

## SECTION 23 70 00 –AIR HANDLING UNITS

### PART 1. GENERAL

- 1.1 Section includes air-handling units to 15,000 cfm and accessories.
- 1.2 Related Sections<sup>1</sup>:
  - A. Division 01 - Brown University Standard for Narragansett Electric Company Rebate Program
  - B. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for housekeeping pads specified by this section.
  - C. Section 23 00 10 – HVAC Design Criteria.
  - D. Section 23 05 29 - Hangers and Supports: Execution requirements for supports specified by this section.
  - E. Section 23 05 48 - Mechanical Sound, Vibration, and Seismic Control: Product requirements for vibration isolators for placement by this section.
  - F. Section 23 07 16 - Mechanical Insulation: Product requirements for insulation for placement by this section.
  - G. Section 23 20 00 - Piping Specialties: Product requirements for meters, gages and steam traps for placement by this section.
  - H. Section 23 20 00 - Heating and Cooling Piping: Product requirements for piping connections to air handling units.
  - I. Division 23 - Humidity Control Equipment: Product requirements for humidifiers and dehumidifiers for placement by this section.
  - J. Division 23 - Duct Accessories: Product requirements for flexible duct connections for placement by this section.
  - K. Section 23 09 00 - Direct Digital Controls: Controls remote from unit.
  - L. Division 23 - Pneumatic Controls: Product requirements for pneumatic controls to interface with air handling units.

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- M. Section 23 09 00 - Sequence of Operation: Sequences of operation applying to units in this section.
  - N. Section 26 05 31 - Wiring Connections: Execution requirements for electric connections specified by this section.
  - O. Section 26 05 90 - Motors: Product requirements for electric motors for placement by this section.
  - P. Division 26 - Variable Frequency Controllers: Variable frequency controllers.
- 1.3 Show Manufacturer's recommended service clearances and pull clearances as shaded areas on mechanical plans.
- 1.4 Provide complete unit information in project schedule. Include all applicable information from example below.

AIR HANDLING UNITS

Drawing Code	AHU-1	AHU-2	AHU-3
[Basis of Design Manufacturer & Model]			
Fan capacity			
Air flow			
External static Pressure			
Motor power			
Heating coil			
Capacity			
Max. Face Velocity			
Fin spacing			
Rows			
Entering Air Temperature			
Leaving Air Temperature			
Entering Water Temperature			
Leaving Water Temperature			
Water Pressure Drop			
***** (OR) *****			
Steam Capacity			
Entering Steam Pressure			
Cooling Coil			
Capacity			
Max. Face Velocity			
Fin spacing			
Rows			
Entering Air Temperature			

Dry Bulb  
Wet Bulb  
Leaving Air Temperature  
Dry Bulb  
Wet Bulb  
Water flow Rate  
Entering Water Temperature  
Leaving Water Temperature  
Pressure Drop  
\*\*\*\*\* (OR) \*\*\*\*\*  
Saturated Suction Temperature  
Max. Face velocity  
Fin spacing  
Rows  
Humidifier  
Select appropriate capacity information based on humidifier type.  
Evaporation Capacity  
Coil water temperature  
Coil steam temperature  
Electrical heat input  
Air Pressure Drop  
Minimum Saturation Efficiency  
Steam Flow Rate  
Entering Steam Pressure  
Sound Power  
Fan Discharge  
1st Octave  
2nd Octave  
3rd Octave  
4th Octave  
5th Octave  
6th Octave  
7th Octave  
8th Octave  
Casing Radiated  
1st Octave  
2nd Octave  
3rd Octave  
4th Octave  
5th Octave  
6th Octave  
7th Octave  
8th Octave

