

SECTION 15830 - TERMINAL UNITS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. Extent of terminal unit work is indicated on drawings and schedules, and by requirements of this section.
- B. Types of terminal units required for project include the following:
 - 1. Baseboard radiation.
 - 2. Finned tube radiation.
 - 3. Convector.
 - 4. Unit heaters.
 - 5. Cabinet unit heaters.
 - 6. Fan-coil units.
 - 7. Unit ventilators.
 - 8. Coils.
 - 9. Electric wall heaters.
 - 10. Electric radiant ceiling panel heaters.
 - 11. Toe space heater.
 - 12. Electric ceiling heater/exhaust fan/light.
 - 13. Radiant-acoustical ceiling panels (hot water).
 - 14. Electric duct heaters.
- C. Refer to other Division 15 sections for piping; ductwork; testing, adjusting and balancing of terminal units; not work of this section.
- D. Refer to Division 16/1 section for the following work; not work of this section.
 - 1. Power supply wiring from power source to power connection on terminal units.
 - 2. Provide the following electrical work as work of this section, complying with requirements of Division-16 sections:
 - a. Control wiring between field-installed controls, indicating devices, and terminal unit control panels.
 - 1) Control wiring specified as work of Division 15 for Automatic Temperature Controls is work of that section.
- E. Refer to other Division 15 sections for automatic temperature controls not factory installed, required in conjunction with terminal units; not work of this section.

1.2 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of terminal units, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. I=B=R Compliance: Test and rate baseboard and finned tube radiation in accordance with I=B=R, provide published ratings bearing emblem of I=B=R.

2. ARI Compliance: Provide coil ratings in accordance with ARI Standard 410 "Forced-Circulation Air-Cooling and Air-Heating Coils".
3. ASHRAE Compliance: Test coils in accordance with ASHRAE Standard 33 "Methods of Testing Forced Circulation Air Cooling and Heating Coils".
4. ARI Compliance: Test and rate fan-coil units in accordance with ARI Standard 440 "Room Fan-Coil Air Conditioners".
5. UL Compliance: Construct and install fan-coil units in compliance with UL 883 "Safety Standards for Fan Coil Units and Room Fan Heater Units".
6. UL Compliance: Provide electrical components for terminal units, which have been listed and labeled by UL.
7. ARI Compliance Test and rate unit ventilators in accordance with ARI Standard 330 "Unit Ventilators".
8. AGA Compliance: All gas fired heating equipment shall be AGA Design Certified.
9. Electric Heating Equipment: All equipment with a heating coil capacity exceeding a 48 amp rating shall have the heating elements subdivided and protected by an overcurrent protection device rated at not more than 60 amps. Equipment not exceeding 48 amps shall also have overcurrent protection. Overcurrent protection devices shall be factory wired and installed in accordance with the National Electric Code. All equipment shall be factory assembled and wired in accordance with the National Fire Protection Association and shall be listed by Underwriters' Laboratories.

1.3 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data, for terminal units showing dimensions, capacities, ratings, performance characteristics, gauges and finishes of materials, and installation-startup instructions.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating terminal unit dimensions, weight loading, required clearances, construction details, field connection details and methods of assembly of components.
- C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to terminal units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
- D. Record Drawings: At project closeout, submit record drawings of installed systems products in accordance with requirements of Division 15.
- E. Samples: Submit 3 samples of each type of cabinet finish furnished.
- F. Maintenance Data: Submit maintenance instructions, including lubrication instructions, filter replacement, motor and drive replacement, control, accessories, "trouble-shooting" maintenance guide, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 15.

1.4 DELIVERY, STORAGE, AND HANDLING:

- A. Handle terminal units and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged terminal units or components; replace with new.
- B. Store terminal units and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.
- C. Comply with Manufacturer's rigging and installation instructions for unloading terminal units, and moving them to final location.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

- 1. Baseboard Radiation
 - a. Slant/Fin Corp.
 - b. Vulcan
 - c. Sterling Radiator; Div. of Reed National Corp.
 - d. Trane
 - e. Weil-McLain, Marley Co.
- 2. Finned Tube Radiation
 - a. Dunham-Bush, Inc.
 - b. Slant/Fin Corp.
 - c. Vulcan
 - d. Sterling Radiator; Div. of Reed National Corp.
 - e. Trane
- 3. Convectors
 - a. Vulcan
 - b. Burnham Corp.; Hydronics Div.
 - c. Dunham-Bush, Inc.
 - d. Trane
- 4. Unit Heaters
 - a. Airtherm Mfg. Co.
 - b. Vulcan
 - c. Dunham-Bush, Inc.
 - d. McQuay Inc.
 - e. Modine Mfg. Co.
 - f. Trane
- 5. Cabinet Unit Heaters
 - a. Airtherm Mfg. Co.
 - b. Dunham-Bush, Inc.
 - c. McQuay Inc.
 - d. Trane

