U.S. Department of Veterans Affairs
Veterans Health Administration
West Palm Beach VA Medical Center

7305 North Military Trail
West Palm Beach, FL 33410
www.westpalmbeach.va.gov

Purchase RTU-3 Replacement Unit

Statement of Work

1.1. GENERAL

The work to be performed under this contract in accordance with this Statement of Work (SOW). Contract shall consist of Replacement of RTU-3 Rental until based on original unit specifications at the Department of Veteran Affairs Healthcare System, 7305 N Military Trail, West Palm Beach, FL 33410-6400. Submit final proposals by email to Contracting Officer Malcolm Davis at Malcolm.davis@va.gov by solicitation deadline.
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1.2. PROJECT DESCRIPTION AND QUALITY ASSURANCE

1.2.1 Contractor shall purchase new RTU based on original unit requirements and specifications. The contractor shall ensure that ALL repairs are in accordance with manufacturers recommendations.

1.2.2 Manufacturer shall have a minimum of 25 years of experience in designing, manufacturing, and servicing air-handling units

1.2.3 New design shall be based on original equipment specifications and design requirements.

1.3. RATING AND CERTIFICAITONS

1.3.1 Unit shall conform to AMCA 210 for fan performance ratings.

1.3.2 Unit shall conform to E.T.L. standards. Unit shall be ETL listed.

1.3.3 Unit sound ratings shall be reported in accordance with AHRI 260 for inlet and discharge sound power levels.

1.3.4 Unit casing radiated sound ratings shall be reported in accordance with ISO 9614 parts 1&2 and ANSI S12.12.

1.3.5 Unit shall conform to AHRI 410 for capacities, pressure drops, and selection procedures of air coils.

1.3.6 Unit shall conform to ANSI/AHRI 430 for all fabrication procedures of air handling units.

1.3.7 Motors covered by the Federal Energy Policy Act (EPACT) shall meet EPACT requirements.

1.3.8 Damper performance shall comply with AMCA 500.

1.3.9 Airflow Monitoring Stations shall be rated in accordance with AMCA 611 95 and bear a Certified Ratings Seal for Airflow Measurement Performance.

1.3.10 Units shall be ISO 9001 certified.

1.3.11 Units shall be manufactured in an ISO 9002 certified facility.

1.3.12 Filter media to comply with ANSI/UL 900 listed Class I or Class II.

1.3.13 Control Wiring comply with NEC codes & ETL requirements.

1.3.14 Units shall comply with energy use AHSRAE 90.1.

1.4. SUBMITTAL DOCUMENTATION REQUIRED

1.4.1 Furnish fan performance ratings and fan curves with specified operating point clearly plotted.

1.4.2 Furnish drawings indicating unit dimensions, required clearances, field connection locations, wiring diagrams, shipping drawings, and curb drawings.

1.4.3 Furnish performance report showing unit level performance data including: fan(s), motor(s), coil(s) and other functional components. Performance report shall also include unit casing performance.

1.4.4 Furnish operation and maintenance data, including instructions for lubrication, filter replacement, motor and drive replacement, and condensate pan cleaning; spare parts lists, and wiring diagrams.

1.4.5 Adjust and report performance ratings for the proper altitude of operation.

1.4.6 Report air-handling unit performance ratings in accordance with ANSI/AHRI-430 (static pressure, airflow, fan speed, and fan brake horsepower).

1.4.7 Report static pressure profiles by component section.

1.4.8 Report coil ratings in accordance with AHRI-410 (capacities and pressure drops).

1.4.9 Report unweighted octave band AHU sound power for inlets and outlets rated in accordance with AHRI Standard 260. Provide eight data points, the first for the octave centered at 63 Hz, and the eighth centered at 8,000 Hz. Manufacturer shall not use sound estimates based on bare fan data (AMCA ratings), nor use calculations like the substitution method based on AHRI 260 tests of other AHU products. Provide data for inlets and outlets as scheduled. Report unweighted casing radiated sound power over the same 8 octave bands in accordance with ISO 9614 Parts 1&2 and ANSI S12.12.

1.4.10 Airflow measuring device performance shall be certified and rated in accordance with AMCA-611. Report data in accordance with AMCA-611. Provide AMCA Certified Rating Seal for Airflow Measurement Performance.

1.4.11 Report panel deflection at +/-8" w.g., stated in terms of 'L/X' where 'L' is the casing panel length and 'X' is a constant provided by the AHU manufacturer.

1.4.12 Report casing leakage rate at +/-8" w.g., specified in terms of percentage of design airflow.

1.4.13 Report weight loads and distributions by component section.

1.4.14 Report product data for filter media, filter performance data, filter assembly, and filter frames.

1.4.15 Report electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

1.4.16 Report motor electrical characteristics.

1.5. SUBMITTAL DOCUMENTATION REQUIRED

1.5.1 Report electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

1.5.2 Comply with ASHRAE 62, Section 5 (mold and corrosion resistant casings, filters upstream of wetted surfaces, and drain pan design).

1.5.3 Comply with ASHRAE 62, Section 7 (practices to be followed during construction and startup). Protect equipment from moisture by appropriate in-transit and on-site procedures.

1.5.4 Follow manufacturer's recommendations for handling, unloading and storage.

1.5.5 Protect, pack, and secure loose-shipped items within the air-handling units. Include detailed packing list of loose-shipped items, including illustrations and instructions for application.

1.5.6 Protect, pack and secure controls devices, motor control devices and other electronic equipment. Do not store electronic equipment in wet or damp areas even when they are sealed and secured.

1.5.7 Enclose and protect control panels, electronic or pneumatic devices, and variable frequency drives. Do not store equipment in wet or damp areas even when they are sealed and secured.

1.5.8 Seal openings to protect against damage during shipping, handling and storage.

1.5.9 Wrap indoor units with a tight sealing membrane. Wrapping membrane shall cover entire AHU during shipping and storage. Cover equipment, regardless of size or shape. Alternatively AHU must be tarped for shipment and storage.

