SECTION 238239.13 - CABINET UNIT HEATERS

This Section includes requirements for sustainable design systems. However, equipment specified in this Section may not meet requirements of those systems. Verify, with manufacturers, that the requirements can be met. To comply, HVAC system design alternatives that do not include cabinet unit heaters may be required.

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
   * + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
      1. SUMMARY
         1. Section includes cabinet unit heaters with centrifugal fans and **[hot-water] [steam] [electric-resistance heating]** coils.
      2. DEFINITIONS

Retain terms that remain after this Section has been edited for a project.

* + - * 1. CWP: Cold working pressure.
        2. DDC: Direct digital control.
        3. PTFE: Polytetrafluoroethylene plastic.
        4. TFE: Tetrafluoroethylene plastic.
      1. SUBMITTALS
         1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
         2. Manufacturer’s installation instructions shall be provided along with product data.
         3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
         4. Product Data: For each type of product.
         5. Include rated capacities, operating characteristics, furnished specialties, and accessories.
         6. Shop Drawings:

Include plans, elevations, sections, and details.

Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

Include location and size of each field connection.

Include details of anchorages and attachments to structure and to supported equipment.

Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.

Retain first subparagraph below for hot-water and steam cabinet unit heaters.

Indicate location and arrangement of piping valves and specialties.

Retain first subparagraph below for cabinet unit heaters with integral controls; delete if control devices are specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

Indicate location and arrangement of integral controls.

Wiring Diagrams: Power, signal, and control wiring.

Retain "Samples" paragraph below for single-stage Samples, with a subordinate list if applicable. Retain "Samples for Initial Selection" and "Samples for Verification" paragraphs for two-stage Samples.

* + - * 1. Samples: For each exposed product and for each color and texture specified.
        2. Samples for Initial Selection: Finish colors for units with factory-applied color finishes.
        3. Samples for Verification: Finish colors for each type of cabinet unit heater indicated with factory-applied color finishes.

Retain "Coordination Drawings" paragraph below for situations where limited space necessitates maximum utilization for efficient installation of different components or if coordination is required for installation of products and materials by separate installers. Coordinate paragraph with other Sections specifying products listed below. Preparation of coordination drawings requires the participation of each trade involved in installations within the limited space.

* + - * 1. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

Suspended ceiling components.

Structural members to which cabinet unit heaters will be attached.

Method of attaching hangers to building structure.

Size and location of initial access modules for acoustical tile.

Items penetrating finished ceiling, including the following:

Lighting fixtures.

Air outlets and inlets.

Speakers.

Sprinklers.

Access panels.

**<Insert item>**.

Perimeter moldings for exposed or partially exposed cabinets.

Retain "Seismic Qualification Data" paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 230548 "Vibration and Seismic Controls for HVAC." See ASCE/SEI 7 for certification requirements for equipment and components.

* + - * 1. Seismic Qualification Data: Submit certification that cabinet unit heaters, accessories, and components will withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC." Include the following:

Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

Include detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

* + - * 1. Field quality-control reports.
      1. CLOSEOUT SUBMITTALS
         1. Operation and Maintenance Data: For cabinet unit heaters to include in emergency, operation, and maintenance manuals.
      2. MAINTENANCE MATERIAL SUBMITTALS

Retain this article for cabinet unit heaters with filters. Extra materials may not be allowed for publicly funded projects.

* + - * 1. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Cabinet Unit-Heater Filters: Furnish **[one] <Insert number>** spare filter(s) for each filter installed.

1. PRODUCTS

See Editing Instruction No. 1 in the Evaluations for cautions about named manufacturers and products. MANUFACTURERS

* + - * 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Airtherm; a Mestek company.

Carrier Corporation.

[Engineered Air](http://www.specagent.com/Lookup?uid=123457102684).

[INDEECO](http://www.specagent.com/Lookup?uid=123457102685).

Markel Products; TPI Corporation.

Marley Engineered Products.