- e. Vulcan
- 6. Fan Coil Units
 - a. Airtherm Mfg. Co.
 - b. Corp.
 - c. Dunham-Bush, Inc.
 - d. McQuay Inc.
 - e. Trane
 - f. York; Div. of York International
 - g. International Fan Coil
- 7. Unit Ventilators
 - a. Trane
 - b. Nesbitt
- 8. Coils:
 - a. Aerofin Corp.
 - b. Corp.
 - c. Dunham-Bush, Inc.
 - d. McQuay Inc.
 - e. Trane (The) Co.
 - f. York; Div. of York International
- 9. Electric Baseboard Radiation
 - a. Sterling
 - b. Trane
 - c. Vulcan
 - d. Q Mark
 - e. Singer
 - f. Markel
 - g. Raywall
- 10. Electric Cabinet Heater
 - a. Airtherm
 - b. Q Mark
 - c. Trane
 - d. Berko
 - e. Markel
 - f. Singer
 - g. Raywall
- 11. Electric Unit Heater
 - a. Q Mark
 - b. Singer
 - c. Trane
 - d. Brasch
 - e. Indeeco
 - f. Berko
 - g. Markel
 - h. Modine

- i. Raywall
12. Electric Convector
 - a. Q Mark
 - b. Singer
 - c. Trane
 - d. Berko
 - e. Markel
 - f. Raywall
 13. Electric Wall Heaters
 - a. Berko
 - b. Q Mark
 - c. Singer
 - d. Brasch
 - e. Markel
 - f. Raywall
 14. Electric Radiant Ceiling Panel Heater
 - a. Aztec
 - b. Berko
 - c. Q Mark
 - d. Singer
 - e. Markel
 - f. Raywall
 15. Toe-Space Heater
 - a. Berko
 - b. Q Mark
 - c. Nutone
 - d. Singer
 - e. Markel
 16. Electric Ceiling Heater/Exhaust Fan/Light
 - a. Markel
 - b. Q Mark
 - c. Raywall
 17. Radiant-Acoustical Ceiling Panels (Hot Water)
 - a. Airtex
 - b. Aero Tech Mfgr Co.

18. Electric Duct Heaters

- a. Brasch
- b. Q Mark
- c. Indeeco
- d. Markel
- e. Raywall

2.2 BASEBOARD RADIATION:

- A. General: Provide (hot water) (steam) (electric) baseboard radiation of lengths, wall to wall enclosure, in locations as indicated, of capacities, style, and having accessories as scheduled.
- B. Cabinets: Minimum 20-ga cold-rolled steel, one-piece back and top panel, front panel with integral damper. Provide steel brackets inserted in back/top panel, to support element and front panel. Provide standard/custom/prime coat baked enamel finish on topside and front panel only.
- C. Elements: Copper tube and aluminum fins, with slide mechanism between element and support brackets to eliminate expansion and contraction noises.
- D. Accessories: Provide the following accessories:
 1. End panels, inside and outside corners, and enclosure extensions.
 2. Removable 18" long cover access section in front of valves, balancing cocks, and traps.
 3. Factory-mounted dampers.
 4. Sill extensions.
 5. Mullion channels.
 6. Pilaster covers.

2.3 FINNED TUBE RADIATION:

- A. General: Provide (hot water) (steam) finned tube radiation of lengths, wall to wall enclosure, in locations as indicated, of capacities, style, and having accessories as scheduled.
- B. Cabinets: Minimum 18/16/14 ga. cold-rolled steel, continuous 20-ga. partial height/full height backplate, minimum 16/18/14 ga. front. Brace and reinforce front minimum of 4'-0" o.c. without visible fasteners.
- C. Elements: Copper tube and aluminum fins, with tube mechanically expanded into fin collars to eliminate noise and ensure durability and performance at scheduled ratings.
- D. Finish: Unfinished zinc coated steel/flat black heat resisting paint backplate, standard factory color selected baked enamel finish/[custom color as selected by Architect in baked enamel finish on front, sides, top and accessories.
- E. Accessories:
 1. End panels, inside and outside corners, and enclosure extensions.
 2. Removable 18" long hinged cover access section in front of valves, balancing cocks, and traps.
 3. Factory-mounted dampers.
 4. Sill extensions.
 5. Mullion channels.
 6. Pilaster covers.