1.5.10 Wrap equipment, including electrical components, for protection against rain, snow, wind, dirt, sun fading, road salt/chemicals, rust and corrosion. Keep equipment clean and dry.

1.5.11 Clearly mark AHU sections with unit tag number, segment sequence number, and direction of airflow. Securely affix safety-warning labels.

Extra Materials required:

1.5.12 Provide one set of filters for balancing, and one additional set for final turnover to owner.

1.5.13 Provide one extra set of belts, in addition to the factory-installed set.

1.6 WARRANTY

1.6.1 Provide warranty for 18 months from date of shipment. Warranty shall cover manufacturer defects. Warranty work shall be performed by manufacturer's factory-trained and factory-employed technician.

1.6.2 Include factory-provided controls in the parts warranties.

1.6.3 Parts associated with routine maintenance, such as belts and air filters shall be excluded.

1.7 SYSTEM STARTUP

1.7.1 Contractor shall clear ductwork prior.

1.7.2 Contractor shall not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.7.3 Comply with manufacturer's start-up requirements to ensure safe and correct operation and integrity of warranty.

2.0 ACCEPTABLE MAUFUACTURES

2.0.1 Basis-of-Design Product:

A. YORK Solution™ Outdoor by Johnson Controls Inc.

Alternately, provide product, subject to compliance with requirements, by one of the following:

B. Daikin Applied Custom

C. Trane Performance Climate Changer, Model CSAA

D. Temtrol Model ITF

E. Approved Equal (Prior Written Approval by Engineer of Record is Required)

2.1. ENVIRONMENTAL AND HAZARDOUS MATERIAL HANDLING

2.1.1. The Contractor shall comply with all of Veteran Affairs Medical Center Environmental Practices for Projects and Services.

3.0. GENERAL SCOPE

3.0.1. Air Handling Unit(s) (AHU) shall consists of a structural base, insulated casing, access doors, fans, motors, motor controls, coils, filters, dampers, controls, components, and accessories; as shown on drawings, schedules, and specifications.

3.0.2. Provide AHU to meet the specified levels of performance for scheduled items including airflow, static pressure, cooling capacity, heating capacity, electrical characteristics, sound, casing leakage, panel deflection and casing thermal performance.

3.0.3. Provide AHU to meet the specified levels of performance for scheduled items including airflow, static pressure, cooling capacity, heating capacity, electrical characteristics, sound, casing leakage, panel deflection and casing thermal performance.

3.0.4. AHU shall maintain structural integrity when wall panels are removed.

3.0.5. Provide internal components and accessories as specified and scheduled. Components and accessories shall be installed by the AHU manufacturer in an ISO-9002 certified facility.

3.0.6. Unit[s] shall be ship in one piece. Split unit(s) only where necessary for shipping and installation.

3.0.7. Manufacturer shall provide detailed, step-by-step instructions for disassembly and reassembly.

3.0.8. For AHU segments that must be broken down for rigging and installation: segment shall be disassembled and reassembled by manufacturer's factory-trained service personnel.

3.0.9. Manufacturer shall perform a field leakage test to confirm 1% maximum leakage per Section 2.27. Manufacturer shall provide a written statement confirming that the unit is built to the manufacturer's factory standards and that the unit will carry the full warranty.

3.1. **STANDARDS COMPLIANCE**

3.1.1. Manufacturer Manufacturer shall comply with ratings and certifications referenced in this specification.

3.1.2. Manufacturers who do not comply with ANSI/AHRI-430 shall factory test EACH unit to verify brake horsepower rating, airflow performance and total static pressure performance. See specification Section 2.27 (VERIFICATION OF PERFORMANCE) for testing requirements.

3.1.3 Manufacturers who do not conform to requirements of AHRI 260 for ducted discharge and return air sound shall submit EACH unit to an independent sound test laboratory for AHRI 260 testing. The test laboratory shall conform to AHRI 260, Section 4.4, Test Equipment and Facilities.

3.2 REQUIREMENTS

BASE RAIL

A. Unit(s) shall be provided with structural base rail under the full perimeter of the unit, formed from mill galvanized steel

B. Structural steel shall be installed providing clearance for proper external trapping of drain pans and steam condensate.

C. Unit(s) shall be provided with base rail and lifting lug system that does not require additional support for rigging. Include base rail lifting lugs at unit corners.

CASING

A. Casing construction shall not rely on the casing panels for structural integrity.

B. Casing panels shall be 2” double-wall construction with thermal break. Thermal break shall be between interior and exterior liner of the panel assembly, and between the panel and casing framework.

C. Provide casing with minimum thermal resistance (R-value) of 13 hr-ft2-°F/BTU. Exposed insulation is not acceptable.

D. Casing panel insulation shall be injected polyurethane foam. Foam insulation shall be manufactured by EcoMate®. Rigid foam board panels shall not be used.

E. Casing panels with perforated interior liners (perforated panels) shall be provided where indicated on the drawings and/or schedule. Perforated

panels shall be a hybrid combination of 1” fiberboard and 1” injected polyurethane foam. Foam insulation shall be manufactured by EcoMate®. Rigid foam board panels shall not be used. Minimum perforated panel thermal resistance (R-Value) shall be R11 hr-ft2-°F/BTU.

F. All exterior casing panels (roof, wall, floor, access door) shall be made of galvanized steel. All interior casing panels shall be made of stainless steel.

G. Panel assembly shall meet UL standard 1995 for fire safety. Panel insulation shall comply with the requirements of NFPA 90A.

H. Insulation system provided shall be resistant to mold growth in accordance with a standardized test method such as UL 181 or ASTM C 1338.

I. Encapsulate insulation with sheet metal so that air does not contact insulation. Solid lined double-walled panels insulated with injected foam shall be hermetically sealed at each corner and around their entire perimeter to eliminate airflow through the panel and to eliminate microbial growth potential within the casing wall.

