

**PART 1 - GENERAL REQUIREMENTS****1.01 SUMMARY**

- A. Extent of terminal heating and cooling unit work is indicated by drawings and schedules, and by requirements of this Section.
- B. Types of terminal heating and cooling units required for project include the following:
  - 1. Hydronic panel radiation
  - 2. Unit heaters
  - 3. Cabinet heaters
  - 4. Fan-Coil units
  - 5. Vertical-stacked fan coil units
  - 6. Wall-mounted fan coil units

**1.02 QUALITY ASSURANCE**

- A. Reference Standards:
  - 1. AHRI 410 – Forced-Circulation Air-Cooling and Air-Heating Coils; Air-Conditioning, Heating, and Refrigeration Institute, most current edition.
  - 2. AHRI 440 – Performance Rating of Room Fan-Coils; Air-Conditioning, Heating, and Refrigeration Institute, most current edition.
  - 3. AHRI 840 – Performance Rating of Unit Ventilators; Air-Conditioning, Heating, and Refrigeration Institute, most current edition.
  - 4. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials, most current edition.
  - 5. 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.
  - 6. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials, Underwriter’s Laboratory, most current edition.
  - 7. UL 1995 – Heating and Cooling Equipment; Underwriter’s Laboratory, most current edition.
  - 8. UL Compliance: Provide electrical components for terminal heating and cooling units which have been listed and labeled by UL.
  - 9. ISO Compliance: Fan coil units shall be manufactured in accordance with standard ISO 9001, Quality Management Systems, most current edition.

**1.03 SUBMITTALS**

- A. Product Data: Submit manufacturer's specifications for terminal heating and cooling units showing dimensions, capacities, ratings, performance characteristics, gages and finishes of materials, and installation instructions.

- B. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, construction details, and field connection details.
- C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to terminal heating and cooling 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. Samples: Submit 3 samples of each type of cabinet finish furnished.
- E. Maintenance Data: Submit maintenance instructions, including lubrication instructions, filter replacement, motor and drive replacement, and spare parts lists. Include this data, product data, shop drawings in maintenance manuals; in accordance with requirements of Division 1.

#### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Handle terminal heating and cooling units and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged terminal heating and cooling units or components; replace with new.
- B. Store terminal heating and cooling 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 heating and cooling units, and moving them to final location.

#### **1.05 SPARE PARTS**

- A. General: Furnish to Owner, with receipt, the following spare parts for terminal heating and cooling units.
  - 1. One set of spare filters of each type required for each unit. Obtain receipt from Owner that spare filters have been provided. In addition to the spare set of filters, install new filters at completion of installation work, and prior to testing, adjusting, and balancing work.
  - 2. If HVAC equipment is used during the construction period, Contractor shall provide one set of filters (if system is designed to include pre-filters and after-filters, provide only pre-filters) when the unit is started and replace filters when needed, but not less than every month. On the day of substantial completion, the Contractor shall clean the unit and provide a new set of filters at each location in the unit.

## **PART 2 - PRODUCTS AND MATERIALS**

### **2.01 HYDRONIC PANEL RADIATION**

- A. General: Provide hydronic panel radiation of lengths and in locations as indicated, and of capacities, style, and having accessories as scheduled.
- B. Cabinets: Provide steel double panel radiators of the lengths and in locations as indicated, and of capacities, style and having accessories as scheduled. The double heating panel radiation shall be of one-piece all-welded steel construction, consisting of a pair of flattened water tube panels welded to headers at each end. Panels shall be rated for minimum working pressure of 125 psig. Welded to the inside of each panel shall be steel corrugated fins to increase the convective output of the radiator. The radiators shall include an integral heavy gauge, all-welded perforated top grille, which will cover the top of all of the finned areas.
- C. The panel radiation shall have a powder coat finish and then be finish painted with a gloss powder coat finish in color as selected by architect.
- D. Accessories: Provide the following accessories:
1. Blank end caps.
  2. End caps with hinged access panel.
  3. Trim strips.
- E. Manufacturer: Subject to compliance with requirements, provide baseboard radiation of one of the following:
1. Airtite
  2. Runtal
  3. Sterling Radiator; Div. of Reed National Corp.
  4. Zehnder Rittling.

