

**SECTION 23 82 00  
CONVECTION HEATING AND COOLING UNITS**

SPEC WRITER NOTES:

1. Delete between//----// if not applicable to project. Also delete any other item or paragraph not applicable in the section and renumber the paragraph.
2. References to pressure in this section are gage pressure unless otherwise noted.

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

SPEC WRITER NOTE: Edit each of the following paragraphs as necessary to agree with products being used.

Induction units, fan-coil units, radiant ceiling panels (for bathrooms), unit heaters, cabinet unit heaters, convectors and finned-tube radiation

**1.2 RELATED WORK**

- A. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic restraints for equipment.
- B. Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.
- C. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT: Noise requirements.
- D. Section 23 21 13, HYDRONIC PIPING: Heating hot water and chilled water piping.
- E. Section 23 31 00, HVAC DUCTS and CASINGS: Ducts and flexible connectors.
- F. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Valve operators.
- G. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC: Flow rates adjusting and balancing.
- H. Section 23 82 16, AIR COILS: Additional coil requirements.
- I. Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS: Requirements for commissioning, systems readiness checklists, and training.
- J. Section 01 09 00 - GENERAL COMMISSIONING REQUIREMENTS

**1.3 QUALITY ASSURANCE**

Refer to Paragraph, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Induction units.
  - 2. Fan-Coil units.
  - 3. Unit heaters.
  - 4. Cabinet unit heaters.
  - 5. Convectors.
  - 6. Finned-tube radiation.
  - 7. Radiant ceiling panels.
- C. Certificates:
  - 1. Compliance with paragraph, QUALITY ASSURANCE.
  - 2. Compliance with specified standards.
- D. Operation and Maintenance Manuals: Submit in accordance with paragraph, INSTRUCTIONS, in Section 01 00 00, GENERAL REQUIREMENTS.
- E. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute / Air Conditioning, Heating and Refrigeration Institute (ANSI/AHRI):
  - 440-08 ..... Performance Rating of Room Fan Coils
 National Fire Protection Association (NFPA):
  - 90A-09 ..... Standard for the Installation of Air  
Conditioning and Ventilating Systems
  - 70-11 ..... National Electrical Code
- C. Underwriters Laboratories, Inc. (UL):
  - 181-08 ..... Standard for Factory-Made Air Ducts and Air  
Connectors
  - 1995-05 ..... Heating and Cooling Equipment

## 1.6 GUARANTY

In accordance with FAR clause 52.246-21

## PART 2 - PRODUCTS

### 2.1 INDUCTION UNITS

- A. General: Induction units shall include an enclosure for cabinet models and casing for concealed models. Base unit shall include air plenums, air-discharge nozzles, air discharge grilles, recirculation grilles, water coil assembly, valve and piping package, condensate drain pan, and an adjustable air-balancing damper. Each unit shall be selected to produce the capacity shown on the drawings, without exceeding the specified static pressure.

SPEC WRITER NOTE: Enclosure color to be selected and specified in consultation with the interior finish.

- B. Enclosure: Construct of galvanized steel minimum 1.3 mm (18 gage), reinforced and braced. Front panel of enclosure shall be removable. Discharge grilles shall be adjustable and shall be of such design as to distribute air throughout the conditioned space. Plastic discharge and return grilles are not acceptable. Provide access doors for all piping and control compartments. Color of the enclosure shall be // //.
- C. Air Plenums: Construct air plenums of galvanized steel with interior acoustically baffled and lined with sound absorbing materials that will attenuate the sound power from the primary air supply to the room. Lining shall be 13 mm (0.5 inch) thick (2.5 lb/ft<sup>3</sup>) density neoprene coated glass fiber. Heat-resistant nozzles shall be integral with or attached airtight to the plenum. Where coil induction units are supplied with vertical runouts, provide a streamlined, vaned, mitered elbow transition piece for connection between the unit and ductwork. Provide an adjustable air-balancing damper in each unit.