J. Unit shall conform to ASHRAE Standard 111 Class 6 for casing leakage no more than 1% of design airflow at 1.25 times design static pressure up to a maximum of +8 inches w.g. in positive pressure sections and -8 inches w.g. in negative pressure sections down to a minimum of 50 CFM measurable leakage or 5,000 design CFM.

K. Provide wall panels and access doors that deflect no more than L/240 when subjected to 1.5 times design static pressure up to a maximum of +8 inches w.g. in positive pressure sections and -8 inches w.g. in negative pressure sections. ‘L’ is the panel-span length and ‘L/240’ is the deflection at panel midpoint.

L. Provide floors and roofs that deflect no more than L/240 when subjected to a 300 lb static load at mid-span. ‘L’ is the panel-span length and ‘L/240’ is the deflection at panel midpoint.

M. Provide outdoor AHUs with a roof system that deflects no more than L/240 when subjected to a static snow load of 30 lb./ft2. ‘L’ is defined as the panel-span length and ‘L/240’ is the deflection at the panel midpoint.

N. Condensation shall not form anywhere on unit exterior at X supply air and Y DB / Z WB exterior ambient. Manufacturer shall supply an external condensation performance line, plotted on the psychrometric chart, based on actual test data. Plot will show the exterior conditions at which unit will sweat given the design supply air temperature. Manufacturer shall clearly indicate whether the design conditions will or will not result in external condensation

forming anywhere on the unit exterior. If the unit will sweat, indicate where sweating will occur. Unit exterior includes the base, base rail, roof, corners, doors, door frames, and under the cooling coil drain pan.

O. Condensation shall not form anywhere on unit exterior at 53 deg F supply air and 81 deg F DB / 73 deg F WB exterior ambient. Manufacturer shall supply an external condensation performance line, plotted on the psychrometric chart, based on actual test data. Plot will show the exterior conditions at which unit will sweat given the design supply air temperature. Manufacturer shall clearly indicate whether the design conditions will or will not result in external condensation forming anywhere on the unit exterior. If the unit will sweat, indicate where sweating will occur. Unit exterior includes the base, base rail, roof, corners, doors, door frames, and under the cooling coil drain pan.

ROOF SYSTEM

A. Roof system outer layer

1. Shall have no points of penetration.
2. Shall use no fasteners.
3. Shall have no metal-to-metal seams joints.
4. Shall not use or require caulking.

B. Roof system shall be warranted by manufacturer against water penetration for a period of 10 years.

C. Roof system shall be sloped with a minimum pitch of 1/8" per foot.

D. Roof system shall overhang side and end panels by a minimum of 2”.

E. Doors shall have drip edge guard above door frame. Drip edge guard shall extend 2” beyond door surface.

F. Field connection at roof of section splits shall not require use of fasteners, sealants or metal seam caps.

ACCESS DOORS

A. Provide double wall access door(s) that meet requirements for the AHU casing.
B. Thermal break door(s) shall incorporate a thermal break in both the door frame and the door panel.

C. Provide industrial-style stainless steel hinges that permit 180 degrees of door swing.

F. Provide latches with roller cam mechanisms that ensure a tight seal. Rotating knife-edge or “paw” latches are not acceptable.

D. Provide each door with a single handle linked to multiple latching points or a separate handle for each latching point. Doors serving access segments shall have an interior latch handle.

E. Provide access doors with a locking hasp to accommodate a lockout device.

F. Provide double-pane viewing windows. Windows shall be a non-condensing type consisting of a desiccant dehumidification layer. Minimum dimension shall be 3” x 8”.

COILS: HEATING AND COOLING

GENERAL DESCRIPTION

A. Coils shall meet or exceed performance scheduled on drawings.

B. Coils shall be provided with performance certified in accordance with AHRI Standard 410 for coil capacity and pressure drop, wherever applicable.

C. Coils circuits shall be designed such that the fluid velocity is within the range of certified rating conditions at design flow.

D. Cooling coils shall be provided with a maximum face velocity as scheduled. Face velocity calculations shall be based on the finned area of the coil.

E. Cooling coil shall be provided with drain pan that is sufficient to contain coil condensate. Drain pan shall extend a minimum of [6”], downstream of the face of the coil.

F. Coil segment casing shall accommodate full-face or reduced-face coils as scheduled. Face and bypass coil segments shall be provided with factory installed bypass damper.

G. Access shall be provided of at least [18”], between coils. Access panel or door shall be easily operable and are easily removable with no special tools, as shown on drawings.

H. Access doors shall be located to provide clearance for pipe insulation, connectors, and accessories. Space shall allow a minimum of 90 degrees of door swing.

I. Coils shall be built in their own full perimeter frame. Tube sheets on each end shall have fully drawn collars to support and protect tubes. Horizontal coil casing and support members shall allow moisture to drain. Casing and support members shall not block finned area.

J. Individual coils shall be removable from the side of the AHU.

K. Intermediate drain pan shall be provided on stacked cooling coils. Intermediate drain pan shall slope in a minimum of two planes toward a single drain connection.

L. A single intermediate vertical coil support shall be provided on coils with a finned length greater than 62." Two vertical supports shall be provided on coils with a finned length greater than 100," and three vertical supports on coils with a finned length greater than 141."

M. Staggered Coil bank shall be provided. Each connection shall be provided with 1/4" FPT plugged vent/drain tap. Circuiting shall allow draining and venting when installed. Vent, drain, and coil connections through AHU casing shall be extended.

N. Gap between coil stub out connection and AHU casing, shall be insulated with a spool-shaped sleeve grommet. Adhesive rings applied to the casing walls shall not be acceptable.

O. Water and glycol coils shall be operable at 325 psig working pressure and up to 250 deg F. Factory test water and glycol coils with 325 psig compressed air under water. Water coils shall conform to Subsection 12.3, "Water-Containing Parts," of UL-207, "Standard for Safety: Refrigerant – Containing Components and Accessories, Nonelectrical."