Ouellet Canada Inc.

Rosemex Products.

Trane.

USA Coil & Air.

Approved equivalent.

* + - 1. DESCRIPTION
         1. Factory-assembled and -tested unit complying with AHRI 440.
         2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

Retain paragraph below for electric cabinet unit heaters.

* + - * 1. Comply with UL 2021.
      1. PERFORMANCE REQUIREMENTS

"ASHRAE Compliance" paragraph below may be required to comply with Project requirements or authorities having jurisdiction. Sustainable design systems require compliance with requirements in ASHRAE 62.1, including requirements for controls, surfaces in contact with the airstream, particulate and gaseous filtration, coil selection and cleaning, and equipment access. Verify, with manufacturers, availability of units with components and features that comply with these requirements.

* + - * 1. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

"ASHRAE/IESNA 90.1 Compliance" paragraph below may be required to comply with Project requirements or authorities having jurisdiction. Sustainable design systems require compliance with requirements in ASHRAE/IESNA 90.1.

* + - * 1. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

Retain "Seismic Performance" paragraph below with "Seismic Qualification Data" paragraph in "Informational Submittals" Article for projects requiring seismic design. Delete paragraph if performance requirements are indicated on Drawings. Model building codes and ASCE/SEI 7 establish criteria for buildings subject to earthquake motions. Coordinate requirements with structural engineer.

* + - * 1. Seismic Performance: Cabinet unit heaters shall withstand the effects of earthquake motions determined according to **[ASCE/SEI 7] <Insert requirement>**.

Retain subparagraph below to define the term "withstand" as it applies to this Project. Definition varies with type of building and occupancy and is critical to valid certification. Option is used for essential facilities where equipment must operate immediately after an earthquake.

The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified**[ and the unit will be fully operational after the seismic event]**."

* + - 1. COIL SECTION INSULATION

Flexible elastomeric insulation and mineral-fiber insulation with a foil face are available from some manufacturers to reduce the number of glass or mineral fibers circulating through the air-conditioned space.

Retain first "Insulation Materials" paragraph below for duct-liner-type, glass-fiber insulation.

* + - * 1. Insulation Materials: ASTM C1071; surfaces exposed to airstream shall have **[aluminum-foil facing] [erosion-resistant coating]** to prevent erosion of glass fibers.

Thickness: **[1/2 inch] [1 inch] [1-1/2 inches]**.

Thermal Conductivity (k-Value): 0.26 Btu x in./h x sq. ft. at 75 deg F mean temperature.

Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E84.

Adhesive: Comply with ASTM C916 and with NFPA 90A or NFPA 90B.

"Airstream Surfaces" subparagraph below may be required to comply with Project requirements or authorities having jurisdiction and is required for sustainable design systems.

Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

Retain "Insulation Materials" paragraph below for flexible elastomeric insulation.

* + - * 1. Insulation Materials: Comply with NFPA 90A or NFPA 90B. Unicellular polyethylene thermal plastic, preformed sheet insulation complying with ASTM C534, Type II, except for density.

Thickness: **[3/8 inch] [1/2 inch] [3/4 inch] [1 inch]**.

Thermal Conductivity (k-Value): 0.24 Btu x in./h x sq. ft. at 75 deg F mean temperature.

Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM C411.

Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

"Airstream Surfaces" subparagraph below may be required to comply with Project requirements or authorities having jurisdiction and is required for sustainable design systems.

Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

* + - 1. CABINETS

Retain "Material" paragraph below for surface, semirecessed, and fully recessed units. Cabinet is not required for concealed units. Coordinate custom color requirements in paragraph below with Sample submittal requirements. Coordinate field painting with painting Sections.

* + - * 1. Material: Steel with **[factory prime coating, ready for field painting] [baked-enamel finish with manufacturer's standard paint, in color selected by Director’s Representative] [baked-enamel finish with manufacturer's custom paint, in color selected by Director’s Representative]**.

