

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

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes: Constant-air-volume, single-zone air handling units.

#### **1.2 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Design vibration isolation and seismic-restraint details, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Seismic Performance: Air-handling units shall withstand the effects of earthquake motions determined according to SEI/ASCE 7. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

#### **1.3 SUBMITTALS**

- A. Product Data: For each air handling unit indicated.
  - 1. Unit dimensions and weight.
  - 2. Cabinet material, metal thickness, finishes, insulation, and accessories.
  - 3. Fans:
    - a. Certified fan performance curves with system operating conditions indicated.
    - b. Certified fan sound power ratings.
    - c. Fan construction and accessories.
    - d. Motor ratings, electrical characteristics, and motor accessories.
  - 4. Certified coil performance ratings with system operating conditions indicated.
  - 5. Dampers, including housings, linkages, and operators.
  - 6. Filters with performance characteristics.
- B. Delegated Design Submittal: For vibration isolation and seismic restraints indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
  - 2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

- C. Seismic Qualification Certificates: For air handling units, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Source quality control reports.
- E. Operation and maintenance data.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.
- C. ARI Certification: Air handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.
- D. Comply with NFPA 70.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
  - 1. Air Enterprises, Inc.
  - 2. Carrier Corporation; a member of the United Technologies Corporation Family.
  - 3. Engineered Air.
  - 4. Mammoth Inc.
  - 5. McQuay International
  - 6. Scott Springfield Mfg. Inc.
  - 7. Trane; American Standard Inc.
  - 8. USA Coil & Air.
  - 9. YORK International Corporation.
  - 10. Petra Engineering Industries Co.

## 2.2 UNIT CASINGS

### A. General Fabrication Requirements for Casings:

1. Forming: Form walls, roofs, and floors with at least two breaks at each joint.
2. Casing Joints: Sheet metal screws or pop rivets.
3. Sealing: Seal all joints with water-resistant sealant.
4. Factory Finish for Steel and Galvanized-Steel Casings: Apply manufacturer's standard primer immediately after cleaning and pretreating.

### B. Casing Insulation and Adhesive:

1. Materials: ASTM C 1071, Type II.
2. Location and Application: Encased between outside and inside casing.

### C. Inspection and Access Panels and Access Doors:

1. Panel and Door Fabrication: Formed and reinforced, double wall and insulated panels of same materials and thicknesses as casing.
2. Access Doors:
  - a. Hinges: A minimum of two ball-bearing hinges and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
  - b. Gasket: Neoprene, applied around entire perimeters of panel frames.
  - c. Fabricate windows in doors of double glazed, wire-reinforced safety glass with an air space between panes and sealed with interior and exterior rubber seals.
  - d. Size: At least 24 by 60 inches.
3. Locations and Applications:
  - a. Fan Section: Doors.
  - b. Access Section: Doors.
  - c. Coil Section: Doors.
  - d. Damper Section: Doors.
  - e. Filter Section: Doors large enough to allow periodic removal and installation of filters.
4. Service Light: 100 W vaporproof fixture in each section accessed with door, with switched junction box located outside adjacent to door.

### D. Condensate Drain Pans:

1. Fabricated with slopes in at least 2 planes to collect condensate from cooling coils (including coil piping connections, coil headers and return bends, and a minimum of 6 inches downstream from cooling-coil face) and from humidifiers.
2. Formed sections.
3. Single wall, galvanized steel sheet.
4. A minimum of 2 inches deep, and complying with requirements in ASHRAE 62.1.
5. Drain Connections: Both ends of pan with NPS 1 threaded nipple.

6. Pan-Top Surface Coating: Asphaltic waterproofing compound.
  7. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.
- E. Air Handling Unit Mounting Frame: Formed galvanized steel channel or structural channel supports, designed for low deflection, welded with integral lifting lugs.
1. Seismic Fabrication Requirements: Fabricate mounting base and attachment to air handling unit sections, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration and Seismic Controls for Mechanical Piping and Equipment" when air handling unit frame is anchored to building structure.