DESIGNER'S NOTE: See HVAC Design Manual Appendix 7-A Table 7-A1 for high humidity areas.

- D. Water Coils: Provide // single water coil. // dual water coils for heating and cooling. // Seamless copper tubing, with copper or aluminum fins, mechanically bonded or soldered to the tubes, suitable for 1378 kPa (200 psig) working pressure. Provide coil connections with no less than 11 mm (7/16-inch) outside diameter flare or sweat connectors, accessory piping package with shut-off valves and terminal connections suitable for connection to the type of control valve supplied, and

manual air vent. Test coils hydrostatically at 2067 kPa (300 psig) or under water at 1722 kPa (250 psig) air pressure. For all induction units in high humidity areas, provide factory-coated coils for protection from corrosion by using multiple stage electro-deposition coating process. Refer to Drawings and Section 23 82 16, AIR COILS, for additional coil requirements.

- E. Provide easily accessible 25 mm (1 inch) thick throwaway type MERV 7 filters for each unit.
- F. Drain or Auxiliary Pans: Galvanized steel, watertight, and properly sized and located to collect all condensed water dripping from any item within the unit enclosure. Provide drain connection when a condensate drain system is indicated. Connection shall be minimum 15 mm (1/2-inch) NPT.

## 2.2 ROOM FAN-COIL UNITS

- A. Capacity Certification: AHRI 440.
- B. Safety Compliance: NEC compliant and UL listed.
- C. Noise Levels: Operating at full cooling capacity, sound power level shall not exceed by more than 5 dB the numerical value of sound pressure levels associated with noise criteria specified in Section 23 05 51, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT. Select units at intermediate speed, for compliance with the noise criteria.
- D. Chassis: Galvanized steel, acoustically and thermally insulated to attenuate noise and prevent condensation.
- E. Cabinet: Minimum 1.3 mm (18 gage) steel reinforced and braced. Arrange components and provide adequate space for installation of piping package and control valves. Finish shall be factory-baked enamel //in manufacturer's standard color//color as selected by the architect// on all exposed surfaces.
  - 1. Vertical Exposed Cabinet Unit: Provide 1.6 mm (16 gage) steel front panel with 13 mm (1/2-inch) thick fiberglass insulation and provide screw-type levelers. //Provide low-silhouette type where shown.//
    - a. Air outlet grilles: Adjustable four-way air deflection located in the top panel.
    - b. Provide two hinged access doors (one each side) equipped with key operated cam-lock fasteners in the unit top panel located to provide access to the unit controls.

2. Horizontal Unit: Provide //Recessed//Exposed//Concealed// type as shown. Provide supports and vibration isolators for horizontal units as recommended by the manufacturer.
- a. Concealed Units: //Provide furred-in type with //return plenum and inlet duct collar and //outlet duct collar.//  
//Provide fully enclosed cabinet with inlet and outlet duct collars.//
  - b. Recessed Units: Provide hinged access door with //stamped integral air inlet grille //and outlet grille// inlet // and outlet duct collar.
  - c. Exposed Units: Fully enclosed cabinet with hinged bottom access panel with cam-lock fasteners. Provide stamped integral inlet and discharged grilles in front of cabinet.
- F. Fans: Centrifugal, forward curved, double width type wheels, galvanized steel or polyester resin construction, statically and dynamically balanced, direct driven.
1. Motors: Premium efficiency, 3-speed permanent split capacitor type with integral thermal overload protection, for operation at not more than 1200 RPM.
  2. Provide a fan speed selector switch, with off, low, medium, and high positions. Switch shall have a set of auxiliary contacts which are open when the switch is in the "off" position and closed when the switch in any of the other positions. On vertical units, mount switch in a junction box in the cabinet of each unit. On ceiling-suspended horizontal and concealed units, switch shall be wall mounted.