2.4 CONVECTORS:

- A. General: Provide hot water/steam convectors having cabinet sizes and in locations as indicated, and of capacities, style, and having accessories as scheduled.
- B. Cabinets: Minimum (14) 16-ga steel front and top panels, (14) 18-ga side panels, and 20-ga back panels. Phosphatize and galvanize back panels, phosphatize and standard/custom/ color baked enamel finish top, sides, and front, with one coat of primer. Secure fronts in place with quick opening slide bolts or camlock fasteners.
 - 1. Recessed Cabinets: One-piece front panel, with 4-side gasketed overlap.
- C. Elements: Aluminum fins, ribbed steel side plates, fin tube supports and copper tubes, cast-iron headers. Factory-test each element to 150 psi air pressure under water.
- D. Accessories: Provide the following accessories:
 - 1. Factory-mounted dampers.
 - 2. 1/2" insulation on cabinet back.
 - 3. Access doors in front for valve access.

2.5 UNIT HEATERS:

- A. General: Provide unit heaters in locations as indicated, and of capacities, style, and having accessories as scheduled.
- B. Horizontal Unit Heaters:
 - 1. Casings: Construct of steel, phosphatized inside and out, and finished with standard color baked enamel finish. Provide motor- mounted panel, minimum of 18-ga steel. Fabricate casing to enclose coil, louvers, and fan blades. Provide louvers for 4-way air diffusion.
 - 2. Fans: Construct of aluminum, and factory-balance. Provide fan inlet orifice, smooth, and drawn into casing back panel.
- C. Vertical Unit Heaters:
 - 1. Casings: Construct of steel, phosphatized inside and out, and finished with standard color baked enamel finish. Design casing to enclose fan, motor, and coil, design fan orifice formed into discharge panel. Provide air diffusers as scheduled.
 - 2. Fans: Construct of aluminum and factory-balance. Design so motor and fan assembly is removable through fan outlet panel.
- D. Coils: Construct of plate-type aluminum fins, mechanically bonded to copper tubes. Design coil for use in steam/hot water applications.
- E. Motors: Provide totally enclosed motors, with built-in overload protection, having electrical characteristics as scheduled.

2.6 CABINET UNIT HEATERS:

- A. General: Provide hot water/steam cabinet heaters having cabinet sizes and in locations as indicated, and of capacities, style, and having accessories as scheduled. Include in basic unit chassis, coil, fanboard, fan wheels, housings, motor, and insulation.

- B. Chassis: Galvanized steel wrap-around structural frame with edges flanged.
- C. Insulation: Faced, heavy density glass fiber.
- D. Cabinet: 16-ga removable front panel, 18-ga top and side panels. Insulate front panel over entire coil section. Provide access door on coil connection side. Clean cabinet parts, bonderize, phosphatize, and flow-coat with baked-on primer. Standard factory color selected baked enamel finish/Custom color as selected by Architect in baked enamel finish.
- E. Water Coils: Construct of 5/8" seamless copper tubes mechanically bonded to configured aluminum fins. Design for 300 psi and leak test at 300 psi under water. Provide same end connections for supply and return.
- F. Steam Coils: Construct of 1" seamless copper tubes mechanically bonded to configured aluminum fins. Design for 75 psi and leak test at 450 psi under water. Provide cast-iron headers, and same end connections for supply and return.
- G. Fans: Provide centrifugal, forward curved double width fan wheels constructed of non-corrosive, molded, fiberglass- reinforced thermo-plastic material. Construct fan scrolls of galvanized steel.
- H. Motors: Provide shaded pole motors with integral thermal over-load protection, and motor cords for plug-in to junction box in unit.
- I. Filters: Provide 1" thick throwaway type filters in fiberboard frames.
- J. Accessories: Provide the following accessories as indicated and/or scheduled:
- K. Wall Boxes: Provide aluminum wall boxes with integral eliminators and insect screen.
 - 1. Recessing Flanges: Provide 18-ga steel flanges for recessing cabinet heaters into wall or ceiling.
 - 2. Sub-bases: Provide 18-ga steel sub-base for vertical units, height as indicated.
 - 3. Extended Oilers: Provide plastic motor oiler tubes extending to beneath top discharge grille.

