**SECTION 23 82 00**

**HEATING AND COOLING TERMINAL UNITS**

**BASED ON DFD MASTER SPECIFICATION DATED 12/11/23**

***This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes and comments from you.***

**P A R T 1 - G E N E R A L**

**SCOPE**

This section includes specification for heating and cooling terminal equipment using water and/or steam as the source. Included are the following topics:

PART 1 - GENERAL

 Scope

 Related Work

 Reference

 Reference Standards

 Quality Assurance

 Shop Drawings

 Operation and Maintenance Data

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PART 2 - PRODUCTS

 Reheat Coils

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PART 3 - EXECUTION

 Installation

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# RELATED WORK

Section 01 91 01 or 01 91 02 – Commissioning Process

Section 23 08 00 – Commissioning of HVAC

Section 23 05 23 - General-Duty Valves for HVAC Piping

Section 23 05 13 - Common Motor Requirements for HVAC Equipment

Section 23 41 00 - Particulate Air Filtration

Section 23 36 00 - Air Duct Accessories

**REFERENCE**

Applicable provisions of Division 1 govern work under this Section.

**REFERENCE STANDARDS**

ARI 210 Standard for Unitary Air-Conditioning Equipment

ARI 410 Standard for Forced-Circulation Air-Cooling and Air-Heating Coils

CS 140

**QUALITY ASSURANCE**

Refer to division 1, General Conditions, Equals and Substitutions

**SHOP DRAWINGS**

Refer to division 1, General Conditions, Submittals.

Include dimensions, capacities, materials of construction, ratings, weights, wiring diagrams, and appropriate identification for all equipment in this section. Include color selection chart where applicable.

# OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

***Delete the following if there are no additional requirements.***

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

1. ***[A/E and commissioning provider to define detailed operation and maintenance data requirements for equipment specifications added to this section.]***

**DESIGN CRITERIA**

Forced Circulation Coils: Ratings certified in accordance with ARI 410.

Electrical Equipment and heaters shall be UL listed for the service specified.

Electrical components and work must be in accordances with National Electrical Code.

**P A R T 2 - P R O D U C T S**

**REHEAT COILS**

Manufacturers: Carrier, Trane, McQuay, Marlo or approved equal.

Construct coils of copper tubes and aluminum fins in a serpentine arrangement with piping connections on the same end. Provide galvanized steel casing, end supports, top and bottom channels to allowance for expansion of finned tube section. Factory test coils at 200 psig.

Headers may be cast iron with tubes expanded into the header, steel pipe with tubes brazed to the header, or seamless copper with tubes brazed to the header.

Frames to be flanged for a gasketed connection to adjacent ductwork or constructed for slip and drive connection to the ductwork.

Minimum reheat coil size is 8 inches x 8 inches.

***The consultant must coordinate the reheat coil schedule on the drawings with this minimum size to insure there are no coils scheduled smaller than 8 inches x 8 inches.***

**UNIT HEATERS**

Manufacturers: Modine, McQuay, Trane, Airtherm, Sterling, Vulcan, Zehnder Rittling or approved equal.

Construct casing of 18 gauge steel with baked enamel finish and heating elements of copper tubing with aluminum fins. Use aluminum fan blades, balanced for quiet operation. Provide safety guard for fan/drive assembly. Test coils units at 200 psig.

Furnish adjustable horizontal and vertical discharge louvers for units with horizontal discharge. Provide an adjustable cone diffuser for projection units with vertical discharge.

Furnish motors with characteristics as scheduled. Single phase, 120 volt motors to be permanently lubricated and provided with thermal overload protection.

**CABINET HEATERS**

Manufacturers: Sterling, McQuay, Trane, Airtherm, Zehnder Rittling, Vulcan or approved equal.

Construct vertical unit casings with 16 gauge steel front panels and minimum 18 gauge steel end and side panels. Horizontal units located in concealed spaces or mounted in ceiling to have minimum 18 gauge front, end, and side panels.

Furnish exposed cabinets in a baked enamel finish in one of the manufacturer's standard colors, selected by the Architect.

Furnish ceiling mounted units with a hinged front panel to allow access to all internal components.

Construct heating elements of copper tubes with aluminum fins, tested at 200 psig.

Use centrifugal type fans, statically and dynamically balanced to operate without objectionable noise and vibration.

Motors to be 120 volt, single phase, permanently lubricated, with thermal overload protection and disconnect switch at unit.

Furnish each unit with filter rack and 1" panel filters as specified in Section 23 41 00.

**CONVECTORS**

Manufacturers: Modine, Sterling, Airtherm, Zehnder Rittling or approved equal.