DESIGNER'S NOTE: Most VA projects will include hydronic heating coils. Steam or Electric heating coils shall be included only where specifically required, and approved, for the particular project.

G. Cooling and Heating Coils:

1. Hydronic (two separate coils for cooling and heating): Copper tubes, 10 mm (three-eighths inch) minimum inside diameter, not less than 4.3 mm (0.017 inch) thick with copper or aluminum fins. Coils shall be pressure tested for bursting and strength in accordance with Underwriters Laboratories, Inc., requirements for pressure tested coils, and shall be designed to provide adequate heat transfer

capacity. Provide manual air vent at high point of each coil and drain at each low point.

//2. Auxiliary steam coils: Serpentine copper tube mechanically bonded to aluminum fins, maximum working pressure 1378 kPa (200 psig). //

//3. Electrical heating coils: Spiral sheath or finned-tube construction with Cal-rod resistance elements in aluminum tubes. Units shall be UL listed and factory wired with unit mounted heat switch, magnetic contactors, high temperature cutout safety control, and fan override thermostat. //

H. Piping Package: Factory furnished with unit by the manufacturer or field-installed by the contractor to fit control valves provided by the controls supplier. Submit manufacturer's detailed drawings of the piping in the end compartments for approval prior to fabrication of the piping packages. Provide ball stop valves on the supply and return pipes and balancing fittings on the return pipes.

I. Drain pans: Furnish galvanized steel with solderless drain connections and molded polystyrene foam insulating liner:

1. Auxiliary drain pan: Located under control valve and piping within the unit enclosure to prevent dripping.

//2. Secondary Drain Pan: //Where shown on the drawings//Where the unit is located such that drain pan overflow will damage the building, // provide a secondary drain pan located // underneath the unit, constructed to extend a minimum of 50 mm (2 inches) beyond the edges of the unit and be a minimum of 38 mm (1-1/2 inches deep) provided with a //separate drain line discharging to conspicuous point// or //water detection device to deactivate the cooling in the unit//.

J. Air Filter: Manufacturer's standard throwaway type, not less than 25 mm (1 inch) thick, MERV 7, supported to be concealed from sight and be tight fitting to prevent air by-pass. Filters shall have slide out frames and be easily replaced without removing enclosure or any part thereof.

K. Control valves and remote wall mounted space thermostats// or unit mounted return air thermostats, where shown or specified //are to be field installed. Provide two-way modulating control valves unless shown or specified otherwise.

### **2.3 UNIT HEATERS**

A. General: Horizontal or vertical discharge type for steam, hot water or electric heating medium, as indicated.

- B. Casing: Steel sheet, phosphatized to resist rust and finished in baked enamel. Provide hanger supports.
- C. Fan: Propeller type, direct driven by manufacturer's standard electric motor. Provide resilient mounting. Provide fan guard for horizontal discharge units.
- D. Discharge Air Control:
  1. Horizontal discharge: Horizontal, adjustable louvers.
  2. Vertical discharge: Radial louver diffuser.

## DESIGNER NOTE

Coil corrosion control is required for high-humidity locations. See VA HVAC Design Manual for locations.

- E. Steam or Hot Water Coil: Aluminum fins bonded to seamless copper tubing by mechanical expansion of the tubing, designed for 517 kPa (75 psig) steam working pressure.
 

//1.// Corrosion Control: Provide corrosion control for coils in high-humidity locations by using a multi-stage, epoxy immersion coating (electrically deposited) process fully described in Section 23 82 16 - Air Coils.//
- F. Electric Units: UL listed, factory wired to terminal strips for field connection of power and control wiring.
  1. Heating elements: Nickel chromium alloy resistance wire embedded in a magnesium oxide insulating refractory and sealed in corrosion resisting metallic sheath with fins. Three phase heaters shall have balanced phases.
  2. Thermal cutout: Manual reset type, which disconnects elements, and motor in the event normal operating temperatures are exceeded.
  3. Magnetic contactor: Factory installed with low voltage relay for remote pilot duty thermostat operation.
- G. Controls: Provide field installed remote wall mounted line voltage electric space thermostats// or unit mounted return air thermostats, where shown or specified // to control the unit fan. //Provide an aquastat on //steam//hot water// units to prevent fan operation when the heating system is off//.