First option in "Vertical Unit, Exposed Front Panels" and "Horizontal Unit, Exposed Bottom Panels" subparagraphs below is the equivalent of 16-gage steel; second option is the equivalent of 14-gage steel.

Vertical Unit, Exposed Front Panels: Minimum **[0.0528-inch-] [0.0677-inch-]** thick **[galvanized ]**sheet steel, removable panels with channel-formed edges secured with tamperproof cam fasteners.

Horizontal Unit, Exposed Bottom Panels: Minimum **[0.0528-inch-] [0.0677-inch-]** thick **[galvanized ]**sheet steel, removable panels secured with tamperproof cam fasteners and safety chain.

Retain "Recessed Flanges" subparagraph below for units that are semirecessed or fully recessed in walls or ceilings.

Recessed Flanges: Steel, finished to match cabinet.

Control Access Door: Key operated.

Retain "Base" subparagraph below for surface, vertical, wall-mounted units.

Base: Minimum 0.0528-inch- thick steel, finished to match cabinet, **[4 inches] [6 inches]** **<Insert dimension>** high with leveling bolts.

Extended Piping Compartment: **[8-inch-] <Insert dimension>** wide piping end pocket.

Accessories described in "False Back" and "Outdoor-Air Wall Box" subparagraphs below are furnished for vertical, wall-mounted units only.

False Back: Minimum 0.0428-inch- thick steel, finished to match cabinet.

Outdoor-Air Wall Box: Minimum 0.1265-inch- thick, aluminum, rain-resistant louver and box with integral eliminators and bird screen; aluminum louver with **[anodized] [baked-enamel]** finish in color selected by Director’s Representative from manufacturer's **[standard] [custom]** colors.

Retain second or third option in "Outdoor-Air Damper" subparagraph below for sustainable design systems, which require compliance with ASHRAE 62.1 and ASHRAE/IESNA 90.1.

Outdoor-Air Damper: Galvanized-steel blades with edge and end seals and nylon bearings; with **[manual] [electronic] [pneumatic]**, two-position actuators.

* + - 1. FILTERS

Retain "Minimum Efficiency Reporting Value and Average Arrestance" paragraph below if requiring MERV 1, 2, 3, or 4 in the "Material" paragraphs below. Retain "Minimum Efficiency Reporting Value" paragraph if requiring MERV 5 and higher in "Material" paragraphs below.

* + - * 1. Minimum Efficiency Reporting Value and Average Arrestance: According to ASHRAE 52.2.
        2. Minimum Efficiency Reporting Value: According to ASHRAE 52.2.

Retain one or more of three "Material" paragraphs below. If retaining more than one filter type, indicate type for each unit in the Cabinet Unit-Heater Schedule on Drawings. LEED 2009 IEQ Prerequisite 1 and LEED v4 EQ Prerequisite, "Minimum Indoor Air Quality Performance," require compliance with ASHRAE 62.1 (2007 and 2010 versions respectively), which requires a MERV rating of 6 or higher for service to occupied spaces. LEED 2009 IEQ Credit 5 and LEED v4 IEQ Credit, "Enhanced Indoor Air Quality Strategies," require MERV 13 or higher. Insert values appropriate to Project sustainability goals. Verify available filter types with manufacturer. Indicate filter thickness in "Capacities and Characteristics" Article or in the Cabinet Unit-Heater Schedule on Drawings.

* + - * 1. Material: Washable Foam, **[MERV 3] <Insert value>**.
        2. Material: Glass fiber treated with adhesive, **[MERV 5] <Insert value>**.
        3. Material: Pleated cotton-polyester media, **[MERV 7] <Insert value>**.
      1. COILS

Retain one of three coil paragraphs below.

* + - * 1. Hot-Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain.
        2. Steam Coil: Copper**[ distributing]** tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 75 psig.

Some manufacturers do not provide electric-resistance heating coils in downflow configuration.

