

SECTION 237313
MODULAR INDOOR CENTRAL-STATION
AIR HANDLING UNITS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish and install air handling units and accessories as shown on the plans.
- B. All systems provided shall be in compliance with code, complete and operational. Refer to complete specifications and drawings for additional detailed requirements. Manufacturers recommended installation guidelines shall be used if no other specific direction is given. Bidder shall be responsible to coordinate and include in his bid all necessary appurtenances and additional material to ensure proper installation and function. All bidders shall be responsible to review the complete set of specifications, drawings and addendums.

1.02 REFERENCE PUBLICATIONS

- A. The following publications are incorporated by reference, and shall be the current issue at the time of bid:
 - 1. Air Conditioning and Refrigeration Institute (ARI):
 - ARI 410..... Forced-Circulation Air-Cooling and Air-Heating Coils
 - ARI 430..... Central-Station Air-Handling Units
 - ARI Guideline D..... Application and Installation of Central Station Air-Handling Units
 - 2. Air Movement and Control Association (AMCA):
 - AMCA 300..... Reverberant Room Method for Sound Testing of Fans
 - 3. American Bearing Manufacturer's Association (AFBMA):
 - AFMBA Std 9..... Load Ratings and Fatigue Life for Ball Bearings
 - AFMBA Std 11..... Load Rating and Fatigue Life for Roller Bearings
 - 4. American Society for Testing and Materials (ASTM):
 - ASTM C 1071 Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material)
 - ASTM F 872..... Filter Units, Air Conditioning: Viscous-Impingement Type, Cleanable

- 5. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
 - ASHRAE 52.1 Gravimetric and Dust-Spot Procedures for Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter
 - ASHRAE 68 Laboratory Method of Testing In-Duct Sound Power Measurement Procedures for Fans
- 6. National Fire Protection Association (NFPA):
 - NFPA 70 National Electrical Code
 - NFPA 90A Installation of Air Conditioning and Ventilating Systems
- 7. Underwriters Laboratories (UL):
 - UL 586 High Efficiency, Particulate, Air Filter Units
 - UL 900 Test Performance of Air Filter Units

1.03 SUBMITTALS

A. Product Data: Manufacturer's data to include the following:

- 1. Air Handling Units
- 2. VFD Drives
- 3. Duct Smoke Detectors
- 4. Accessories

B. Performance Data

- 1. ARI Coil Performance Data
- 2. Fan Curves
- 3. Filters
- 4. Dimensions
- 5. Weights

PART 2 - PRODUCTS

2.01 FACTORY-FABRICATED AIR HANDLING UNITS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- 1. Johnson Controls (York) Model: XTI-54X84.
- 2. Ingersoll Rand (Trane) Model: CLCH-21.
- 3. United Technologies (Carrier) Model: 39LX21.

- B. Units shall be single-zone draw-through type with chilled water cooling, hot water reheat and angled pleated filter section as indicated. Units shall include fans, coils, airtight insulated casing, filters, drives, access sections where indicated, pan, and vibration-isolators, and appurtenances as required for specified operation. Each air handling unit shall have physical dimensions suitable to fit space allotted to the unit and shall have the capacity indicated. Air handling unit shall have published ratings based on tests performed according to ARI 430.
- C. Casings: Casing sections shall be double wall type, constructed of a minimum 18 gauge galvanized steel, or 18 gauge steel outer casing protected with a corrosion resistant paint finish. Inner casing of double-wall units shall be minimum 24 gauge galvanized steel. Casing shall be designed and constructed with an integral structural steel frame such that exterior panels are non-load bearing. Exterior panels shall be individually removable. Removal shall not affect the structural integrity of the unit. Casings shall be provided with inspection doors, access sections, and access doors as indicated. Inspection and access doors shall be insulated, fully gasketed, double-wall type, of minimum 18 gauge outer and 24 gauge inner panels. Doors shall be rigid and provided with heavy duty hinges and latches. Access doors shall be minimum 10" wide and shall be the full height of the unit casing. Drain pan shall be double-bottom type constructed of 16 gauge-galvanized steel, double pitched to the drain connection. Drain pans shall be constructed water tight, treated to prevent corrosion, and designed for positive condensate drainage. When two or more cooling coils are used, with one stacked above the other, condensate from the upper coils shall not flow across the face of lower coils. Intermediate drain pans or condensate collection channels and downspouts shall be provided, as required to carry condensate to the unit drain pan out of the air stream and without moisture carryover. Each casing section handling conditioned air shall be insulated with not less than 1" thick, 1-1/2 pound density coated fibrous glass material (or equivalent) having a thermal conductivity not greater than 0.23 Btu/hr-SF-F. Factory applied fibrous glass insulation shall conform to ASTM C 1071, except that the minimum thickness and density requirements do not apply, and shall meet the requirements of NFPA 90A. Duct liner material, coating, and adhesive shall conform to fire-hazard requirements specified for duct insulation. Exposed insulation edges and joints where insulation panels are butted together shall be protected with a metal nosing strip or shall be coated to conform to meet erosion resistance requirements of ASTM C 1071. A latched and hinged inspection door shall be provided in the fan and coil sections. Additional inspection doors, access doors and access sections shall be provided where indicated.
- D. Heating and Cooling Coils: Coils shall be fin-and tube type constructed of seamless copper tubes and aluminum fins mechanically bonded or soldered to the tubes. Casing and tube support sheets shall be not lighter than 16 gauge galvanized steel, formed to provide structural strength. When required, multiple tube supports shall be provided to prevent tube sag. Each coil shall be tested at the factory under water at not less than 400 psi air pressure and shall be suitable for 200 psi working pressure. Coils shall be mounted for counter-flow service. Coils shall be rated and certified according to ARI 410.
1. Water Coils: Water coils shall be installed with a pitch of not less than 1/8" per foot of the tube length toward the drain end. Headers shall be constructed of cast iron, welded steel or copper. Each coil shall be provided with a plugged vent and drain connection extending through the unit casing.
- E. Air Filters: Air filters shall be listed according to requirements of UL 900. Air filters shall be provided with slide out filter racks.