## 2.3 FAN, DRIVE, AND MOTOR SECTION

- A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and motor horsepower.
1. Shafts: Designed for continuous operation at maximum rated fan speed and motor horsepower, and with field adjustable alignment.
    - a. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
    - b. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
- B. Centrifugal Fan Housings: Formed and reinforced steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.
1. Bracing: Steel angle or channel supports for mounting and supporting fan scroll, wheel, motor, and accessories.
  2. Horizontal-Flanged, Split Housing: Bolted construction.
  3. Housing for Supply Fan: Attach housing to fan section casing with metal-edged flexible duct connector.
  4. Flexible Connector: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4 inch wide, 0.028 inch thick, galvanized steel sheet or 0.032 inch thick aluminum sheets; select metal compatible with casing.
    - a. Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives shall comply with UL 181, Class 1.
      - 1) Fabric Minimum Weight: 26 oz./sq. yd.
      - 2) Fabric Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
      - 3) Fabric Service Temperature: Minus 40 to plus 200 deg F.
- C. Plug Fans Housings: Steel cabinet; fabricated without fan scroll and volute housing.
- D. Backward Inclined, Centrifugal Fan Wheels: Single width single inlet and double width double inlet construction with curved inlet flange, backplate, backward inclined blades welded or

riveted to flange and backplate; cast iron or cast steel hub riveted to backplate and fastened to shaft with set screws.

- E. Forward Curved, Centrifugal Fan Wheels: Inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically fastened to flange and backplate; cast-steel hub swaged to backplate and fastened to shaft with set screws.
- F. Fan Shaft Bearings:
  - 1. Prelubricated and Sealed, Ball Bearings: Self-aligning, pillow-block type with a rated life of 50,000 hours according to ABMA 9.
  - 2. Grease Lubricated, Tapered-Roller Bearings: Self-aligning, pillow block type with double locking collars and 2 piece, cast iron housing with grease lines extended to outside unit and a rated life of 50,000 hours according to ABMA 11.

**OR**

- 3. Grease Lubricated Bearings: Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing with grease lines extended to outside unit.
- G. Belt Drives: Factory mounted, with adjustable alignment and belt tensioning, and with 1.5 service factor based on fan motor.
  - 1. Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
  - 2. Motor Pulleys: Adjustable pitch for use with 5 hp motors and smaller; fixed pitch for use with motors larger than 5 hp. Select pulley size so pitch adjustment is at the middle of adjustment range at fan design conditions.
  - 3. Belts: Oil resistant, nonsparking, and nonstatic; in matched sets for multiple-belt drives.
  - 4. Belt Guards: Comply with requirements specified by OSHA and fabricate according to SMACNA's "HVAC Duct Construction Standards"; 0.1046 inch thick, 3/4 inch diamond mesh wire screen, welded to steel angle frame; prime coated.
- H. Internal Vibration Isolation and Seismic Control: Fans shall be factory mounted with manufacturer's standard restrained vibration isolation mounting devices having a minimum static deflection of <Insert value>.
  - 1. Seismic Fabrication Requirements: Fabricate fan section, internal mounting frame and attachment to fans, fan housings, motors, casings, accessories, and other fan section components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration and Seismic Controls for Mechanical Piping and Equipment" when fan mounting frame and air handling unit mounting frame are anchored to building structure.
  - 2. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Electrical Motors for Mechanical Equipment."
  - 3. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

4. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
5. Mount unit mounted disconnect switches on exterior of unit.

## 2.4 COIL SECTION

### A. General Requirements for Coil Section:

1. Comply with ARI 410.
2. Fabricate coil section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. Coils shall not act as structural component of unit.
4. Seismic Fabrication Requirements: Fabricate coil section, internal mounting frame and attachment to coils, and other coil section components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration and Seismic Controls for Mechanical Piping and Equipment" when coil-mounting frame and air-handling-unit mounting frame are anchored to building structure.

## 2.5 AIR FILTRATION SECTION

- ### A. General Requirements for Air Filtration Section: Comply with requirements in Division 23 Section "Filters Used in HVAC Systems."

## 2.6 DAMPERS

- ### A. Comply with requirements in Division 23 Section "Air Duct Accessories."
- ### B. Damper Operators: Comply with requirements in Division 23 Section "Direct Digital Control (DDC) System."