2.7 FAN-COIL UNITS:

- A. General: Provide fan-coil units having cabinet sizes, and in locations indicated, and of capacities, style, and having accessories as scheduled. Include in basic unit chassis, coils, fanboard, drain pan assembly, fans, housing, motor, filter, and insulation.
- B. Chassis: Construct chassis of galvanized steel with flanged edges.
- C. Insulation: Faced, heavy density glass fiber.
- D. Cabinet: Construct of 18-ga steel removable panels, 16-ga front. Provide insulation over entire coil section. Clean cabinet parts, bonderize, phosphatize, and flow-coat with baked-on primer. Standard factory color selected baked enamel finish./ Custom color as selected by Architect in baked enamel finish.
- E. Coils: Construct of 1/2" seamless copper tubes mechanically bonded to configured aluminum fins. Design for 250 psi working pressure, and leak tested at 350 psi under water.

- F. Auxiliary Heating Coils: Construct of 1/2" seamless copper tubes mechanically bonded to configured aluminum fins. Design for 250 psi working pressure.
- G. Drain Pans: Construct of galvanized steel. Insulate with polystyrene or polyurethane insulation. Provide drain connection.
- H. Fans: Provide centrifugal forward curved double width wheels of reinforced fiberglass, in galvanized steel fan scrolls.
- I. Motors: Provide motors with integral thermal overload protection. Run test motors at factory in assembled unit prior to shipping. Provide quickly detachable motor cords.
- J. Filters: Provide 1" thick throwaway type filters in fiberboard frames.
- K. Dampers: Provide 18-ga steel damper blades with polyurethane stop across entire blade length. Provide factory-mounted electric operators for 25% open cycle.
- L. Accessories: Provide the following accessories as indicated and/or scheduled:
 - 1. Wall Boxes: Provide aluminum wall boxes with integral eliminators and insect screen.
 - 2. Discharge Grille Panels: Provide 18-ga galvanized steel, stamped integral grilles, with access doors.
 - 3. Sub-Bases: Provide 18-ga steel sub-base, height as indicated.
 - 4. Extended Oilers: Provide plastic motor oiler tubes extending to beneath top discharge grille.
 - 5. Recessing Flanges: Provide 18-ga steel flanges for recessing fan-coil units into wall or ceiling.

2.8 UNIT VENTILATORS:

- A. General: Provide unit ventilators having cabinet sizes, and in locations indicated, and of capacities, style, and having accessories as scheduled. Include in basic unit cabinets, dampers, fan board assembly, motors, coils, filters, drain pans, outdoor air intake and shelving/accessories.
- B. Cabinets: Construct of 16-ga furniture steel with exposed edges rounded. Provide removable front. Clean, phosphatize, and flow coat with baked-on primer paint steel surfaces/standard factory color selection baked enamel finish. Color as selected by Architect/Engineer in a baked enamel finish. Provide discharge air grille of heavy steel bars welded in place integral with unit structure and cleanable sight blockoffs below grille at end pockets. Provide completely removable end panels for access to piping and valves. Provide leveling legs. Provide pipe access openings in bottom of each end pocket, and pipe chase across back of unit for crossover piping and wiring. Unit inlet grilles shall be removable for filter access.
- C. Dampers: Provide dual-blade type mixing dampers for modulation of return and outside air. Provide sealing device on damper edges and ends. Bypass dampers shall be aluminum, insulated and tight sealing.
- D. Fan Board Assembly: Provide single rigid assembly including fans, fan housings, bearings, fan shaft and motor. Mount fan assembly on rubber isolators. Wrap-around portion shall be 3/4", 6 lbs density, molded fiberglass and vinyl coated exterior surface.

- E. Motors: Provide permanent split-capacitor type with two speed motors. Provide multiple tap auto transformer wired to motor.
- F. Coils: Construct hydronic coils of 5/8" copper tubes with plate-type heavy gauge aluminum fins with crack-free continuous fin collars. Drain pan shall be deep formed galvanized steel internally lined with closed cell inert plastic insulating material.
- G. Refrigeration: Construct direct expansion coils of 2-row copper tubes and aluminum fins, conforming to ARI 210. Provide factory-installed thermal expansion valve, refrigerant filter/dryer, and R-22 holding charge. Provide condensing units equipped with built-in suction line accumulator, anti-slugging devices, crank-case heater, filter-drier, winding thermostat, current overload protection, pressure limiting valve, and electrical control panel. Also equip with sweat connection special adapters, service valves, and sight glass. Provide start-capacitor kit.
- H. Accessories: Provide the following accessories as indicated and/or specified:
 - 1. Filters: Provide 1" thick throwaway/permanent/replaceable media filters.
 - 2. Wall Louvers: Provide wall louvers for outside air intake, vertical blade design with channels and constructed of heavy gauge aluminum.
 - 3. Unit Shelving: Construct unit shelving of 16 gauge materials and finished to match unit ventilator cabinets. Provide adjustable shelves reinforced with a formed channel. Closed shelving doors shall be roller hung doors with lock. Provide shelving with protective aluminum trim strip on front edge and cover with damage resistant top material.
 - 4. Crossover Piping: Provide in cabinet pipe chase, crossover piping of size and configuration as indicated on drawings.

