of the control system they intend to provide and install.
 - a. Provide all hardware, software, programming, etcetera as necessary for the new AHU to communicate with the central PCA system and as necessary to display parameters appropriately at the central plant.
 - b. AHU's controllers shall be compatible with maintenance troubleshooting devices including the portable laptop computers used for local troubleshooting of the PBB's, PCA Controls and the individual AHU's.
2. Control system shall be low voltage (12 & 24 VAC). Control transformer shall be provided and sized to adequately serve all connected loads.
3. Contactors shall be full voltage non-reversing type and designed to meet international standards including UL and IEC. Contactors shall be AC operated with 120V 50/60 Hz holding coil and functionally assigned for ON-OFF control.

B. Remote Monitoring:

1. Local and Remote Communications: The rooftop HVAC units shall use controllers that apply industry standard, open communications Modbus or BACnet protocol. The controllers will be subject to architect and Airport approval. BACnet devices must be BTL listed and must be fully open. All necessary programming tools and licensing for the controllers shall be provided to the Airport. Controllers must be connected by ethernet cable to the Owner's General Services Network (GSN) – complying to the requirements of the Owner's IT department – and integrated to the Owner's Tridium Niagara Building Automation Systems (BAS). The contractor shall provide additional services, including, but not limited to, all system software, programming tools, graphics tools, licenses, and installation support necessary for the integration and configuration of these controllers to the Owner's existing BASs via Owner's approved BAS integrator. The rooftop unit controller shall provide the following information for monitoring purposes.
2. Graphics on PCA control system to include the display of operational information of the AHU. This information graphically displayed for each unit should include but not be limited to the following:
 - a) On/Off Status.
 - b) Fault Condition.
 - c) Cabin Temperature Selection.
 - d) Discharge Air Temperature.
 - e) Entering Air Temperature.
 - f) Interstage Air Temperature.
 - g) PG/W Supply Valve Position.
 - h) Internal Control Valve Position (% to Upstream Coil).
 - i) Inlet PG/W Temperature Cooling.
 - j) Interstage PG/W Temperature Cooling.
 - k) Outlet PG/W Temperature Cooling.
 - l) Inlet PG/W Temperature Heating.
 - m) Outlet PG/W Temperature Heating.
 - n) Flow PG/W Cooling.
 - o) Flow PG/W Heating.
 - p) Smoke Detector Status.
 - q) Single Hose/Dual Hose Operation.
 - r) VFD Speed
 - s) VFD Fault/Status.
 - t) Dirty Filter Status.
 - u) Aircraft Selector Position.
 - v) BTU metering Cooling
 - w) BTU metering Heating
 - x) AHU controller receives common outdoor air temperature value from the central plant for utilizing, along with the AHU's onboard sensors, for selecting the appropriate heating or cooling mode of operation.

C. Remote Control Station:

1. The control station shall be housed in a NEMA 4X stainless steel enclosure, and shall operate on 24 volts or less and shall be located on the bridge lift column (aircraft side of the bridge), so as to be accessible from ground level. Coordinate this position with all other installed equipment and ancillaries so as to prevent interferences. The station shall be configured as indicated on the design drawings. Modifications to this configuration must be approved by the Engineer.
2. The control station shall have a fault-indicator lamp as follows.
 - a. Flash: non-critical fault, AHU still operational.

- b. Steady: critical fault, AHU prevented from operating.
- 3. The control station shall have a selector switch to choose the aircraft the AHU is to serve. This selector switch shall be as shown on the drawings and shall be labeled with the abbreviations of the class of aircraft serviced as follows:
 - a. RJ (Regional Jets)
 - b. NB (Narrow Body Aircraft)
 - c. WB (Wide Body Aircraft)
 - d. WBx2 (Wide Body Dual Output Mode)
- D. Cabin Temperature Controller:
 - 1. The AHUs shall have a cabin temperature controller as indicated in the drawings which originates from right side of the cab looking out toward the ramp. The selector should mimic a R/2 thermistor curve which indicates a 77° F reading at a value of 10K ohms. Manufacturer's control sequence shall utilize programming to protect against the overcooling/overheating of aircraft, by limiting the discharge temperature to a reasonable range for the corresponding ambient temperature.
 - 2. COMPONENTS AND OPERATION
 - a. Casing:
 - 1) Manufacturer's standard casing construction, having corrosion protection coating, and exterior finish. Where the AHU is provided as a unitized enclosure construction, casings shall have removable panels or access doors for inspection and access to internal parts, a minimum of 1" thick thermal insulation, knockouts for electrical and exterior condensate drain connection, and lifting lugs.
 - b. Blower:
 - 1) Provide blower that is factory fabricated and assembled, factory tested and factory finished, with required capacities and characteristics. The blower shall be centrifugal type and sized for the appropriate constant volume airflow requirements in accordance with the selected size of the AHU. The blower motor shall be selected such that the fan brake horsepower does not exceed the maximum supplied by the motor over the design operating range of the AHU.
 - 2) Blower and Shafts: Statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower. Vibration shall not be more than 0.1 inches/second or 0.5 MIL displacement. Blower shaft to be turned, ground, and polished steel designed to operate at no more than 70% of the first critical speed at the top of the speed range of the fan's class.
 - 3) Shaft Bearings: Provide bearings having a median life "Rating Life" (AFBMA L50) of 200,000 calculated in accordance with AFBMA 9 for ball bearings or AFBMA 11 for roller bearings.
 - 4) Blower: Centrifugal, direct-drive fans; and permanently lubricated motor bearings where bearings are not accessible for greasing.
 - 5) A 2-pole, drip-proof blower motor shall be directly connected to the blower impeller. Motor shall be of NEMA Design B, Class F insulation, 1.15 S.F.
 - c. Factory Finish:
 - 1) Exterior Sheet Metal Parts: Prime coating prior to final assembly. Final color to match the new PBB.
 - 2) Interior Surfaces: All air flow surfaces shall be stainless steel or aluminum. Manufacturer's standard finish is acceptable on all other interior surfaces.