## 2.7 CAPACITIES AND CHARACTERISTICS

### A. Casing:

1. Outside Casing: Galvanized steel, minimum 16 gage.
2. Inside Casing: Galvanized steel, perforated except downstream of cooling coils and in outside air intakes, minimum 22 gage.
3. Floor Plate: Galvanized steel, minimum 14 gage.
4. Insulation Thickness: 4 inches.
5. Static-Pressure Classifications for Unit Sections before Fans: **[2-inch wg] [3-inch wg] [4-inch wg] [6-inch wg]**.
6. Static-Pressure Classifications for Unit Sections after Fans: **[2-inch wg] [3-inch wg] [4-inch wg] [6-inch wg] [8-inch wg]**.

### B. Supply Fan:

1. **[Class I] [Class II] [Class III]**: AMCA 99-2408.
2. Drive: **[V-belt] [Direct]**.

3. Type: **[Steel, backward inclined centrifugal]** **[Galvanized steel, forward-curved centrifugal]**.

C. Return Fan:

1. **[Class I]** **[Class II]** **[Class III]**: AMCA 99-2408.
2. Drive: **[V-belt]** **[Direct]**.
3. Type: **[Steel, backward inclined centrifugal]** **[Galvanized steel, forward-curved centrifugal]**.

D. Preheat and Heating Coils:

1. Piping Connections: **[Threaded]** **[Flanged]**, **[same end]** **[opposite ends]** of coil.
2. Tube Material: Copper.
3. Fin Type: Plate or spiral.
4. Fin Material: Aluminum.
5. Fin Spacing: 11 per inch maximum.
6. Fin and Tube Joint: Mechanical bond.
7. Headers:
  - a. Cast iron with cleaning plugs and drain and air vent tappings extended to exterior of unit.
  - b. Seamless copper tube with brazed joints, prime coated.
  - c. Fabricated steel, with brazed joints, prime coated.
  - d. Provide insulated cover to conceal headers exposed outside casings.
8. Frames: Channel frame, 0.052 inch thick galvanized steel.
9. Coil Working Pressure Ratings: 200 psig.

E. Cooling Coil:

1. Fin Type: **[Plate]** **[Spiral]**.
2. Fin Spacing: 11 per inch maximum.
3. Coil Working Pressure Ratings: 200 psig.
4. Refrigerant Type: **<Insert type>**.

F. Prefilters:

1. Type: **<Insert type from Section 234100>**.
2. Access Location: **[Front]** **[Back]** **[Side]**.

G. Filters:

1. Type: **<Insert type from Section 234100>**.
2. Access Location: **[Front]** **[Back]** **[Side]**.

## 2.8 SOURCE QUALITY CONTROL

- A. Fan Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.
- B. Fan Performance Rating: Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency. Rate performance according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating."
- C. Water Coils: Factory tested to 300 psig (2070 kPa) according to ARI 410 and ASHRAE 33.
- D. Refrigerant Coils: Factory tested to 450 psig (3105 kPa) according to ARI 410 and ASHRAE 33.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Equipment Mounting: Install air-handling units on concrete bases [**using restrained spring isolators**] [**without vibration isolation devices**]. Secure units to anchor bolts installed in concrete bases. Concrete base is specified in Division 23 Section "Common Work Results for Mechanical" and concrete materials and installation requirements are specified in Division 03 Section "Cast-in-Place Concrete." Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration and Seismic Controls for Mechanical Piping and Equipment."
  - 1. Minimum Deflection: [**1 inch**] [**2 inches**] [**3 inches**].
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18 inch centers around the full perimeter of concrete base.
  - 3. Install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
- B. Suspended Units: Suspend and brace units from structural-steel support frame using threaded steel rods and spring hangers. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration and Seismic Controls for Mechanical Piping and Equipment."
- C. Arrange installation of units to provide access space around air-handling units for service and maintenance.
- D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with new, clean filters.
- E. Install filter gage, static pressure taps upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum in accessible position. Provide filter gages on filter banks, installed with separate static-pressure taps upstream and downstream of filters.



- F. Comply with requirements for piping specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- G. Install piping adjacent to air handling unit to allow service and maintenance.
- H. Connect piping to air handling units mounted on vibration isolators with flexible connectors.
- I. Connect condensate drain pans using ASTM B 88, Type L copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.
- J. Heating Hot and Chilled Water Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.
- K. Refrigerant Piping: Comply with applicable requirements in Division 23 Section "Refrigerant Piping." Install shutoff valve and union or flange at each supply and return connection.
- L. Connect duct to air handling units with flexible connections. Comply with requirements in Division 23 Section "Air Duct Accessories."

**END OF SECTION 23 73 13**