P. Direct expansion (DX) coils shall conform to UL-207, "Standard for Safety: Refrigerant –Containing Components and Accessories, Nonelectrical," when operating with a maximum refrigerant pressure of 325 psig. Factory shall test DX coils with 325 psig compressed air under water. DX coils shall be dehydrated and sealed prior to installation.

Q. Steam distributing coils shall be operable at 50 psig pressure and a corresponding saturated steam temperature of 298□ F. Factory test steam

coils with 315 psig compressed air under water. Dehydrate and seal coils prior to shipping.

R. Steam-distributing coils shall be provided with a tube outer diameter (OD) of 1" and an inner distribution tube of 5/8" O.D. Circuit coils for gravity drain of condensate without trapping. Steam shall discharge in the direction of condensate flow to ensure even heat transfer across each tube.

S. Water, glycol and DX coils shall be provided with a tube OD of 1/2” or 5/8”. Mechanically expand tubes shall form fin bond and provide burnished, work-hardened interior surface.

T. Water, glycol and steam coil headers shall be made of seamless copper or brass tubing. Pipe connections shall be steel or red brass. Header connections (tubes and piping connections) shall be silver-brazed or TIG welded.

U. DX coils shall be provided with brass distributor and solder-type connections. Suction and discharge connections shall be on the same end regardless of coil depth. DX coils shall be provided with a hot gas bypass port on distributor.

V. Continuous aluminum or copper fins shall be provided for coils with die-formed fins. Fins shall have fully drawn collars to accurately space fins and protect tubes. Fins shall be 0.006" or 0.008 or 0.01" thick.

W. Coil coatings shall be provided as scheduled or indicated on drawings.

PRIMARY DRAIN PANS

A. Unit(s) shall be provided with a drain pans under each cooling coil and humidifier.

B. Provide drain pan under the complete width and length of cooling coil and humidifier sections. Drain pan shall be full width, and extend a minimum of 6” downstream of cooling coil.

C. Drain pans for cooling coils and humidifiers shall meet the requirements of ASHRAE 62.

D. Drain connection shall be made of same material as drain pan. Dissimilar metals shall not be used to mitigate risk of galvanic corrosion. Drain connection shall be welded to the drain pan.

E. Drain pan shall be double wall with an insulation R-value of 6.25 hr-ft2-°F/(BTU-in).

F. Drain pan shall have minimum of 2” of injected polyurethane foam insulation under the entire bottom surface of the drain pan. Drain pan shall be foam injected as a complete assembly and shall include thermal breaks at connection points to unit casing. Foam insulation shall be manufactured by EcoMate®.

G. Drain pan shall allow visual inspection and physical cleaning on 100% of the pan surface without removal of the coil or humidifier.

H. Provide a minimum of 1” clearance between the drain pan and any coil casing, coil support or any other obstruction.

I. Provide drain pan that allows the design rate of condensate drainage regardless of fan status.

J. Provide drain pan sloped in at least two planes by at least 1/8” per foot toward a single drain. Locate drain connection at the lowest point of the pan. Pan shall have no horizontal surfaces.

PIPE CHASE CABINET

A. Provide pipe chases with double wall, insulated panels. Pipe chase shall have the same thermal performance as the unit casing.

B. Provide a perimeter base rail and/or roof curb under the pipe chase[s] that meets requirements for the AHU base rail and/or roof curb.

C. Manufacturer may combine the pipe chase enclosures of adjacent segments.

D. Provide a minimum pipe chase depth, as shown on drawings. Pipe chase depth is the clear inside dimension from inner pipe chase surface to outer unit surface.

E. In case, pipe chases shipped separate from AHU, manufacturer shall provide chases with lifting lugs for field installation per the AHU base rail requirements ‘if required’.

F. Manufacturer shall provide step-by-step instructions with illustrations for proper pipe chase installation.

SERVICE VESTIBULE

A. Service vestibule shall extend the full-length of the main unit.

B. Service vestibule shall be integral to unit housing and shall not be a separate section for factory or field attachment.

C. Service vestibule shall have continuous roof system as an integral part of unit housing and shall conform to requirements outlined in “ROOF SYSTEM” section.

ROOF CURBS

A. Provide factory-fabricated galvanized steel roof curb. Roof curb shall support the full-perimeter of the air handling equipment, including pipe chases.

B. Match roof curb to roof slope. Curb surface shall be level in both axes.

C. Provide wood nailing strip to which roofer may nail roof flashing.

D. Ship roof curb loose for field installation prior to unit placement.

FANS

A. Unit[s] shall be provided with fans as shown on equipment schedule and drawings.

B. The fan section shall be provided with an access door on the drive side of the fan.

C. Fans shall be provided with the following safety accessories:
   1. Fan inlet screens in the inlets of fan housing
   2. Fan cage on discharge of fan housing

D. Mount the fan and motor assembly on a common adjustable base. This common base shall attach to vibration isolators, which mount to structural support channels. These channels shall span the AHU floor and mount directly to the AHU frame. Manufacturers not complying with this requirement must submit detailed structural and weight data to a licensed structural engineer for review and stamped certification. The mechanical engineer shall review these engineers’ final reports prior to submittal approval.

E. Provide vibration isolation, as scheduled.

F. DWDI fans shall be connected to the unit casing or bulkheads with canvas flexible connection.

G. Provide horizontal thrust restraints between AHU casing and fan housings with end discharge. This requirement applies to the following cases:
1. SWSI fans operating at greater than 3” of total static pressure

G. DWDI airfoil fans operating at greater than 6” of total static pressure

I. Bearings shall be offered either with sealed bearings (permanent lubrication) or with serviceable bearings to facilitate periodic relubrication. Bearings requiring relubrication shall offer grease lines extended from the bearing to an accessible location on the fan-support bracket on the drive side of the fan.

K. Piezometer Ring: Airflow station shall be factory installed at fan inlet. The device shall have a measurement accuracy of ± 5%. Tubing shall be field-installed.