2.9 COILS:

- A. General: Provide coils of size and in location indicated, and of capacities and having performance data as scheduled. Certify coil capacities, pressure drops, and selection procedures in accordance with ARI 410.
- B. Heating Coils:
 - 1. Fins: Construct of continuous aluminum or copper configured plate-fin type with full fin collars for accurate spacing and maximum fin-tube contact.
 - 2. Tubes: Construct of copper tubing, expanded into fin collars for permanent fin-tube bond and expanded into header for permanent leaktight joint.
 - 3. Headers: Construct of gray cast iron for coils 33" high and smaller. Hydrostatically test to 400 psi before assembly. Construct of round seamless copper tube for coils over 33" high.
 - 4. Casings: Construct of 16-ga continuous coated galvanized steel with fins recessed into channels to minimize air bypass.
 - 5. Testing: Proof test coils at 300 psi, leak test at 200 psi under water.
 - 6. Coil Types: Provide the following coil types as indicated, and as scheduled.

- a. Hot Water to 200 psi, 220 deg. F (104 deg. C): Provide 2-row, 5/8" tubes, same-end connection coil. Provide rolled tube-to-header joints for coil heights 33" and smaller. Provide brazed tube-to-header joints for coil heights over 33".
- b. Hot Water to 225 psi, 325 deg. F (163 deg. C): Provide 2-row, 5/8" tubes, same-end connection, dual-tube-feed coil. Reinforce tube-to-header joints with brass bushings and provide expanded joints.
- c. Hot Water to 225 psi, 325 deg. F (163 deg. C) and Steam to 200 psi, 400 deg. F (204 deg. C): Provide 2-rows, 5/8" tubes, single tube continuous circuit, same-end connection coil. Roll connection tube.
- d. Steam to 200 psi, 400 deg. F (204 deg. C): Provide 2-rows 5/8" tubes, same-end connection coil. Reinforce tube joints with brass bushings. Provide steam deflectors opposite supply connection.
- e. Steam to 200 psi, 400 deg. F (204 deg. C): Provide 2-rows, 1" tubes, same-end connections, steam distributing tube type coil. Locate distributing tube concentrically within condensing tube supported by corrosion-resistant clips. Provide steam deflectors opposite supply connection.

C. Cooling Coils:

1. Fins: Construct of continuous aluminum or copper configured plate-fin type with full fin collars for accurate fin spacing and maximum fin-tube contact.
2. Tubes: Construct of 5/8" seamless copper tubes, arranged in parallel pattern with respect to air flow.
3. Casings: Construct of 16-ga continuous coated galvanized steel for coil heights 33" and smaller; 14-ga for coil heights over 33". Provide formed end supports and top and bottom channels. Provide 16-ga steel center tube support for coil lengths 42" to 96", 2 or more supports for coil lengths over 96".
4. Air Bypass Arrestor: Provide foam sealing strip located between casing channels and fins along top and bottom.
5. U-Bends: Construct of 5/8" copper tubes, machine die- formed on each end to provide accurate fit for silver brazed joints.
6. Testing: Proof test water coils at 300 psi and leak test at 200 psi under water. Proof test refrigerant coils at 450 psi and leak test at 300 psi under water; clean, dehydrate, and seal with dry nitrogen charge.
7. Coil Types: Provide the following coil types as indicated, and as scheduled:
 - a. Cleanable and Drainable Water Coils: Provide close-grained gray cast-iron inlet, outlet, and removable headers. Bolt headers to flat steel plates with gaskets. Roll tubes into steel plates and headers.
 - b. Drainable Water Coils: Provide close-grained gray cast-iron inlet, outlet, and intermediate headers.