- d. Coils:
 - 1) Aluminum plate fins and seamless copper tube. Fins shall have collars drawn, belled, and firmly bonded to the tubes by means of mechanical or hydraulic-expansion of the tubes. No soldering or tinning shall be used in the bonding process. Coils shall have a galvanized steel casing and shall be easily removable for maintenance.
 - 2) Coils shall be constructed and tested in general accordance with ASHRAE 15 and ARI 410.
 - 3) Coils shall be leak tested to 250 psig with air pressure under water.
- e. Airflow Control:
 - 1) Airflow control shall be via a VFD driven blower motor to control the air flow capacity of the blower. The VFD shall automatically adjust the air flow during aircraft cooling to the requirements of the aircraft selected on the remote control station. During aircraft heating, the VFD shall automatically adjust to the 50% mass air flow position for the aircraft selected on the remote control station.
- f. Air Flow Ducting:
 - 1) All ducting, plenum transitions, and other air flow components shall be made from either aluminum or stainless steel.
 - 2) Plenum and air flow ductwork shall be properly insulated with polyurethane foam insulation as necessary to prevent the forming of condensation on ductwork surfaces and as necessary to minimize impact on unit performance.
- g. Inlet Air Filters:
 - 1) Inlet air filters shall be factory fabricated by a company regularly engaged and specialized in filter manufacturing. Filters shall be cleanable, encased in a metal frame, and rated for the application for which they are being used. The air filters shall meet the following minimum requirements.
 - a) The AHUs shall utilize standard size, commercially available, washable air filters. Filter media shall be made from zinc electroplated steel mesh in alternating layers of flat and herringbone crimp providing high filtration and dust-holding capacity.
 - b) The metal enclosing frame shall be constructed of rigid, heavy duty, and at least 20 gauge galvanized steel.
 - c) Face velocity shall be no greater than 500 feet per minute with an initial resistance of 0.3" water gauge, final resistance of 0.5" water gauge, and an average resistance of 80%.
 - d) The filter section shall be furnished with a differential pressure sensor measuring across all filters to activate a "dirty filter" alarm. The PCA unit shall be equipped with a visual indicator for notification of alarm.
- h. Condensate Drains:
 - 1) A condensation drain pan shall be included. Drain pan shall be stainless steel.
 - 2) Units shall incorporate a freeze valve that will open automatically as ambient temperatures approach freezing and which shall dump all stored condensate as necessary to protect from freezing.
 - 3) Condensate shall be routed to the contractor-supplied ramp-mounted sump pump.
- i. PCA Air Hose:
 - 1) Each AHU shall be provided with single or dual, as specified, length as indicated on drawings, of 14" diameter insulated hose and one 14" to 8"