* + - * 1. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, mounted in ceramic inserts in galvanized-steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.
      1. CONTROLS
         1. Fan and Motor Board: Removable.

Fan: Forward curved, **[high static, ]**double width, centrifugal, directly connected to motor; thermoplastic or painted-steel wheels and aluminum, painted-steel, or galvanized-steel fan scrolls.

Motor characteristics such as NEMA designation, temperature rating, service factor, enclosure type, and efficiency are specified in Section 230513 "Common Motor Requirements for HVAC Equipment." If different characteristics are required, insert subparagraphs below to suit Project.

Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

Wiring Terminations: Connect motor to chassis wiring with plug connection.

Retain "Factory, Hot-Water Piping Package" paragraph below to require factory-piping package.

* + - * 1. Factory, Hot-Water Piping Package: **[ASTM B88, Type L]** copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet, and outlet.

Retain one or more of first four subparagraphs below.

**[Two] [Three]**-way, **[two-position] [modulating]** control valve.**[ Three-way valve packages shall include bypass line with manually adjustable balance device.]**

Hose Kits: Minimum 400-psig working pressure, and operating temperatures from 33 to 211 deg F. Tag hose kits to equipment designations.

Length: **[24 inches] [36 inches] <Insert dimension>**.

Minimum Diameter: Equal to cabinet unit-heater connection size.

Two-Piece, Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.

Calibrated-Orifice Balancing Valves: Bronze body, ball type, 125-psig working pressure, 250 deg F maximum operating temperature; with calibrated orifice or venture, connection for portable differential pressure meter with integral seals, threaded ends, and equipped with a memory stop to retain set position.

Automatic Flow-Control Valve: Brass or ferrous-metal body, 300-psig working pressure at 250 deg F, with removable, corrosion-resistant, tamperproof, self-cleaning piston spring; factory set to maintain constant indicated flow within plus or minus 10 percent of differential pressure range of 2 to 80 psig.

Y-Pattern, Hot-Water Strainers: Cast-iron body (ASTM A126, Class B); 125-psig minimum working pressure; with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 threaded pipe and full-port ball valve in strainer drain connection.

Wrought-Copper Unions: ASME B16.22.

Retain first paragraph below and delete "Basic Unit Controls" paragraph below if controls are part of overall temperature-control system.

* + - * 1. Control devices and operational sequences are specified in Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC."
        2. Basic Unit Controls:

Control voltage transformer.

Verify control features with manufacturer.

**[Wall] [Unit]**-mounted thermostat with the following features:

Heat-off switch.

Fan on-auto switch.

Retain first subparagraph below if multispeed motors are specified.

Manual fan-speed switch.

Adjustable deadband.

**[Concealed] [Exposed]** set point.

**[Concealed] [Exposed]** indication.

Deg F indication.

**[Wall] [Unit]**-mounted temperature sensor.

Unoccupied period override push button.

Data entry and access port.

Input data includes room temperature and occupied and unoccupied periods.

Output data includes room temperature, supply-air temperature, entering-water temperature, operating mode, and status.

Retain "(DDC )Terminal Controller" paragraph below and coordinate with "Basic Unit Controls" paragraph above or with control devices specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

* + - * 1. **[DDC ]**Terminal Controller:

Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.

Unoccupied Period Override: **[Two] <Insert number>** hours.

Unit Supply-Air Fan Operations:

Occupied Periods: Fan runs continuously.

Unoccupied Periods: Fan cycles to maintain setback room temperature.

Heating-Coil Operations:

Occupied Periods: **[Open control valve] [Modulate control valve] [Energize electric-resistance coil]** to provide heating if room temperature falls below thermostat set point.

Unoccupied Periods: Start fan and **[open control valve] [modulate control valve] [energize electric-resistance coil]** if room temperature falls below setback temperature.

Retain "Outdoor-Air Damper Operation" subparagraph below for automatic outdoor-air intake damper.