## PART 2. PRODUCTS

### 2.1 CASING

- A. Channel base of welded steel. Assemble sections with gaskets and bolts.
- B. Casing:
  - 1. Galvanized Steel: All housings shall be double wall, insulated type.
  - 2. Insulation: No exposed insulation in air stream. Insulation shall be adequate to prevent condensation.
  - 3. Floor Plate:
    - a) Casing pans shall be braced to support internal equipment components without sagging or pulsating. Floor shall be painted with rust-inhibiting primer and exterior enamel. Provide drains extending through sides of unit base.
  - 4. Finish: Rust inhibiting primer and exterior enamel as a minimum.
  - 5. Condensate Drain Pans:
    - a) Provide IAQ type condensate drain pan. Insulated stainless steel drain pan shall extend beyond cooling coil section as required to catch blow-by. Pan shall be minimum 20 gauge stainless steel continuously welded to form watertight basin, with insulation. Condensate drain pipe shall be either bottom connected or, if side connected, with bottom of nipple flush with bottom of pan.

### 2.2 FANS

- A. Backward inclined fans are preferred; where unavailable in smaller sizes forward curved centrifugal type is acceptable. All fans to be statically and dynamically balanced, and resiliently mounted.
- B. Performance ratings per ANSI/AMCA Standard 210 Laboratory methods of Testing Fans for Aerodynamic Performance Rating.
- C. Sound ratings per AMCA Standard 301 Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- D. Internal Mounting: Locate fan and motor internally on welded steel base coated with corrosion resistant paint. Factory mount motor on slide rails. Furnish access to motor, drive, and bearings through removable casing panels or hinged access doors. Mount base on vibration isolators.

- E. External Mounting: Locate motor, drive, and belt guard on integral casing framework on exterior of casing. Mount casing on vibration isolators.
- F. Fan Modulation: Variable Frequency Drive. Refer to Division 26.
- G. Provide flexible connection to separate unit from connecting ductwork.

### 2.3 BEARINGS AND DRIVES

- A. Bearings: Self-aligning, grease lubricated, ball bearings with lubrication fittings extended to exterior of casing with copper tube and grease fitting rigidly attached to casing. Grease to be compatible with Brown Trades grease product used for preventive maintenance. Minimum rated ABMA 9 L<sub>50</sub> bearing life to be:
  - 1. 100,000 hours under 1,800 cfm
  - 2. 200,000 hours 1,800 cfm and above
- B. Shafts: Solid, hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.
- C. Fan Drive: Sheaves to be dynamically balanced, bored to fit shafts, and keyed. Provide adjustable pitch motor sheave to obtain required rpm with sheaves set at mid-position as recommended by manufacturer. On systems 4,000 cfm and over, replace adjustable sheaves with fixed sheaves of size determined during TAB to provide design airflow rate. Provide matched V-belts, with drive rated minimum 1.5 times nameplate rating of motor.
- D. Fan motor: Three phase for motors 1/2 horsepower and larger, NEMA design B, continuously rated at 40 degrees C, high efficiency, with integral overload protection where available, and permanently lubricated bearings rated ABMA 9 L<sub>50</sub> 100,000 hours as a minimum.
  - 1. Motors to be totally enclosed. Open drip-proof motor acceptable only where totally enclosed motor is not available as standard from manufacturer. Provide explosion proof motor where required by application.
- E. Belt Guard: Fabricate to SMACNA standard.
- F. Variable Frequency Drive:
  - 1. Required for units serving VAV distribution systems over 4000 cfm.
  - 2. Furnished for supply fan, and return fan where provided.
  - 3. See Sections 23 09 00 and 23 09 03 - HVAC BAS Systems.

4. Control from duct static pressure by unit-mounted controller. Static pressure sensed by duct-mounted sensor(s). Engineer to determine and show sensor location on mechanical plan.
5. Furnish field adjustable duct high limit safety control to protect ductwork from excessive duct pressure.