**2.4 CABINET UNIT HEATERS**

- A. General: Vertical or horizontal type for steam, hot water or electric heating medium, as indicated.
- B. Cabinet: Not less than 1.3 mm (18 gage) steel with front panel for vertical units and hinged front panel for horizontal units. Finish on exposed cabinet shall be factory-baked enamel in manufacturer's standard color as selected by the Architect. Provide 76 mm (3-inch) high sub-base for vertical floor mounted units.
- C. Fan: Centrifugal blower, direct driven by a single phase, two-speed, electric motor with inherent overload protection. Provide resilient motor/fan mount.
- D. Filter: Manufacturer's standard, one inch thick, throwaway type MERV 7 filters.

## DESIGNER NOTE

Coil corrosion control is required for high-humidity locations. See VA HVAC Design Manual for locations.

- E. Steam or Hot Water Coil: Aluminum fins bonded to seamless copper tubing by mechanical expansion of the tubing, designed for 517 kPa (75 psi) steam working pressure.  
//1.// Provide corrosion control for coils in high-humidity locations by using a multi-stage, epoxy immersion coating (electrically deposited) process fully described in Section 23 82 16 - Air Coils.//
- F. Electric Coil: Spiral sheath or finned-tube construction with Cal-rod resistance elements in aluminum tubes. Units shall be UL listed and factory wired with unit mounted heat switch, magnetic contactors, high temperature cutout safety control, and fan override thermostat.
- G. Factory Mounted Controls: Manual fan starter and three-position (low, high and off) fan speed switch. Provide field installed remote wall mounted line voltage electric space thermostats// or unit mounted return air thermostats, where shown or specified // to control the unit fan. //Provide an aquastat on //steam//hot water// units to prevent fan operation when the heating system is off//.

**2.5 WALL-MOUNTED UNIT HEATER**

- A. General: Electric heat, fan driven, thermostatic control, UL listed.
- B. Enclosure:
  - 1. Wall box: Not less than 1.3 mm (18 gage) steel, recessed type.
  - 2. Ribbed 1.6 mm (16 gage) steel front cover.



3. Closely spaced discharge louvers.
  4. Concealed screws for locking trim frame to front cover.
  5. Finished in baked enamel of manufacturer's standard color with satin finish anodized aluminum trim frame.
- C. Heating Elements: Steel sheath enclosed finned-tube type.
- D. Integral Controls:
1. Two-pole terminal block.
  2. Built-in fan delay switch.
  3. Automatic reset line voltage internal thermal overheats protection.
  4. Built-in thermostat comfort control with adjustment range between -1 to 32 degree C (30-90 degrees F), and manually set "No Heat" position; tamper resistant adjustment by inserting screwdriver through front cover louvers.

## 2.6 CONVECTORS

- A. Ratings: In accordance with AHRI 445.
- B. Enclosure: Steel panels, minimum 1.3 mm (18 gage) front and 1.0 mm (20 gage) back and sides. Provide baked enamel finish in standard manufacturer's colors as selected by the Architect. Provide easy access to heating elements, valves and controls.
1. Fully recessed units: Flanged enclosure with 13 mm (1/2-inch) thick fiber-glass insulation on the back. Provide one-piece front panel with integral inlet and outlet grilles.
  2. Wall hung and freestanding units: Sloping top design.
- C. Hydronic/Steam Heating Elements: Copper tubing expanded into cast iron or cast brass headers and aluminum fins with integral collars bonded by mechanical expansion of tubing. Elements shall withstand 690 kPa (100 psig) air pressure when factory tested under water.
- D. Electric Heating Elements (Wall Hung and Freestanding Units):
1. Cal-rod electric resistance type inside aluminum tubes, mechanically expanded into fins and suspended between junction boxes. Provide capillary type automatic reset thermal cutout for immediate overheat protection. Front panel temperature shall not exceed 54 degrees C (130 degrees F). Units shall be UL approved.
  2. Unit mounted temperature control: Two stage (low/high/off) line or low voltage thermostat with control relays.
- E. //Provide field installed remote wall mounted line or low voltage electric space thermostats// or unit mounted return air thermostats,

where shown or specified // on //steam//hot water// units to operate the unit control valve//.