### **2.02 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 baked enamel. 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 baked enamel. 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 or hot water applications. Coil shall have minimum working pressure of 125 psig.
- E. Motors: Provide totally enclosed motors, with built-in overload protection, having electrical characteristics as scheduled.
- F. Manufacturer: Subject to compliance with requirements, provide unit heaters of one of the following:
1. Airtherm Mfg. Co.
  2. Daikin Applied.
  3. Dunham-Bush, Inc.
  4. Modine Mfg. Co.
  5. Rittling Hydro-Air Components, Inc.
  6. Trane (The) Co.
  7. Wing (The) Co.; Div. Wing Industries, Inc.
  8. Young Radiator Co.

### **2.03 CABINET HEATERS**

- A. General: Provide 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.
- E. Water Coils: Construct of 5/8" seamless copper tubes mechanically bonded to configured aluminum fins. Design for 200 psi and pressure 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 100 psi and pressure test at 300 psi. 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. Filters shall have minimum MERV rating per ASHRAE 52.2 of MERV 4.
- J. 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.
  - 4. Extended Oilers: Provide plastic motor oiler tubes extending to beneath top discharge grille.
- K. Manufacturer: Subject to compliance with requirements, provide cabinet heaters of one of the following:
  - 1. Airtherm Mfg. Co.
  - 2. Daikin Applied.
  - 3. Dunham-Bush, Inc.
  - 4. Modine Mfg. Co.
  - 5. Trane (The) Co.
  - 6. Young Radiator Co.
  - 7. Zehnder Rittling.

## 2.04 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.
  - 1. Units shall be listed according to UL 1995.
  - 2. Units shall be certified according to AHRI 440.
  - 3. Units shall be manufactured in accordance with ISO 9001.
- B. Chassis: Construct chassis of galvanized steel with flanged edges.
- C. Insulation:
  - 1. 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.
- E. Water Coils: Construct of 1/2 inch or 5/8 inch seamless copper tubes mechanically bonded to configured aluminum fins. Provide manual air vent to allow coil venting. Design for minimum 200 psi working pressure, and pressure test at minimum 300 psi under water.
- F. Auxiliary Heating Coils: Construct of 7/16 inch or 5/8 inch seamless copper tubes mechanically bonded to configured aluminum fins. Design for minimum 200 psi working pressure, and pressure test at minimum 300 psi under water.
- G. Drain Pans: Construct of galvanized steel. Insulate with polystyrene, elastomeric closed cell foam, or polyurethane insulation. Provide drain connection.
- H. Fans: Provide centrifugal forward curved double width wheels of reinforced fiberglass or galvanized steel, 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. Filters shall have minimum MERV rating per ASHRAE 52.2 of MERV 8.
- 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 or epoxy powder coated 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.
  - 6. Provide an integral condensate switch to prevent unit from operating if drain becomes blocked.
  - 7. Provide an integral condensate pump with GFCI to continuously remove condensate.
  - 8. Floor mounted units: Provide adjustable leveling legs.
  - 9. Provide a service disconnect switch to isolate power from the unit during maintenance.

- M. Electrical: Unit shall have single point power connection with voltage and phase as scheduled on the drawings.
- N. Manufacturer: Subject to compliance with requirements, provide fan-coil units of one of the following:
  - 1. Airtherm Mfg. Co.
  - 2. Carrier Corp.
  - 3. Daikin Applied.
  - 4. Dunham-Bush, Inc.
  - 5. Enviro-Tec by Johnson Controls, Inc.
  - 6. Greenheck
  - 7. International Environmental Corp.
  - 8. Johnson Controls, Inc.
  - 9. Price
  - 10. Titus
  - 11. Trane (The) Co.
  - 12. Williams
  - 13. Zehnder Rittling.