1. Extended Surface Pleated Panel Filters: Filters shall be 2" deep, sectional, disposable type of the size indicated and shall have an average efficiency of 25 to 30% when tested according to ASHRAE 52.1. Initial resistance at 500' per minute shall not exceed 0.3" water gauge. Filters shall be UL Class 2. Media shall be nonwoven cotton and synthetic fiber mat. A wire support grid bonded to the media shall be attached to a moisture resistant fiberboard frame. All four edges of the filter media shall be bonded to the inside of the frame to prevent air bypass and increase rigidity.
 2. Replaceable Media Filters: Replaceable media filters shall be the dry-media type, of the size required to suit the application. Filtering media shall be not less than 2 inches thick fibrous glass media pad supported by a structural wire grid or woven wire mesh. Pad shall be enclosed in a holding frame of not less than 16 gauge galvanized steel and equipped with quick-opening mechanism for changing filter media. The airflow capacity of the filter shall be based on net filter face velocity not exceeding 300' per minute, with initial resistance of 0.12" water gauge. Average efficiency shall be not less than 30% when tested according to ASHRAE 52.1.
 3. Filter Section: Filter sections shall be of the angled slide out type. Filter holding frames shall be gasketed and fabricated from not lighter than 16 gauge sheet steel with rust-inhibitor coating. All joints shall be airtight. The filter section shall be constructed in a manner identical to the remainder of the unit casing with a side access door.
- F. Fans: Fans shall be centrifugal AF type as indicated. Fans and shafts shall be dynamically balanced prior to installation in air handling unit. The entire fan assembly shall be statically and dynamically balanced at the factory after it has been installed in the air handling unit. Fans shall be mounted on steel shafts accurately ground and finished. Fan bearings shall be sealed against dust and dirt and shall be precision self-aligning ball or roller type. Bearing life shall be L-50 rated at not less than 200,000 hours as defined by AFBMA Std 9 and AFBMA Std 11. Bearings shall be permanently lubricated or lubricated type with lubrication fittings readily accessible at the drive side of the unit. Bearings shall be supported by structural shapes, or die formed sheet structural members, or support plates securely attached to the unit casing. Bearings may not be fastened directly to the unit sheet metal casing. Fans and scrolls shall be furnished with coating indicated. Fans shall be driven by a unit-mounted motor. If applicable, belt guards shall be the three sided enclosed type with solid or expanded metal face. All belt drives shall be designed for not less than a 1.2 service factor based on motor nameplate rating. Motor sheaves shall be variable pitch. Where fixed sheaves are required, variable pitch sheaves may be used during air balance, but shall be replaced with an appropriate fixed sheave after air balance is completed. Variable pitch sheaves shall be selected to drive the fan at a speed that will produce the specified capacity when set at the approximate midpoint of the sheave adjustment. Motors for V-belt drives shall be provided with adjustable bases. Fan motors shall have totally enclosed TEFC enclosures. Unit fan or fans shall be selected to produce the required capacity at the fan static pressure. Sound power level shall be as indicated. The sound power level values shall be obtained according to AMCA 300 or ASHRAE 68.
- G. Access Sections: Provide an access section between coils as indicated. Access sections shall be furnished with an access door to facilitate visual coil inspection. Access sections shall be constructed in a manner identical to the remainder of the unit casing.
- H. Factory Installed Variable Frequency Drive:

1. Acceptable Manufacturers: Eaton, Square D Company, Graham, JCI. Furnish with integral controller for VAV application.
2. Combination Variable Frequency Drive/Disconnects shall be properly sized, mounted, wired to the fan motor, and commissioned by the AHU Manufacturer. Combination VFD disconnects shall include VFD, a circuit breaker disconnect, and a Hand-Off-Auto (HOA) switch. An oversized control transformer, and on/off binary output, variable speed signal analog output, and all interfacing wiring between the VFD and the DDC controller shall be provided with factory mounted controls.
3. Disconnects: VFD/disconnects shall be supplied with an instantaneous short circuit trip circuit breaker. A through-the-door interlocking handle shall be spring loaded and designed to rest only in the full "ON" or "OFF" state. A concealed defeater mechanism will allow entry into the enclosure when the handle is in the "ON" position. A heavy-duty snap action flange operated fusible disconnect switch is also acceptable. The blades shall be visible in the "OFF" position. A terminal guard shall be supplied on the line side terminals.
4. Enclosures: VFD/disconnects shall have NEMA Type 1 steel open ventilated enclosures.
5. Variable Frequency Drives: The VFD/disconnects shall be supplied with a high performance pulse width modulated (PWM) AC drive that generates a sine-code, variable voltage/frequency, three phase output for optimum speed control. Insulated gate bipolar output transistors (IGBT's) shall ensure a low audible magnetic motor noise (@ 60 Hz) of less than 2 dB (@1 meter) above across the line operation. Power electronics shall provide at least 97% efficiency.
6. The VFD shall have one 16 bit microprocessor control logic circuit board for all horsepower ratings. All programming shall be maintained in nonvolatile RAM memory so the program will be maintained when power is removed. A digital operator keypad and display shall provide local control and readout for: run/stop/jog, speed, reset, volts, amps, kilowatts, and diagnostics.
7. Output current overload should be rated at 125% of motor FLA for one minute. The VFD shall have the following minimal protective features: current limited stall prevention, auto restart after momentary power loss, speed search for starting into rotating motor, anti-windmill with DC injection before start, phase to phase short circuit protection, and ground fault protection. Ambient service temperature rating of -10° to 40° C, and humidity rating to 95% noncondensing. The VFD shall meet or exceed UL, IEEE 444 (ANSI-C343), and IEC: 146A.
8. The VFD shall be integrated with a Controller. The controller shall be configured for I/O control of duct static pressure. The controller shall be furnished with direct-to-drive contact closure inputs for remote fire stat, fire panel and O/A damper contacts.
9. Factory Mounting: VFD/disconnects shall be mounted externally on the drive side of the air handling unit fan section. Ensure 4' of mechanical room clearance in front of the starter for serviceability per OSHA standards.

10. Factory Wiring: VFD/disconnects shall be wired to fan motor in "liquid tight" conduit and junction boxes. Units with factory mounted controls shall also include power wiring from the starter control transformer to the control system transformers. A binary start-stop signal and an analog speed signal shall be wired complete from the direct digital controller to the VFD. Wiring methods shall comply with the National Electrical Code and NFPA 90.
11. Factory Commissioning: Trained factory personnel shall ensure proper operation of the VFD by a thorough factory test. The VFD shall be properly set for voltage and full load amps of the actual motor supplied.

I. Accessories:

1. Lubrication lines: Provide extended bearing lubrication lines which extend out of the airstream for ease of service and maintainability.
2. Duct Smoke Detectors: Provide addressable smoke detectors in accordance with the drawings, NFPA 90A and UL 268A.

A. Duct smoke detectors: Furnish duct smoke detector(s) with the following features:

- a. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
- b. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
- c. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore for normal operation.
- d. Integral Visual-Indicating Light: LED type, indicating detector with power-on status.
- e. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
- f. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

B. Acceptable Manufacturers: Silent Knight, Firelite, Edwards Signals, Potter Signal, System Sensor.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Initial start-up shall be performed by the HVAC manufacturer's representative's and shall ensure that the unit is operating properly in accordance with manufacturer's recommendations. Verify proper fan rotation. Operate the unit and cycle through control sequences to verify proper functionality. Correct any deficiencies noted.
- B. All damaged surfaces of installed units shall be touched up to original factory finish.
- C. Controls: Specified controls shall be furnished by the Controls Contractor, except as previously specified or indicated.

- D. Duct Smoke Detector(s): Smoke detectors shall be interfaced and configured with the existing fire alarm panel.
- E. All installation procedures shall be per the manufacturer's instructions, standard industry practice and local current codes.

END OF SECTION 237313