- c. Standard Water Coils: Provide close-grained gray cast-iron inlet and outlet headers for coil heights 33" and smaller. Provide seamless copper tube headers for coil heights over 33".
 - d. Refrigerant Coils: Provide refrigerant distributor of venturi type with low pressure drop design, arranged for down feed and maximum of 12 circuits per distributor. Provide seamless copper tube suction header. Construct distributor tubes of 5/16" copper tube for R-12, 1/4" copper tube for R-22.
8. Cooling coils shall be capable of operating at face velocities up to 600 FPM without moisture carryover. Coat fins with fin coating to prevent moisture carryover. Any coils found to have excessive moisture carryover during system operation shall be corrected by the manufacturer at no cost to the Owner.
9. Evaporative Section: Provide an evaporative section, over a common pan section with the cooling coil. This section shall be constructed with the coil preceding the evaporative section in the direction of air flow. The "Munters Fill" type media is to be 12" deep, in the direction of air flow. Section is to be complete with distribution pipe and header with a connection point in the center of the header for a 3/4" copper pipe. Media is to have a saturation efficiency of 89% at 500 feet per minute face velocity.

Edit Note: Select Coated Steel or Stainless Steel

10. Pan: The pan under the cooling coil and the evaporative section shall be 1/8" MOH HRS plate/heavy gauge 304 stainless steel continuously welded. Pan to be a minimum of 12" deep with drain coupling welded to the structural support. Finish inside of pan with three coats of zinc impregnated submarine primer (ZIPCOR) for MOH HRS.
11. Evaporative Section Casing: Provide a casing enclosure of heavy gauge galvanized iron with the inside surface painted with two coats of "ZIPCOR".

OR

Heavy gauge 304 stainless steel.

2.10 ELECTRIC BASEBOARD RADIATION:

- A. General: Provide electric baseboard radiation of lengths, in locations as indicated, of capacities, style and having accessories as scheduled.
- B. Cabinets: Minimum 18-ga. cold steel, front cover brackets, junction box and built-in wireway the length of the heater. Provide standard/custom baked enamel finish.
- C. Elements: Electric resistance heating element, full length auto-reset thermal overload disconnect switch, junction boxes at both ends of each section, (unit mounted thermostat) (low voltage transformer/relay section).
- D. Accessories: Provide the following accessories:
 - 1. End panels.

2.11 ELECTRIC CABINET HEATERS:

- A. General: Provide electric cabinet heaters having cabinet sizes and in locations as indicated, and of capacities, style, and having accessories as scheduled. Include in basic unit chassis, coil, fanboard, fan wheels, housings, motor, and insulation.
- B. Chassis: Galvanized steel wrap-around structural frame with edges flanged.
- C. Insulation: Faced, heavy density glass fiber.
- D. Cabinet: 16-ga removable front panel, 8-ga top and side panels. Insulate front panel over entire coil section. Provide access door on coil connection side. Clean cabinet parts, bonderize, phosphatize, and flow-coat with baked-on primer/standard factory color selected baked enamel finish/custom color as selected by Architect in baked enamel finish.
- E. Electric Element: Electric resistance element with manual-reset thermal overload protection, (unit mounted thermostat) (unit mounted contactors and transformer).
- F. Fans: Provide centrifugal, forward curved double width fan wheels constructed of non-corrosive, molded, fiberglass- reinforced thermo-plastic material. Construct fan scrolls of galvanized steel.
- G. Motors: Provide shaded pole motors with integral thermal over-load protection, and motor cords for plug-in to junction box in unit.
- H. Filters: Provide 1" thick throwaway type filters in fiberboard frames.
- I. Accessories: Provide the following accessories as indicated and/or scheduled.
 - 1. Wall boxes: Provide aluminum wall boxes with integral eliminators and insect screen.
 - 2. Recessing Flanges: Provide 18-ga steel flanges for recessing cabinet heaters into wall or ceiling.
 - 3. Sub-bases: Provide 18 ga steel sub-base for vertical units, height as indicated.

2.12 ELECTRIC UNIT HEATERS:

- A. General: Provide electric unit heaters in locations as indicated, and of capacities, style, and having accessories as scheduled.
- B. Horizontal Unit Heaters:
 - 1. Casings: Construct of steel, phosphatized inside and out, and finished with standard color baked enamel finish. Provide motor-mounted panel, minimum of 18-ga steel. Fabricate casing to enclose coil, louvers, and fan blades. Provide louvers for 2-way air diffusion.
 - 2. Fans: Construct of aluminum, and factory-balance. Provide fan inlet orifice, smooth, and drawn into casing back panel.

C. Vertical Unit Heaters:

1. Casings: Construct of steel, phosphatized inside and out, and finished with standard color baked enamel finish., Design casing to enclose fan, motor, and coil, design fan orifice formed into discharge panel. Provide air diffusers as scheduled.
2. Fans: Construct of aluminum and factory-balance. Design so motor and fan assembly is removable through fan outlet panel.