BEARINGS AND DRIVES

A. Unit[s] fans shall be provided with bearings complying with ANSI/AFBMA 9 for fatigue life ratings and with an average life L10 of at least 200,000 hours, as scheduled.

B. Forward curved fans smaller than 18” shall be provided with permanently lubricated bearings. For other fans, manufacturer shall provide re-greaseable bearings with hydraulic grease fittings and lube lines extended to the motor side of the fan or to the exterior of the unit [primary access side].

C. Fans shall be provided drives selected with a 1.5 service factor. Sheaves shall be machined from a close grain cast iron and statically balanced by the manufacturer.

D. Fixed pitch sheaves shall be provided on both the fan and motor. Fans with motors rated at 15 HP or less may be field balanced using variable pitch sheaves. Fixed pitch sheaves shall be provided when final balance is complete. Air balancer shall select and provide final set of sheaves.

E. For Belt-driven fans with 10 HP motors or greater shall be provided with multiple belt drives. Belts shall be V-type, precision molded, raw edge construction, anti-static, oil- and heat-resistant.

Direct-Drive Fans (Single or Dual)

A. Plenum (SWSI) Fan
1. Plenum fan wheel shall be single-width, single-inlet, with [9], blades.
2. Plenum fan blades shall be aluminum backward-inclined airfoil.
3. Plenum fan shall be direct-driven.

ELECTRICAL MOTORS

A. Fan motors shall be built in accordance and comply with the latest standards of the NEMA and IEEE.
B. AHU and fan motors shall comply with ASHRAE 90.1.
C. Fan motors shall be provided with the following characteristics:
1. Voltage, Frequency and Phase, as scheduled.
2. Motor RPM, as scheduled
3. Minimum service factor of 1.15
4. Premium efficiency, or as required to meet ASHRAE 90.1
5. NEMA design ball bearing type
6. Rated for continuous duty at full load in a 104□F [40□C] ambient
7. Open drip proof (ODP) or totally enclosed, fan cooled (TEFC) as scheduled.
8. Suitable for use in variable frequency application, per NEMA MG-1 Part 30
9. Premium Efficiency Inverter ready per NEMA STD MG1 PART 31.4.4.2

FAN-MOTOR DISCONNECTS

A. Manufacturer shall provide UL or ETL listed fan-motor disconnects and associated components, as scheduled and shown on drawings. Disconnects shall comply with applicable provisions of the National Electric Code.
B. Fused or non-fused fan-motor disconnects shall be provided in NEMA 1, NEMA 3R, NEMA 4, NEMA 12 enclosures, as scheduled or as shown on drawings.
C. Disconnects shall be mounted on the primary access side of the associated fan segment. Whereas, unit main disconnect shall be mounted on the primary access side of supply fan section.
D. Disconnect shall be suitable for use as an OSHA lockout/tagout disconnect when applied in accordance with part IV, Department of Labor OSHA 29 CFR Part 1910, Control of Hazardous Energy Source (lockout/tagout): final rule.
E. Disconnect handles shall be lockable in the “off” position with up to three padlocks. Switch mechanism shall be directly lockable in the “off” position via padlock when door is open.
F. Disconnects shall be provided with integral ground lug.
1. Provide two (2) #14 ground wires on 16A to 100A disconnects.
2. Provide one (1) #6-250 ground wire on 200A to 400A disconnects.
G. Auxiliary contacts shall be provided as scheduled.

ACROSS-THE-LINE FAN-MOTOR STARTERS

A. Manufacturer shall provide UL or ETL listed motor starters and associated components, as scheduled and shown on drawings. Starters shall comply with applicable provisions of the National Electric Code.

B. Starter shall be provided in a NEMA 3R enclosure.

C. Starter shall be mounted on the primary access side of its associated fan section, and wire starter to motor, unless shown otherwise on drawings.

Starter panel shall consist of following features :

1. Main power block
2. Motor contactor(s)
3. Individual starter short circuit and overload protection devices
4. Two primary control fuses, one secondary control line size fuse
5. Three phase ambient compensated overload heater elements
6. 115-Volt control power transformer with primary and secondary protection
7. Five-point terminal strip for field control connections
8. Factory wired, non-fused, fused main power disconnect, integral with starter panel
9. Integrated on/off auto switch.
10. Wiring to fan motor

Starters on outdoor units shall be suitable for use in ambient temperatures from 5 F to 104 F:

1. Provide low ambient temperature kit suitable for use down to -20□F.
2. Provide high ambient temperature kit suitable for use up to 135□F.

FAN-MOTOR VARIABLE FREQUENCY DRIVES (VFDS)

A. Manufacturer shall provide UL or ETL listed VFDs and associated components, as scheduled and shown on drawings. VFDs shall comply with applicable provisions of the National Electric Code.

B. VFDs shall be mounted in a dedicated NEMA 1 compartment located on the primary access side of its associated fan section and wire VFD to motor, unless otherwise indicated on drawings.

C. Outdoor VFDs shall be enclosed in a NEMA 3R enclosure.

D. VFDs on outdoor units shall be suitable for use in ambient temperatures from 5F to 104F:

1. Provide low ambient temperature kit suitable for use down to -20□F.
2. Provide high ambient temperature kit suitable for use up to 135□F.

E. After unit installation, VFD shall be started and programmed by a factory trained and employed service technician. Refer to Section 3.05.