## 2.4 COILS

- A. General Selection Criteria: Coils shall be selected for 400 fpm face velocity. Coils shall not be more than four row. Coils with more than 10 fins per inch shall not be deeper than three row. Provide additional coils or coil sections as required.
- B. Freeze Protection: Cooling coils shall have non-trapping circuits to facilitate seasonal drainage. In research buildings, provisions to eliminate need for drainage shall be made. Steam preheat coils shall be freeze proof type tube in tube.
- C. Casing: Provide access to both sides of coils. Enclose coils with headers and return bends fully contained within casing. Slide coils into casing through removable end panel with blank off sheets and sealing collars at connection penetrations.
- D. Water Coils:
  1. Certify capacities, pressure drops, and selection procedures in accordance with ARI 410.
  2. Tubes: Minimum 1/2-inch OD seamless copper expanded into fins, brazed joints.
  3. Fins: Aluminum.
  4. Casing: Die formed channel frame of galvanized steel.
  5. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.
  6. Configuration: Drainable, with threaded plugs for drain and vent.
- E. Steam Heating Coil:
  - 1) Use only where medium temperature hot water is not available.
  - 2) Headers: Cast iron with tubes expanded into header, seamless copper tube with silver brazed joints, or prime coated steel pipe with brazed joints.
  - 3) Configuration: Drainable, with threaded plugs for drain and vent, threaded plugs in return bends and in headers opposite each tube, sloped within frame to condensate connection.
- F. Refrigerant Coils:
  - 1) Thermostatic expansion valves required.

- 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.

G. Electric Coils:

1. Not allowed, except with written permission of Brown Project Manager.
  - 1) Where exception is permitted:
    - a) Coil: Enclosed copper tube, aluminum finned element.
    - b) Controls: built-in SCR controller furnished under this Division.

## 2.5 HUMIDIFIERS

- A. Humidifier shall be located in straight runs of duct, three duct widths before change in duct direction or reduction in duct size. Provide humidification in supply trunk if unit location does not permit three duct widths before first change in duct direction.
- B. Steam Grid Humidifier: See Steam Humidifier Section.

## 2.6 FILTERS

- A. See Section 23 00 10 – HVAC Design Criteria.

## 2.7 DAMPERS

- A. Mixing Boxes: Section with factory mounted outside and return air dampers of galvanized steel with vinyl bulb edging and edge seals in galvanized frame, with galvanized steel axles in self-lubricating brass bearings, in parallel blade arrangement with damper blades positioned across short air opening dimension. Furnish removable, full width support for freeze-protection thermostat, with removable end panel to permit support removal.
- B. Damper Leakage: Maximum 2 percent at 4-inch wg differential pressure when sized for 2000 fpm face velocity.
- C. Damper Actuators: Furnish factory installed electric damper actuators for outside air, return air, and exhaust air dampers, face and bypass dampers. Actuators shall be external to unit housing, rated for minimum 100,000 cycles.

## 2.8 ECONOMIZER

- A. Furnish fully modulating economizer from 0 to 100 percent outside air with adjustable minimum position control and spring return motor for outside air damper closure during unit shutdown or power interruption.

### PART 3. EXECUTION

#### 3.1 INSTALLATION

- A. Install flexible connections between unit and inlet and discharge ductwork. Install metal bands of connectors parallel with minimum **1 inch** flex between ductwork and fan while running. Refer to Division 23.
- B. Install vibration isolators. Install isolated fans with resilient mountings and flexible electrical leads. Install restraining snubbers as required. Adjust snubbers to prevent tension in flexible connectors when fan is operating. Refer to Section 23 05 48 - Mechanical Sound, Vibration, And Seismic Control.
- C. Install floor mounted units on concrete housekeeping pads at least 4 inches high and 6 inches wider than unit. Refer to Section 03 30 00 – Cast In Place Concrete.
- D. Refrigerant Coils: Install sight glass in liquid line within **12 inches** of coil.
- E. Insulate coil headers located outside airflow. Refer to Section 23 07 19 – Mechanical Piping Insulation.
- F. Installation Hot Water Heating Coil:
  - 1) Make connections to coils with unions or flanges.
  - 2) Connect water supply to leaving airside of coil (counter flow arrangement).
  - 3) Locate water supply at bottom of supply header and return water connection at top.
  - 4) Install water coils to allow draining and install drain connection at low points.

END OF SECTION