D. Elements: Unit shall include electric resistance element with manual-reset thermal overload protection, (unit mounted thermostat) (unit mounted contactors and transformer).

E. Motors: Provide totally enclosed motors, with built-in overload protection, having electrical characteristics as scheduled.

2.13 ELECTRIC CONVECTORS:

A. General: Provide electric convectors having cabinet sizes and in locations as indicated, and of capacities, style, and having accessories as scheduled.

B. Cabinets: Minimum (14) 16-ga steel front and top panels, (14) 16-ga side panels, and 20-ga back panels. Phosphate and galvanize back panels, phosphatize and standard/custom color baked enamel finish top, sides, and front, with one coat of primer. Secure fronts in place with quick opening slide bolts or camlock fasteners.

C. Elements: Heating element shall have full length auto-reset thermal overload disconnect switch, line voltage safety disconnect switch, (unit mounted thermostat).

D. Accessories: Provide the following accessories:

1. Factory-mounted dampers.
2. 1/2" insulation on cabinet back.
3. Access doors in front for valve access.

2.14 ELECTRIC WALL HEATER:

A. Unit shall include electric resistance type heating elements visible/concealed adjustable thermostat, concealed electrical connections, line voltage disconnect enclosed fan motor, and wall box.

B. Unit shall be standard color baked enamel finish.

2.15 ELECTRIC RADIANT CEILING PANEL HEATER:

A. Panel shall fit a standard 2' x 4' lay-in ceiling grid. Provide mounting kit. Panel finish shall be off-white. Panel shall be UL approved, baked enamel finish (with silk screened fissured pattern) to match ceiling finish.

B. Panel shall include 3" fiberglass pad above heating element.

C. Panels shall have a five (5) year warranty.

2.16 TOE-SPACE HEATER:

A. Unit shall be designed for installation in cabinet toe-space. Unit shall be UL labeled.

- B. Unit shall include steel housing, integral inlet and discharge grille, electric heating element with thermal overload protection, five (5) year warranty on heating element, centrifugal fan, unit mounted thermostat. Motor/fan assembly shall be vibration isolated.
- C. Unit shall be standard color baked enamel finish.

2.17 CEILING HEATER/EXHAUST FAN/LIGHT:

- A. Unit shall be UL labeled and shall be HVI tested and certified to comply with HUD standards.
- B. Unit shall include fan(s), exhaust backdraft damper, wall/roof cap, automatic thermal overload protection, heating element, wall switch with separate on-off/timer controls for heat, exhaust, and light. Motor/fan assembly shall be vibration isolated.
- C. Unit shall be standard color baked enamel finish.

2.18 RADIANT-ACOUSTICAL CEILING PANELS:

- A. The radiant acoustical panels shall be placed into a standard grid system to be provided by the General Contractor in accordance with the Architect's reflected ceiling plans.
- B. Provide 1/2" O.D., Type "L" copper loops for interconnection of panels.
- C. Radiant panels shall have certified performance data provided by a recognized testing laboratory.
- D. Panels shall be finished with standard white paint.
- E. Provide supervision by distributor of panels.

2.19 ELECTRIC DUCT HEATERS:

- A. Electric duct heaters shall be electric resistance type. Controlling contactors shall be magnetic/mercury relay type and shall be wired so as to de-energize the heater circuits. All contactors and over current protection devices shall be factory wired and installed in accordance with the National Electric Code, the National Fire Protection Association, and Underwriters' Laboratories.
- B. Coil shall be non-stratifying design such that each stage of heat is spread over the entire face of the coil.
- C. Coil shall have a built-in pressure differential type air flow safety switch and auto-reset thermal overload protection wired into the control circuit, and manual-reset thermal overload protection wired into the power circuit to the coil. Heater shall include line voltage disconnect switch.
- D. Provide a built-in fused control power transformer.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which terminal units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF BASEBOARD RADIATION:

- A. General: Install baseboard radiation as indicated, and in accordance with manufacturer's installation instructions.
- B. Locate baseboard radiation on outside walls as indicated, run cover continuous wall-to-wall unless otherwise indicated.
- C. Center elements under windows. Where multiple windows occur over units, divide element into equal segments centered under each window.
- D. Install end caps where units butt against walls. Install access panels centered in front of each shutoff valve, balancing cock, or temperature control valve.

3.3 INSTALLATION OF FINNED TUBE RADIATION:

- A. General: Install finned tube radiation as indicated, and in accordance with manufacturer's installation instructions.
- B. Locate finned tube radiation on outside walls as indicated, run cover wall-to-wall unless otherwise indicated.
- C. Center elements under windows. Where multiple windows occur over units, divide element into equal segments centered under each window.
- D. Install end caps where units butt against walls. Install access panels centered in front of each shutoff valve, balancing cock, steam trap, or temperature control valve.