***For residence projects and other areas where front panels will have a high abuse probability, select heavier gauge construction. Select SS or epoxy finish front and back panels where exposed to high humidity areas.***

Construct heating elements of copper tubes with aluminum fins expanded into cast iron or brass headers. Support heating elements on adjustable brackets to allow for expansion and pitch. Certify coil ratings in accordance with Commercial Standard CS 140.

Construct enclosures of 18 [14)] gauge steel [stainless steel][epoxy coated] back and end panels, and 16 [14] gauge steel front [stainless steel] [epoxy coated] and top panels. Furnish steel panels in a baked enamel [epoxy] finish in one of the manufacturers' standard colors, selected by Architect. Furnish stainless steel panels in a standard finish, selected by Architect.

**FIN TUBE RADIATION**

Manufacturers: Slant/Fin, Sterling, Vulcan, Zehnder Rittling, or approved equal.

Construct heating elements of steel fin on steel tube or aluminum fin on copper tube. Provide wall mounted support cradles which allow expansion of heating element without noise.

***Consultant should always select finned tube radiation with the smallest possible tube diameter, consistent with satisfying the heat loss of the space. This will maintain velocities more likely to remove air from the system,minimize the total flow required for radiation elements, and usually reduce overall cost. Note that fin tube radiation is rated at 3 fps water velocities unless derating factors are applied. For residence projects and other areas where front panels will have a high abuse probability, and/or installation with cabinets heights of 20-inches and over, select heavier gauge construction. Select SS or epoxy finish front and back panels where exposed to high humidity areas.***

Enclosures: Sloped top/louvered bottom with die formed grilles. Constructed with removable front panels of 16 [14] gauge steel [stainless steel] [epoxy coated), and wall mounting channel. Furnish steel panels in a baked enamel [epoxy] finish in one of the manufacturers' standard colors, selected by Architect. Furnish stainless steel panels in a standard finish, selected by Architect.

Provide dirt gasket for mounting between back panel and wall.

Provide accessories such as inside and outside corners and end caps where required for the complete installation. Where wall-to-wall installations are indicated on plans, provide enclosure extensions or field modification of enclosure to conform to actual room dimensions.

Provide hinged access doors at all valves, traps, and vents.

**UNIT VENTILATORS**

Manufacturers: McQuay, Modine, Trane, or approved equal.

Provide with heating and/or cooling capacities as scheduled.

Construct cabinets of 16 gauge steel with all exposed edges rounded. Front panels must be removable, secured in place with allen wrench operated cam locks. Cabinets to have easily removable inlet and outlet grilles. Provide a baked enamel finish in one of the manufacturer's standard colors, selected by the Architect.

Construct coils with a galvanized steel casing, copper tubes, aluminum fins and test at 200 psig.

Furnish an insulated galvanized steel drain pans below coils.

Construct direct expansion cooling coils of copper tubes with aluminum fins, conforming to ARI 210. Provide factory installed expansion valve, refrigerant filter/dryer, and holding charge. Where units are equipped with direct expansion cooling, both unit ventilator and condensing unit must be provided by the same manufacturer, and matched for proper performance.

Use centrifugal type fans, statically and dynamically balanced for operation without objectionable noise and vibration. Mount fan assembly on rubber isolators.

Motors to be permanent split capacitor type, two speed, with built-in thermal overload protection. Provide a manual disconnect switch inside cabinet.

Furnish each unit with filter rack and 1" panel filters as specified in Section 23 41 00. Design filter assembly to filter both outside air and return air.

Use insulated type outside air and return air dampers equipped with resilient blade seals and stainless steel jamb seals.

Provide wall louvers for outside air intake. Louvers shall be constructed of anodized aluminum and finished in a color selected by Architect.

***Coordinate the preceeding paragraph with the architect for louver furnishing and installation responsibilities.***

**FAN COIL UNITS**

Manufacturers: Carrier, Enviro-Tec, IEC, Trane, McQuay, Modine.

***For residence projects and other areas where front panels will have a high abuse probability, specify heavier gauge construction.***

Furnish with separate hot and chilled water coils, speed selector switch, condensate drain pan, and casing.

Use centrifugal type fans, statically and dynamically balanced for operation without objectionable noise and vibration. Mount fan assembly on rubber isolators.

Motors to be permanent split capacitor type with built-in thermal overload protection. Provide a manual disconnect switch inside cabinet.

Provide ducted units with air inlet and outlet duct collars.

Provide access doors in cabinet to allow maintenance of internal mechanical and electrical devices.

