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**SECTION 23 73 13**  
**MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Casing construction.
- B. Fan section.
- C. Coil section.
- D. Filter and air cleaner section.

**1.2 RELATED REQUIREMENTS**

- A. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.
- B. Section 23 33 00 - Air Duct Accessories: Flexible duct connections.
- C. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

**1.3 REFERENCE STANDARDS**

- A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings 2015 (Reaffirmed 2020).
- B. ACGIH - Ultraviolet Radiation: TLV(R) Physical Agents 7th Edition Documentation 2010.
- C. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils 2001, with Addenda (2011).
- D. AHRI 430 (I-P) - Performance Rating of Central Station Air-handling Unit Supply Fans 2020.
- E. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating 2012 (Reapproved 2015).
- F. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size 2017, with Addendum (2022).
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.
- I. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.
- J. UL (DIR) - Online Certifications Directory Current Edition.
- K. UL 153 - Portable Electric Luminaires Current Edition, Including All Revisions.
- L. UL 1598 - Luminaires Current Edition, Including All Revisions.
- M. UL 1995 - Heating and Cooling Equipment Current Edition, Including All Revisions.

**1.4 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Listed manufacturers and series are for reference only and do not promote any single product. Series are provided for reference, and should not be used as an ordering model number. Accessories and options may be custom components purchased separately.
- C. Product Data: Provide manufacturer's catalog sheet for equipment indicating rough-in size, finish, and accessories. Manufacturer's data sheets on each item of equipment and device, marked up to identify the items to be used on the project.
  - 1. Published Literature: Indicate dimensions, weights, capacities, ratings, gauges and finishes of materials, and electrical characteristics and connection requirements.
  - 2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
  - 3. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.

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- 4. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
  - D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
    - 1. Submit under Operation and Maintenance Data books
    - 2. AHU.
  - E. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
  - F. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.
  - G. Manufacturer's Instructions: Include installation instructions.
  - H. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.
  - I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
    - 2. Extra Fan Belts: One set for each unit.
    - 3. Extra Filters: One set for each unit.

#### **1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.
- B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.
- C. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

#### **1.7 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide minimum two year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

### **PART 2 PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Trane Inc.
- B. Substitutions: See Section 01 60 00 - Product Requirements.

#### **2.2 REGULATORY REQUIREMENTS**

- A. Comply with NFPA 70.
  - B. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.
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**2.3 CASING CONSTRUCTION**

- A. Full Perimeter Base Rail:
  - 1. Construct of galvanized steel.
  - 2. Provide base rail of sufficient height to raise unit for external trapping of condensate drain pans.
- B. Casing:
  - 1. Construct of one piece, insulated, double wall panels.
  - 2. Provide mid-span, no through metal, internal thermal break.
  - 3. Construct outer panels of galvanized steel and inner panels of galvanized steel.
  - 4. Casing Air Pressure Performance Requirements:
    - a. Able to withstand up to 8 inches w.g. positive or negative static pressure.
    - b. Not to exceed 0.0042 inches per inch deflection at 1.5 times design static pressure up to a maximum of plus 8 inches w.g. in positive pressure sections and minus 8 inches w.g. in negative pressure sections.
- C. Access Doors:
  - 1. Construction, thermal and air pressure performance same as casing.
  - 2. Provide surface mounted handles on hinged, swing doors.
- D. Casing Leakage: Seal joints and provide airtight access doors so that air leakage does not exceed one percent of design flow at the specified casing pressure.
- E. Insulation:
  - 1. Provide minimum thermal thickness of 12 R throughout.
  - 2. Completely fill panel cavities in each direction to prevent voids and settling.
  - 3. Comply with NFPA 90A.
- F. Drain Pan Construction:
  - 1. Provide cooling coil with an insulated, double wall, stainless steel drain pan complying with ASHRAE 62.1 for indoor air quality and sufficiently sized to collect all condensate.
  - 2. Slope in two planes to promote positive drainage and eliminate stagnate water conditions.
  - 3. Locate outlet of sufficient diameter at lowest point of pan to prevent overflow at normal operating conditions.
  - 4. Provide threaded drain connections constructed of drain pan material, extended sufficient distance beyond the base to accommodate field installed, condensate drain trapping.
- G. Finish:
  - 1. Indoor Units:
    - a. Provide exterior, galvanized steel panels with painted surface complying with ASTM B177/B177M.
    - b. Color: Manufacturer's standard color.

**2.4 FAN SECTION**

- A. Type: Forward curved, single width, single inlet, centrifugal plug type fan, in compliance with AMCA 99. Refer to Section 23 3413.
  - B. Performance Ratings: Determined in accordance with AMCA 210 and labeled with AMCA Certified Rating Seal.
  - C. Sound Ratings: AMCA 301; tested to AMCA 300 and label with AMCA Certified Sound Rating Seal.
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- D. Bearings: Self-aligning, grease lubricated, with lubrication fittings extended to exterior of casing with plastic tube and grease fitting rigidly attached to casing.
  - E. Mounting:
    - 1. Locate fan and motor internally on welded steel base coated with corrosion resistant paint.
    - 2. Factory mount motor on slide rails.
    - 3. Provide access to motor, drive, and bearings through removable casing panels or hinged access doors.
    - 4. Mount base on vibration isolators.
  - F. External Motor Junction Box: Factory mount NEMA 4 external junction box and connect to extended motor leads from internally mounted motors.
  - G. Motor Wiring Conduit: Factory wire fan motor wiring to the unit mounted starter-disconnect.
  - H. Flexible Duct Connections:
    - 1. For separating fan, coil, and adjacent sections.
  - I. Drives:
    - 1. Comply with AMCA 99.
    - 2. Bearings: Heavy duty pillow block type, ball bearings, with ABMA STD 9 L-10 life at 50,000 hours.
    - 3. Shafts: Solid, hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.
    - 4. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts, and keyed. Variable and adjustable pitch sheaves for motors 15 hp and under selected so required rpm is obtained with sheaves set at mid-position; fixed sheave for 20 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.
    - 5. Belt Guard: Fabricate to SMACNA (DCS); 0.106 inch thick, 3/4 inch diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