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

- a) Hose lengths specified, or indicated on drawings, are a minimum length only. Provide and install sufficient hose lengths to reach all aircraft capable of being serviced at the gates as indicated on the aircraft parking plans.
- 2) Air delivery hose shall be of the lightweight insulated type, maximum thermal conductance of 1.28 BTU/hr/ft/°F, pressure rated for 50" water maximum. Hose shall be 14" diameter flat type. Hose is to be supplied in sections of no more than 25' in length, connected with Velcro seals, with a 14" to 8" diameter reducing adapter on the end section.
- 3) All ducts, hose support sleeves and mounting hardware shall be provided and installed in accordance with the contract drawings and shall be painted to match the color of the newly installed passenger boarding bridge.
- 4) Approved Manufacturers:
 - a) J&B Aviation (SuperHose)
 - b) Estex
 - c) JBT Ultra Hose
 - d) Twist Aero
- j. EG/W Supply and Return Hoses
 - 1) 2-ply EPDM Flexible Hose reinforced with helically-wound wire. Sized as per the drawings.
 - 2) Temperature Range: -40°F to 212°F.
 - 3) Working Pressure: 150 PSIG.
 - 4) Insulate as indicated on drawings.
- k. Dual Output Damper Assembly:
 - 1) A dual output damper assembly, complete with mounting hardware, dampers, and damper motors shall be provided by the AHU manufacturer for all Class V AHU's.
- l. Mounting Brackets:
 - 1) Factory fabricated mounting brackets shall be utilized for installation of the PCA AHU. Design of these brackets shall be such so as to prevent any welding or cutting of the bridge components to facilitate installation. Brackets shall be universal in nature so as to allow for installation on industry standard, commercially available passenger boarding bridges.
- m. Safety Provisions:
 - 1) All corners of the unit's lower rim shall be equipped with corner bumpers.
 - 2) The entire lower rim, and all vertical corner edges of the AHU shall be distinguished with an alternating yellow/black adhesive safety tape. Safety tape minimum width shall be 2 inches.
 - 3) The electric circuitry of the AHUs shall be protected against short-circuit currents or grounds by means of circuit breakers.
 - 4) Each motor shall have separate overload protection.
 - 5) The AHUs shall be protected against overheating when in the Heating mode. Protection shall be automatically resetting.
 - 6) Smoke Detector:
 - a) Each AHU shall be equipped with a factory installed and tested smoke detector.
 - b) The smoke detector shall be of the ionization type and shall be

mounted at each AHU discharge plenum. The smoke detector shall interface with the AHU control circuitry. When sufficient smoke is sensed, the entire AHU shall shut down. A manual switch shall be utilized to reset the smoke detector.

- c) A fault of the smoke detector itself shall also cause the entire unit to shut down and alarm.

3. CONFIGURATION

- a. The manufacturer shall provide a new, compact, light-weight, low-noise, and insulated AHU that can be mounted under the Passenger Boarding Bridge (PBB), such that the operational characteristics of the bridge are unrestricted and the bridge's structural integrity is uncompromised. It is the Engineer's intent to have the AHUs mounted under the PBB "C" tunnel.
- b. Manufacturer shall install units as necessary to prevent damage to the units while simultaneously allowing full passenger boarding bridge operational movement so as to service all aircraft as indicated.
- c. Maximum Dimensions and Weights: (LxWxH, weight)
 - 1) Class III: (116", 76", 54", 3800 lbs)
 - 2) Class IV: (156", 76", 59", 5300 lbs)
 - 3) Class V: (156", 76", 59", 5300 lbs)

4. PBB INTERLOCKS

- a. Unit shall interlock with the PBB to prevent PBB horizontal operation while AHU is operating. Coordinate with the passenger boarding bridge manufacturer.

5. FACTORY TESTING

- a. The manufacturer shall test every AHU to assure compliance with the specifications. Submit certification test sheets. The Owner shall be notified fourteen (14) days prior to the date of such tests. The Owner reserves the right to witness tests and request additional tests if necessary to demonstrate compliance with the specifications.
- b. Factory mass flow tests shall be conducted for each size of AHUs at design ambient conditions with a test apparatus whose resulting calculated mass flow has been certified by the NEBB, or other approved, Agency. The submittal for the AHUs shall include the agency certification report of the test apparatus, sealed and authenticated by the agency.
- c. Should factory tests fail to indicate compliance with specifications, all costs associated with re-testing, including costs associated with Owner's witness services, will be the responsibility of the manufacturer.

6. 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.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. This equipment and ancillary devices shall be installed, tested, and commissioned by the Passenger Boarding Bridge Installing Contractor.
- B. Install in accordance with manufacturer's instructions and project documents.
- C. Equipment installation personnel shall meet all local security and safety requirements.
- D. The AHU or its associated routing of hoses, air ducts, etc., shall not hinder or restrict the boarding bridge from operating within its full designed operating range.
- E. Arrange installation of AHUs to provide adequate clearance for service and maintenance.
- F. The AHUs shall be properly aligned, adjusted, and lubricated before final acceptance.
- G. Install condensate discharge system as indicated on the contract drawings.
- H. Complete all punchlist items.

3.2 EXAMINATION

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

3.3 INTERFACE WITH OTHER WORK

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

3.4 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.

3.5 STARTING EQUIPMENT AND SYSTEMS

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

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

END OF SECTION