F. Unit(s) shall be provided with following VFD disconnect and bypass

1. Non-Fused, Fused main disconnect
2. 2 contactor VFD bypass with VFD service input switch and Non-Fused, Fused main disconnect

Unit(s) shall be provided with harmonic distortion feedback protection:

1. Equivalent 5% impedance input line reactor
2. Integral RFI/EMI filtering to meet EMC EN61800-3 for First Environment

Unit(s) shall be provided with a user interface consisting of following features:

1. 30 Character multi-lingual alphanumeric display
2. Parameter set-up and operating data
3. Display data shall include:

a) output frequency (Hz)
b) speed (RPM)
c) motor current
d) calculated % motor torque
e) calculated motor power (kW)
f) DC bus voltage
g) output voltage
h) heat sink temperature
i) elapsed time meter (re-settable)
j) kWh (re-settable)
k) input / output terminal monitor
l) PID actual value (feedback) & error
m) fault text
n) warning text
o) scalable process variable display

VFD shall be provided with the following protection circuits

1. over current
2. ground fault
3. over voltage
4. under voltage
5. over temperature
6. input power loss of phase
7. loss of reference/feedback
8. adjustable current limit regulator
9. VFD shall be UL 508C approved for electronic motor overload (12t).

VFD shall be provided with features for high input transient protection and surge suppression, such as

1. 4 MOVs ahead of diode bridge
2. 120 Joule rated 1600V diode module
3. Compliant with UL 1449 / ANSI 61.4

L. VFD shall be provided with the following communication features:

1. Two programmable analog inputs
2. Six programmable digital inputs
3. Two programmable analog output
4. Three programmable digital relay outputs
5. Modbus RTU Communications protocol
6. Adjustable filters on analog inputs and outputs
7. Input speed signals, including 4-20 mA and 0-10 VDC
8. Accel/Decel contacts [floating point control]
9. Auto restart [customer selectable and adjustable]
10. Start/Stop options shall include [2 wire dry contact closure], application of input power, and application of reference signal (PID sleep/wake-up).
11. Integrated control interface for Siemens FLN, Johnson N2, Modbus RTU, BACnet MS/TP or LONWorks over RS-485.

VFD shall consist of the following functions:

1. Pre-magnetization on start
2. DC braking/hold at stop
3. Ramp or coast to stop
4. Seven preset speeds
5. Three critical frequency lockout bands
6. Start function shall include ramp, flying start, automatic torque boost, and automatic torque boost with flying start

FACTORY INSTALLED ELECTRICAL ACCESSORIES

A. In addition to motor power terminals, unit(s) shall be provided with an independent power terminal for convenience receptacles and lights.

B. All switches shall be provided as shown on drawings.

C. Unit[s] shall be provided with LED (light emitting diode) lights in segments as scheduled or shown on drawings.

D. On supply fan segment 120V convenience receptacle shall be provided.

FACTORY PACKAGED CONTROLS

A. All factory wiring shall be internal to the unit to maintain product standards for less than 1% air leakage.
B. All wiring at unit splits shall be connected with quick-connects - no field splicing of wiring is allowed.
C. Control panels shall be factory mounted and all end devices shall be terminated either directly to the controller or to a terminal block.
D. Control panels shall include integral 24VAC transformers with circuit breaker overloads.
E. No low voltage controls or communication wiring shall be running in the same tray, conduit or proximity as any high voltage wiring
F. Averaging temperature sensors shall be mounted to cover as much cross-sectional area of the interior unit as possible. End and support brackets shall be provided to support sensing element and eliminate strain
G. For mounting probe temperature sensing elements at discharge and air inlet openings, support brackets shall be provided a solid mounting location to minimize vibration effects
H. All actuators for control dampers shall be mounted within the frame of the damper. Actuators shall be mounted on the access side of the damper to facilitate commissioning and servicing
I. Low temperature cut out sensors shall be mounted on downstream face of first water coil within the coil housing frame.
J. High temperature cut out sensors shall be mounted, so that the manual reset switch is accessible from the fan section access door. The temperature sensor shall be mounted in the discharge air stream.
K. High and low pressure cutout devices shall be mounted so that the manual reset switch is accessible from the fan section access door without putting operator at risk.
L. The differential pressure switch for filters shall have pressure pick up points located on either side of the filter section.
M. Factory mounted control panels shall be mounted to the exterior wall of the supply fan section. Internal unit wiring is brought into the panel through a single rear knockout. The penetration shall be sealed to prevent air and leakage moisture leakage. Unless single point power optional is selected, power to the control panel shall be provided with a field–supplied connection.
N. Factory packaged controls shall be factory tested using a functional test method. All inputs [AI, BI, DI] and outputs [AO, BO, DO] shall be tested. All sensors and switches shall be cycled through a change of state. All actuators shall be stroked to verify correct operation and rotation through the full operating range. The factory test data results shall be fully documented including all operational conditions. A factory test report document shall be available for each unit. The factory test report shall be provided to the commissioning agent.

FILTERS

A. Unit[s] shall be provided with filter segments consisting of filters and frames as scheduled.

B. Side or front loading filters for filter segments located upstream of coil segment(s) shall be provided with an access door on the drive side through which filters can be easily loaded.
C. Segments located downstream of coil segment(s) shall be provided with face loading filters. Access plenum and access door of 18” [minimum] shall be provided on the drive side through which face loading filters can be easily loaded.
D. Class 2 or Class 1 filter media shall be provided per U.L. 900 and as required by local codes.
E. Filter types, efficiencies, and nominal depths shall be as follows:
1. Flat filters – 2” throwaway, 2” permanent cleanable, 2” 30% pleated, or 4” 30% pleated filters, as scheduled.
2. Angled filters – 2” throwaway, 2” permanent cleanable, or 2” 30% pleated filters, as scheduled.
3. Rigid filters – 4” mini pleated, 12” rigid, or 22” bag filters with efficiencies of [90-95%, MERV 15], respectively; as scheduled.
4. Carbon filters – 2” deep rechargeable, incinerable, or disposable panels filled with 60% activity carbon, as scheduled.
5. HEPA filters – 12” 99.97%, or 99.99% efficient media, as scheduled.
F. A pre-filter rack shall be provided in rigid filter segments. Pre-filters shall have 2” throwaway, 2” permanent cleanable, 2” 30% pleated, or 4” 30% pleated filters as scheduled.
G. Carbon filtration system shall be designed for a minimum contact efficiency of 99% with a residence time of at least 0.08 seconds.
H. Provide post-filter and/or pre-filter rack in carbon filter segments with 2” throwaway, 2” permanent cleanable, 2” 30% pleated, or 4” 30% pleated filters, as scheduled.
I. Performance of installed filtration system shall be certified via a DOP test and classified as UL Class 1 when tested in accordance with UL Standard 586.
J. Filter frame shall be specifically developed for HEPA filters, with appropriate quantities of filter clamps.
K. Flush mounted, factory installed differential pressure gage on the drive side of unit shall be provided to measure pressure drop across filters. Manufacturer shall provide fully functional gauges, complete with tubing.