## **2.5 COIL SECTION**

- A. Casing: Provide access to both sides of coils. Enclose coils with headers and return bends exposed outside casing. Slide coils into casing through removable end panel with blank off sheets and sealing collars at connection penetrations.
- B. Air Coils:
  - 1. Certify capacities, pressure drops, and selection procedures in accordance with AHRI 410.
- C. Refrigerant Coils:
  - 1. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.
  - 2. Headers: Seamless copper tubes with silver brazed joints.
  - 3. Liquid Distributors: Brass or copper venturi distributor with seamless copper distributor tubes.
  - 4. Configuration: Down feed with bottom suction.

## **2.6 FILTER AND AIR CLEANER SECTION**

- A. General: Provide filter sections with filter racks, minimum of one access door for filter removal, and filter block-offs to prevent air bypass.
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- B. Pleated Media Filters:
  - 1. Media: 2 inch, 100 percent synthetic fibers, continuously laminated to a grid with water repellent adhesive, and capable of operating up to a maximum of 625 fpm without loss of efficiency and holding capacity.
  - 2. Frame: Steel wire grid.
  - 3. Minimum Efficiency Reporting Value: MERV 8 when tested in accordance with ASHRAE Std 52.2.
- C. Differential Pressure Gauge:
  - 1. Provide factory installed dial type differential pressure gauge, flush mounted with casing outer wall, and fully piped to both sides of each filter to indicate status.
  - 2. Maintain plus/minus 5 percent accuracy within operating limits of 20 degrees F to 120 degrees F.

## **2.7 ACCESS SECTION**

- A. Provide where indicated on drawings to allow for inspection, cleaning, and maintenance of field-installed components.
- B. Construct access doors same as previously specified within this Section.

## **2.8 CONTROLS**

- A. Combination Starter-Disconnects:
  - 1. Factory mount in full metal enclosure and wire to fan motor.
  - 2. Mount starter-disconnect on fan section externally in a NEMA 1 enclosure within a dedicated controls section or housed fan section.
  - 3. Include the following items:
    - a. Hand-Off-Auto (H-O-A) switch.
    - b. Two normally open auxiliary contacts.
    - c. Overload heaters.
    - d. Manual reset overloads.
    - e. 120V control transformer with fusing and secondary grounding.
  - 4. Include power wiring from the starter control transformer to the secondary control system transformers, and start-stop wiring from the direct digital controller start-stop relay to the starter H-O-A switch.

## **PART 3 EXECUTION**

### **3.1 INTERFACE WITH WORK OF OTHER SECTIONS**

- A. Confirm framing and support members.
- B. Confirm rough-in and framing of walls and partitions with supports for equipment and accessories.
- C. Confirm rough-in locations and power requirements before rough-in installation. Refer to Section 26 27 17 - Equipment Wiring.
- D. Confirm rough-in location and signals before rough-in installation. refer to section 23 09 13 - Instrumentation and Control Devices for HVAC.

### **3.2 EXAMINATION**

- A. Verify that surfaces are suitable for installation.
- B. Examine areas to receive equipment for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- C. Verify that piping and equipment are ready to receive work.
- D. Verify field measurements are as shown on shop drawings.
- E. Electrical:
  - 1. Verify electrical power, voltage, phase and current is available and of the correct characteristics.
  - 2. Verify rough-in for electrical connections to verify actual locations before installing.
  - 3. Verify motor type and VFD or disconnect type for compatibility prior to ordering equipment.
- F. Controls:
  - 1. Verify signal power, voltage, phase and current is available and of the correct characteristics.
  - 2. Verify rough-in for control connections to verify actual locations before installing.
- G. Maintain clearances to combustibles and service clearances.
- H. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.3 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Bolt sections together with gaskets.
- C. Isolate fan section with flexible duct connections.
- D. Install flexible duct connections between fan inlet and discharge ductwork and air handling unit sections. Ensure that metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
- E. Install assembled unit on vibration isolators. Install isolated fans with resilient mountings and flexible electrical leads. Install restraining snubbers as indicated. Refer to Section 23 05 48. Adjust snubbers to prevent tension in flexible connectors when fan is operating.
- F. Provide fixed sheaves required for final air balance.
- G. Refrigerant Coils: Provide sight glass in liquid line within 12 inches of coil.
- H. Insulate coil headers located outside air flow as specified for piping. Refer to Section 23 07 16.

### **3.4 SYSTEM STARTUP**

- A. Provide manufacturer's field representative to perform systems startup.
- B. Prepare and start equipment and systems in accordance with manufacturers' instructions and recommendations.
- C. Adjust for proper operation within manufacturer's published tolerances.

### **3.5 CLOSEOUT ACTIVITIES**

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.
- C. Demonstrate proper operation of equipment to Owner's designated representative.
- D. Demonstration: Demonstrate operation of system to Owner's personnel.
  - 1. Use operation and maintenance data as reference during demonstration.
  - 2. Conduct walking tour of project.
  - 3. Briefly describe function, operation, and maintenance of each component.
- E. Training: Train Owner's personnel on operation and maintenance of system.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of two hours of training.

3. Instructor: Manufacturer's training personnel.
4. Location: At project site.

**END OF SECTION 23 73 13**