3.4 INSTALLATION OF CONVECTORS:

- A. General: Install convectors as indicated, and in accordance with manufacturer's installation instructions.
- B. Locate convectors as indicated, coordinate with other trades to assure correct recess size for recessed convectors.

3.5 INSTALLATION OF UNIT HEATERS:

- A. General: Install unit heaters as indicated, and in accordance with manufacturer's installation instructions.
- B. Uncrate units and inspect for damage. Verify that nameplate data corresponds with unit designation.
- C. Hang units from building substrate, not from piping. Mount as high as possible to maintain greatest headroom possible unless otherwise indicated.
- D. Support units with rod-type hangers anchored to building substrate.
- E. Install piping as indicated.
- F. Protect units with protective covers during balance of construction.

3.6 INSTALLATION OF CABINET HEATERS:

- A. General: Install cabinet heaters as indicated, and in accordance with manufacturer's installation instructions.
- B. Locate cabinet heaters as indicated, coordinate with other trades to assure correct recess size for recessed units.
- C. Install piping as indicated.
- D. Protect units with protective covers during balance of construction.

3.7 INSTALLATION OF FAN-COIL UNITS:

- A. General: Install fan-coil units as indicated, and in accordance with manufacturer's installation instructions.
- B. Locate fan-coil units as indicated, coordinate with other trades to assure correct recess size for recessed units.
- C. Provide piping as detailed on the drawings.
- D. Provide 3/4" condensate drain pipe from unit drain pan connection to nearest adequate floor drain or drain pipe.
- E. Protect units with protective covers during balance of construction.

3.8 INSTALLATION OF UNIT VENTILATORS:

- A. General: Install unit ventilators as indicated, and in accordance with manufacturer's installation instructions.
- B. Locate unit ventilators as indicated, level and shim units, anchor to substrate. Coordinate with other trades for exact location of wall louvers.
- C. Install piping as indicated.
- D. Protect units with protective covers during balance of construction.
- E. Install shelving and auxiliary radiation, provide wall trim pieces for continuous wall-to-wall installation.

3.9 INSTALLATION OF COILS:

- A. General: Install coils as indicated, and in accordance with manufacturer's installation instructions.
- B. Mount coils on steel supports to form banks or stacks as indicated, brace, secure to air intake chamber. Place in location to permit installation of bypass damper if required, provide steel baffles where required to prevent bypassing of air.
- C. Pitch coil casings for drainage, not less than 1/8" toward return connections, except where drainage feature is included in coil design.
- D. Provide for each bank of cooling coils, drain pan(s) under each coil supported off of floor of sufficient height to allow installation of condensate drain pipe trap to allow drainage of

condensate from pan when installed on suction side of fan. Provide condensate drain piping from drain pan connection to nearest adequate floor drain. Plug any unused drain connection.

- E. Provide for each steam coil unit, steam supply connection with strainer, gate valve, automatic temperature regulating valve, condensate return connection with vacuum breaker, f & t trap, and gate valve, as indicated.
 - F. Provide for each hot or chilled water coil unit, water supply, return connection, strainer, gate valves, automatic temperature regulating valve, balancing cocks, as indicated.
 - G. Provide electric wiring for each electric duct heater in accordance with manufacturer's installation instructions and Division 16.
- 3.10 INSTALLATION OF ELECTRICAL TOE SPACE HEATERS:
- A. General: Install electric toe space heaters as indicated, and in accordance with manufacturer's installation instructions.
 - B. Inspect for damage and verify that nameplate data corresponds with unit designation.
- 3.11 INSTALLATION OF RADIANT CEILING PANELS:
- A. General: Install electric/hot water radiant ceiling panels as indicated and in accordance with manufacturers' installation instructions.
 - B. Inspect for damage and verify that nameplate data correspondence with panel designation.
- 3.12 ELECTRICAL WIRING:
- A. General: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
 - B. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-16 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
- 3.13 ADJUSTING AND CLEANING:
- A. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean terminal coils and inside of cabinets.
 - B. Retouch any marred or scratched surfaces of factory- finished cabinets, using finish materials furnished by manufacturer.
 - C. Install new filter units for terminals requiring same.
- 3.14 START-UP:
- A. Start-up, test, and adjust terminal units in accordance with manufacturer's published start-up instructions. Adjust for proper airflow where applicable.

END OF SECTION 15830