## 2.7 FINNED-TUBE RADIATION

- A. Ratings: Certified under the I=B=R program of the Gas Appliance Manufacturer's Association.
- B. Enclosures: 1.6 mm (16 gage) steel, sloping top, designed for wall mounting. Provide baked enamel finish in standard manufacturer's colors as selected by the Architect. End plates and corner pieces shall be die-formed with round edges and fit flush with enclosure surface. Where continuous wall-to-wall installations are shown on the drawings provide all fillers, corner fittings, sleeves, end caps and other accessories, which shall have the same profile as the basic unit. Provide access panels or extensions where required for access to valves, or traps shown on the drawings.
- C. Hydronic/Steam Heating Elements: Steel pipe or nonferrous tubing with fins mechanically bonded by mechanical expansion of the tube. Elements shall be positively positioned front-to-back with provisions for silent horizontal expansion and contraction.
- D. Electric Heating Elements: Cal-rod electric resistance type inside aluminum tubes, mechanically expanded into fins and suspended between junction boxes. Provide capillary type automatic reset thermal cutout for immediate overheat protection. Front panel temperature shall not exceed 54 degrees C (130 degrees F). Units shall be UL approved. VA Comment - Steam is generally not used.

## 2.8 RADIANT CEILING PANELS:

SPEC WRITER NOTE: Use of radiant ceiling panel system is not permitted for cooling application. Use panels for heating application per VA HVAC Design Manual

- A. Electric Heating Panels: UL listed, 0.55 mm (26 gage) steel backplate, 0.70 mm (24 gage) steel faceplate, with one inch thick insulation between plates and over radiant panel. Finish with two coats flat white baked-on polyester paint for lay-in installation in an exposed "T" suspended ceiling.
  - 1. Controls: Provide low voltage wall thermostats and required control transformers, relays and contactors for installation by the Electrical Contractor. Re-write the cancelled statement differently
- B. Hydronic Radiant Panels: Lay-in type, 1.00 mm (0.040) inch aluminum faceplate with 13 mm (1/2-inch) I.D copper serpentine water coil

mechanically bonded to faceplate, finished with two coats baked white polyester finish with a light reflection value of 70 to 80 percent. Panels shall weigh no more than 0.68 kg (1.5 pounds) per square foot when filled with water. Provide 75 mm (3-inch) un-faced fiberglass blanket insulation pre-cut for installation above panels. Panels shall be //600 mm x 600 mm (2' x 2')// 600 mm x 1200 mm (2' x 4')// continuous linear// arranged as shown on the drawings.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.
- B. Handle and install units in accordance with manufacturer's written instructions.
- C. Support units rigidly so they remain stationary at all times. Cross-bracing or other means of stiffening shall be provided as necessary. Method of support shall be such that distortion and malfunction of units cannot occur.
- D. Install fiberglass blanket insulation with a minimum R value of 8 above hydronic radiant panels.

#### **3.2 OPERATIONAL TEST**

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

#### **3.3 STARTUP AND TESTING**

- A. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Resident Engineer and Commissioning Agent. Provide a minimum of 7 days prior notice.

#### **3.4 COMMISSIONING**

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

#### **3.5 DEMONSTRATION AND TRAINING**

- A. Provide services of manufacturer's technical representative for four hours to instruct VA personnel in operation and maintenance of units.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS.

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