## **2.05 WALL-MOUNTED FAN COIL UNITS**

- A. General: Provide wall-mounted fan-coil units having cabinet sizes, and in locations indicated, and of capacities, and having accessories as scheduled. Include in basic unit chassis, mounting bracket, coils, fan, drain pan assembly, fans, housing, motor, filter and insulation. Units shall be factory assembled and tested.
- B. Cabinet: Designed for installation against a vertical wall surface. Construct of high impact polymer or galvanealed steel. Provide internal insulation. Mounting brackets shall be manufacturer supplied. Provide adjustable discharge air grille. Provide standard white finish unless otherwise specified on the drawings.
- C. Water Coils: Construct of 3/8"seamless copper tubes mechanically bonded to aluminum fins. Design for 200 psi working pressure, and pressure test at 300 psi under water.
- D. Drain Pans: Construct of high impact polymer or galvanized steel. Insulate exterior of drain pan with polystyrene or polyurethane insulation. Provide condensate drain pipe connection.
- E. Fans: Provide dynamically balanced multi-speed fan.
- F. Motors: Provide totally enclosed, permanent split capacitor, three speed type motors with integral thermal overload protection. Run test motors at factory in assembled unit prior to shipping.
- G. Filters: Provide permanent washable filter.

- H. Accessories: Provide the following accessories as indicated and/or scheduled:
  - 1. Dry contact for local interlock of external devices.
  - 2. Field provided condensate pump, powered by the fan coil unit with a built-in safety cut off switch.
- I. Manufacturer: Subject to compliance with requirements, provide fan-coil units of one of the following:
  - 1. Multiaqua.

### **PART 3 - EXECUTION**

#### **3.01 GENERAL**

- A. Install terminal heating and cooling units in accordance with manufacturer's written instructions.
- B. Examine areas to receive terminal heating and cooling units for compliance with requirements for installation tolerances and other conditions affecting performance.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Suspended Units: Suspend units from structural steel support frame using threaded steel rods and vibration isolation springs.
- E. Arrange installation of units to provide access space around units for service and maintenance.

#### **3.02 INSTALLATION OF HYDRONIC PANEL RADIATION**

- A. Center elements under windows. Where multiple windows occur over units, divide element into equal segments centered under each window.
- B. Install end caps where units butt against walls. Install access panels centered in front of each shutoff valve, balancing cock, or temperature control valve.

#### **3.03 INSTALLATION OF UNIT HEATERS**

- A. Hang units from building substrate, not from piping. Mount as high as possible to maintain greatest headroom possible unless otherwise indicated.
- B. Support units with rod-type hangers anchored to building substrate.
- C. Protect units with protective covers during balance of construction.

### **3.04 PIPING CONNECTIONS**

- A. Piping: Piping installation requirements are specified in other Division 23 sections. The Drawings indicate the general arrangement of piping, valves, fittings, and specialties. The following are specific connection requirements:
1. Arrange piping installations adjacent to units to allow unit servicing and maintenance.
  2. Connect water supply piping to the air leaving side of water coils.
  3. Route unit condensate drain from cooling coil drain pans to location shown on the drawings or, if not shown, to nearest indirect waste connection. Provide trap at connection to drain pan with depth as noted on the drawings and install cleanouts at changes in direction. Size condensate drain piping in accordance with local code and as shown on the drawings.

### **3.05 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 Electric Installer.
1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 Sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

### **3.06 ADJUSTING AND CLEANING**

- A. General: Just prior to substantial completion clean unit's exposed surfaces and vacuum clean internal components including fan wheel, fan cabinet, all heat exchange surfaces, cooling/heating coil sections, filter sections, access sections, etc.
- B. Retouch any marred or scratched surfaces of factory-finished surfaces, using finish materials furnished by manufacturer.
- C. Install new filters in terminal heating and cooling units requiring same. Do not operate units without filters installed.

### **3.07 STARTUP**

- A. Final Checks Before Start-Up: Perform the following operations and checks before start-up:
1. Remove shipping, blocking, and bracing.
  2. Verify unit is secure on mountings and supporting devices and that connections for piping, ductwork, and electrical are complete. Verify

proper thermal overload protection is installed in motors, starters, and disconnects.

3. Perform cleaning and adjusting specified in this Section.
4. Disconnect fan drive from motor and verify proper motor rotation direction and verify fan wheel free rotation and smooth bearings operations. Reconnect fan drive system, align belts, and install belt guards.
5. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.

B. Start-Up Services: Start-up terminal heating and cooling units in accordance with manufacturer's written start-up instructions. Do not operate units without filters installed. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

1. Energize motor, verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.
  - a) Replace fan and motor pulleys as required to achieve design conditions.
  - b) Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for procedures for system testing, adjusting, and balancing.

**END OF SECTION**