DAMPERS

A. Dampers provided shall be tested in accordance with AMCA 500.
B. Factory-installed dampers shall be provided, as shown on drawings.
C. Dampers shall have airfoil blades, extruded vinyl edge seals, and flexible metal compressible jamb seals.
D. Dampers shall have a maximum leakage rate of 4 CFM/square foot at 1" w.g., and shall comply with ASHRAE 90.1.

E. Damper blades shall be parallel acting unless otherwise indicated.
F. Damper blades shall be galvanized steel or aluminum, as scheduled.

UVC FIXTURES

A. Fixtures have been tested, listed and labeled as UL/C-UL under Category Code ABQK (Accessories, Air Duct Mounted), UL Standards: 153, 1598 & 1995 respectively.
B. Fixtures meet the “UL” drip proof design and each fixture is equipped with an electrical interlock.
C. Each lamp contains no more than 5.5 milligrams of mercury consistent with current environmental practices while producing the specified output at 500 fpm in temperatures of 55-135□ F.
D. Useful lamp life shall be 9000 hours with no more than a 20% output loss at the end of one year of continuous use. They are constructed with UVC proof metal bases and shall not produce ozone.

AIRFLOW MONITORING STATIONS

A. Optional airflow monitoring stations shall be provided on air inlets, as shown in performance specifications.
B. Airflow monitoring stations shall bear the AMCA Certified Ratings Seal for Airflow Measurement Performance.
C. Airflow monitoring station dampers shall comply with leakage rates per ASHRAE 90.1.
D. Airflow monitoring stations shall be accurate within 5% of actual airflow between 300 FPM and 3000 FPM free area velocity.
E. Factory installed transducer that sends a CFM-proportional, 4-20 mA or 0-10V signal shall be provided only when factory packaged controls option is selected.

DIFFUSERS

A. Diffuser segments shall be provided, as shown on product drawings.
B. Perforated steel diffuser plates shall be installed between fans and downstream components when required to ensure proper velocity profiles across downstream components.

AIR BLENDERS

A. Multiple-blade, air-mixer assembly shall mix air to prevent stratification.
B. Air blenders shall be of the rotary turbulating design consisting of radially extending blades. Units shall be completely fixed devices, with no moving parts.
C. Static air mixers material shall be .080” or .125” thick aluminum [.095” 304 Stainless Steel]. Static air mixers shall be welded.
D. When multiple air blenders are used, they shall impart a counter rotational mixing of the airstreams relative to each other. Simple mixing devices that do

not produce expanding discharge with counter rotational mixing will not be acceptable.
E. The air blenders shall be installed such that the blender shall be capable of providing a minimum mixing effectiveness of 75% and ± 6 °F standard deviation when mixing 50% OA with 50% RAS at 50 °F inlet temperature differential, and minimum mixing effectiveness of 80% and ± 5 °F standard deviation when mixing 30% OA with 70% RAS at 50 °F inlet temperature differential.

APPURTENANCES

A. Rain hoods shall be provided on outdoor unit air intakes, as shown on drawings. Moisture screens shall be provided on outdoor air inlet rain hoods.
B. Steel, [structural formed or welded] base rails suitable for rigging and lifting shall be provided, as shown on product drawings.
C. Safety grates over bottom openings shall be provided, as shown on drawings. Safety grates shall be capable of supporting a 300 lb. center load.
D. Lifting lugs shall be provided where required.

EXTERIOR FINISHES

A. Manufacturer shall clean the exterior surfaces of units prior to application of exterior protective coating.
B. Manufacturer shall paint exterior surfaces of outdoor units prior to shipment.
1. Manufacturer shall apply a primer prior to application of finish coating.
2. Exterior finish coating shall show a breakdown of less than 1/8” on either side of a scribed line when subjected to ASTM B117 2,000 hour, 5% salt spray conditions. This is equivalent to an ASTM D1654 rating of ‘6.’ Also, per ASTM D610, degree of rusting to meet #8-G and per ASTM D714 degree of blister to meet #6 medium.

3.3 INSTALLATION

A. Install equipment per industry standards, applicable codes, and manufacturer’s instructions.
B. AHUs shall not be used for temporary heating, cooling or ventilation prior to complete inspection and startup performed per this specification.
C. Install AHUs on a concrete pad, roof curb, or structural steel base, as shown on drawings.

D. Install AHUs with manufacturer's recommended clearances for access, coil pull, and fan removal.
E. One complete set of filters shall be provided for testing, balancing, and commissioning. Provide second complete set of filters at time of transfer to owner.
F. Install AHU plumb and level. Connect piping and ductwork according to manufacturer's instructions.
G. Install seismic restraints and anchors per applicable local building codes. Refer to specification Section 230548 (15240 / 15070) for product and installation requirements.
H. Install pipe chases per manufacturer's instructions.
I. Insulate plumbing associated with drain pan drains and connections.
J. Install insulation on all staggered coil piping connections, both internal and external to the unit.

FIELD QUALITY CONTROL

A. AHU shall be stored as per manufacturer's written recommendations.
B. AHUs shall be stored indoors in a warm, clean, dry place where unit(s) will be protected from weather, construction traffic, dirt, dust, water and moisture. If unit(s) to be stored for more than 6 months, manufacturer's instruction for long-term storage shall be followed.
C. Rig and lift units shall be according manufacturer's instructions.