***Special ceiling access may be required for units with hinged fronts.***

Units in exposed locations to have an 18 [16] gauge steel cabinet with baked enamel finish in one of the manufacturer's standard colors, selected by Architect. Provide concealed units with a galvanized steel cabinet.

Acoustically and thermally insulate all units with minimum 1/2" fiberglass insulation. Insulate drain pans with 1/2" fire retardant closed cell foam insulation.

Furnish each unit with filter rack and 1" panel filters as specified in Section 23 41 00.

**ELECTRIC HEATERS**

***The following material can be edited for use with wall heaters or duct mounted electric reheat coils. Electric heat should be avoided if another, less costly heating medium is available. DFD approval is required if electric heat is planned for use.***

Manufacturers: Berko, Chromalox, Markel, Trane, or approved equal.

Use corrosion resistant heating elements, designed and spaced for even distribution of air across the heating element, and installed to prevent noise of expansion and contraction.

Provide units with necessary overheat protection, reset devices, air flow interlock switch, contactors, transformers, local non-fused disconnect switch that is prewired, and other controls as may be required by codes.

***The disconnect switch may be inside an enclosure, as may be the case for wall heaters in public areas. The intent is to have a disconnecting means for the maintenance person so that all power can be disconnected before work on the heater begins.***

Fan powered units must be provided with thermostat and controls to maintain fan operation until residual heat in the heating elements has been dissipated. The fans and motors shall be balanced and mounted for vibration free operation.

Construct cabinets of 20 gauge steel, furnished exposed cabinets with a baked enamel finish in one of the manufacturer's standard colors, selected by Architect.

**P A R T 3 - E X E C U T I O N**

**INSTALLATION**

Install units in accordance with manufacturer's installation instructions.

Install branch water or steam/condensate piping to each unit with a minimum of three elbows to allow for expansion and contraction of the piping system.

Coordinate location of units with other trades to assure correct recess size for recessed units.

After installation, provide protective covers to prevent accumulation of dirt on units during balance of construction.

**REHEAT COILS**

Comb bent or crushed fins and clean dust and debris from each coil before enclosing coils in ductwork. Pitch coil casings in accordance with manufacturer's instructions. Install a drain valve on the coil side of the shutoff valves for each reheat coil.

Pipe coils with multiple rows for counter flow arrangement.

**UNIT HEATERS**

Suspend units from building structure and as high as possible to maintain headroom beneath units; supporting from piping systems will not be accepted.

Install a drain valve on the coil side of the shutoff valves for each hot water unit heater.

**CABINET HEATERS**

Mount units in locations indicated on the drawings and as detailed. Install a drain valve on the coil side of the shutoff valves for each hot water cabinet heater.

***Verify that any unit installed in a fire rated wall will not destroy the integrity of the rating.***

**CONVECTORS**

Mount units in locations indicated on the drawings and as detailed. Install a drain valve on the coil side of the shutoff valves for each hot water cabinet heater.

***Verify that any unit installed in a fire rated wall will not destroy the integrity of the rating.***

**FIN TUBE RADIATION**

Install continuous dirt guard gasket between wall mounting channel and wall, or caulk continuous along top of wall mounting channel at wall.

Install a drain valve on the radiation side of the shutoff valves for each separately valved section of radiation.

Install access doors or panels, centered in front of each shut-off valve, balancing valve, steam trap, and temperature control valve located inside radiation enclosure.

**UNIT VENTILATORS**

Level and shim units and anchor to substrate. Coordinate exact location of wall louvers with other trades. After installation, provide protective covers to prevent accumulation of dirt during balance of construction.

Install a drain valve on the coil side of the shutoff valves for each hot and chilled water coil.

**FAN COIL UNITS**

Mount units in locations indicated on the drawings and as detailed. Install a drain valve on the coil side of the shutoff valves for each hot and chilled water coil.

**ELECTRIC HEATERS**

Install units where indicated on the drawings and details. Where heaters are indicated to be installed in ductwork, provide manufacturers recommended upstream and downstream ductwork to prevent overheating preblems.

Electric heaters located in toilet and shower rooms must be installed at least 6” above the finished floor.

***Coordinate electrical wiring with electical drawings.***

Units will be wired by the Electrical Contractor.

**CONSTRUCTION VERIFICATION**

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 23 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

**FUNCTIONAL PERFORMANCE TESTING**

Contractor is responsible for utilizing the functional performance test forms supplied under specification Section 23 08 00 in accordance with the procedures defined for functional performance testing in Section 01 91 01 or 01 91 02.

# AGENCY TRAINING

All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 91 01 or 01 91 02.

END OF SECTION