AHU INSPECTION

A. Hire manufacturer's factory-trained and factory-employed service technician to perform an inspection of unit and installation prior to startup. Technician shall inspect and verify the following as a minimum:
3. Damage of any kind
4. Level installation of unit
5. Proper reassembly and sealing of unit segments at shipping splits.
6. Tight seal around perimeter of unit at the roof curb
7. Installation of shipped-loose parts, including filters, air hoods, bird screens and mist eliminators.
8. Completion and tightness of electrical, ductwork and piping
9. Tight seals around wiring, conduit and piping penetrations through AHU casing.
10. Supply of electricity from the building's permanent source
11. Integrity of condensate trap for positive or negative pressure operation
12. Condensate traps charged with water
13. Removal of shipping bolts and shipping restraints
14. Sealing of pipe chase floor(s) at penetration locations.
15. Tightness and full motion range of damper linkages operate manually
16. Complete installation of control system including end devices and wiring
17. Cleanliness of AHU interior and connecting ductwork

18. Proper service and access clearances
19. Proper installation of filters
20. Filter gauge set to zero

INSPECTION AND ADJUSTMENT: AHU FAN ASSEMBLY

A. Hire the manufacturer's factory-trained and factory-employed service technician perform an inspection of the AHU fan assembly subsequent to general AHU inspection and prior to startup. Technician shall inspect and verify the following as a minimum:
1. Fan isolation base and thrust restraint alignment
2. Tight set screws on pulleys, bearings and fan
3. Tight fan bearing bolts
4. Tight fan and motor sheaves
5. Tight motor base and mounting bolts
6. Blower wheel tight and aligned to fan shaft
7. Sheave alignment and belt tension
8. Fan discharge alignment with discharge opening
9. Fan bearing lubrication
10. Free rotation of moving components rotate manually

B. Manufacturer shall dynamically balance fan/motor/base assembly.
1. Balance constant volume fan assemblies at design RPM.
2. Balance variable volume fan assemblies from 10% to 100% of design RPM.
3. Take filter-in measurements in the horizontal and vertical axes on the drive and opposite-drive sides of fan shafts.
4. Constant speed fan vibration limits: filter-in measurements shall not exceed 4 mils.
5. Variable speed fan vibration limits: filter -in measurements shall not exceed 7 mils.

C. Manufacturer shall hi-pot test wiring intended to carry voltages greater than 30VAC.

STARTUP SERVICE AND OWNER TRAINING

A. Manufacturer's factory-trained and factory-employed service technician shall startup AHUs. Technician shall perform the following steps as a minimum:
1. Energize the unit disconnect switch
2. Verify correct voltage, phases and cycles
3. Energize fan motor briefly ("bump") and verify correct direction of rotation.
4. Re-check damper operation; verify that unit cannot and will not operate with all dampers in the closed position.

5. Energize fan motors and verify that motor FLA is within manufacturer's tolerance of nameplate FLA for each phase.

B. Provide a minimum of 4 hours of training for owner's personnel by manufacturer's factory-trained and factory-employed service technician. Training shall include AHU controls, motor starter, VFD, and AHU.

C. Training shall include startup and shutdown procedures as well as regular operation and maintenance requirements.

D. If AHU is provided with a factory-mounted variable frequency drive (VFD), hire the VFD manufacturer's factory-trained and factory-employed service technician to inspect, test, adjust, program and start the VFD. Ensure that critical resonant frequencies are programmed as 'skip frequencies' in the VFD controller.

E. Submit a startup report summarizing any problems found and remedies performed.

FIELD PERFORMANCE VERIFICATION

A. Leakage: Pressurize casing to maximum operating static pressure [up to +/-8" w.g.] and measure leakage. If leakage exceeds 1% of design airflow, seal leakage points with a permanent solution. Repeat test. If the AHU still does not pass, contact the manufacturer to seal unit.

B. Submit a field test report with testing data recorded. Include description of corrective actions taken.

3.07 CLEANING

A. Clean unit interior prior to operating. Remove tools, debris, dust and dirt.

B. Clean exterior prior to transfer to owner.

3.08 DOCUMENTATION

A. Provide Installation Instruction Manual, & Startup checklist in the supply fan section of each unit.

B. Provide six copies of Spare Parts Manual for owner's project system manual.

4.0 Demolition

4.0.1 The contractor shall remove existing components and clean up any debris after project is completed.

4.1 Protection of Existing Work

4.1.1 The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass on or adjacent to the work site and which do not interfere with the work required under this contract. If any limbs are branches are broken during the contract performance by careless operation of equipment or employees, the contractor shall clean cut and paint the cut with a tree-pruning compound approved by the COR.

4.1.2 The Contractor shall protect from all damage of improvements and utilities at or near the work site and on adjacent property including those that are the property of a third party from failure to comply with the requirements and reasonable care while performing the work.

4.1.3 The contractor shall under regulations prescribed by the Contracting Officer to use only the established approved roadways. When materials or equipment are transported, vehicles must not exceed loading capacity recommended by manufacturer and local or state laws to include the load limit on the upper parking garage deck. When it is necessary for the contractor to cross curbs or sidewalks the contractor shall protect them from damage.

4.1.4 It is the responsibility of the contractor to repair suitably or replace all damaged property due to contractors' negligence.

4.2 Scheduling, Phasing, and Working Hours

Schedule of Contract

4.2.1 The contractor shall complete the work required under this scope in **calendar** 120 days or less from date of award. Extensions may be granted as directed by project VAMC management team. If the contractor proposes an earlier completion date, and the Government accepts the contractor's proposal, the contractors proposed completion date shall prevail.

4.2.2 Work at the West Palm Beach VAHCS site shall take place during normal working hours, Monday through Friday 8am-430pm. or as approved by the COR.

4.2.3 The contractor shall not commence performance of the tasks in this scope until approved by the COR.