Outdoor-Air Damper Operation:

Occupied Periods: Open dampers. Delay damper opening if room temperature is more than three degrees below set point.

Unoccupied Periods: Close damper.

Controller shall have volatile-memory backup.

* + - * 1. Interface with DDC System for HVAC Requirements:

Interface relay for scheduled operation.

Interface relay to provide indication of fault at central workstation.

Interface shall be **[BAC-net] [or] [LonWorks]** compatible for central DDC system for HVAC workstation and include the following functions:

Adjust set points.

Cabinet unit-heater start, stop, and operating status.

Data inquiry, including **[outdoor-air damper position and ]**supply-air and room-air temperature.

Occupied and unoccupied schedules.

* + - * 1. Electrical Connection: Factory-wired motors and controls for a single field connection.
      1. CAPACITIES AND CHARACTERISTICS

If Project has more than one type or configuration of cabinet unit heater, delete this article and schedule cabinet unit heaters on Drawings.

* + - * 1. Cabinet:

Vertical, Surface Mounted: Upflow.

Top: **[Flat] [Sloped] [Flat or sloped]**.

Air Inlet: **[Open bottom] [Front, punched louver] [Front, extruded-aluminum bar grille]**.

Air Outlet: **[Front] [Top] [Front or top], [quad louver] [punched louver] [extruded-aluminum bar grille]**.

Vertical, Surface Mounted: Downflow.

Top: **[Flat] [Sloped] [Flat or sloped]**.

Air Inlet: **[Front] [Top] [Front or top], [punched louver] [extruded-aluminum bar grille]**.

Air Outlet: Front, **[quad louver] [punched louver] [extruded-aluminum bar grille]**.

Vertical, Semirecessed: Upflow.

Air Inlet: **[Open bottom] [Front, punched louver] [Front, extruded-aluminum bar grille]**.

Air Outlet: **[Front] [Top] [Front or top], [quad louver] [punched louver] [extruded-aluminum bar grille]**.

Vertical, Semirecessed: Downflow.

Air Inlet: **[Front] [Top] [Front or top], [punched louver] [extruded-aluminum bar grille]**.

Air Outlet: Front, **[quad louver] [punched louver] [extruded-aluminum bar grille]**.

Vertical, Fully Recessed: **[Upflow] [Downflow]**.

Air Inlet: **[Front] [Duct connection], [punched louver] [extruded-aluminum bar grille]**.

Air Outlet: **[Front] [Duct connection], [quad louver] [punched louver] [extruded-aluminum bar grille]**.

Horizontal, Surface Mounted:

Air Inlet: **[Bottom] [Front] [Bottom or front], [punched louver] [extruded-aluminum bar grille]**.

Air Outlet: **[Front] [Top] [Front or top], [quad louver] [punched louver] [extruded-aluminum bar grille]**.

Horizontal, Semi recessed:

Air Inlet: **[Bottom] [Front] [Bottom or front], [punched louver] [extruded-aluminum bar grille]**.

Air Outlet: **[Front] [Top] [Front or top], [quad louver] [punched louver] [extruded-aluminum bar grille]**.

Horizontal, Fully Recessed:

Air Inlet: **[Front] [Duct connection], [punched louver] [extruded-aluminum bar grille]**.

Air Outlet: **[Front] [Duct connection], [quad louver] [punched louver] [extruded-aluminum bar grille]**.

* + - * 1. Concealed Unit Heater:

Vertical: **[Upflow] [Downflow]**.

Air Inlet: **[Open bottom] [Front, punched louver] [Front, extruded-aluminum bar grille]**.

Air Outlet: **[Front] [Top] [Front or top]**, **[quad louver] [punched louver] [extruded-aluminum bar grille]**.

Horizontal: Upflow.

Air Inlet: **[Open bottom] [Front, punched louver] [Front, extruded-aluminum bar grille]**.

Air Outlet: **[Front] [Top] [Front or top], [quad louver] [punched louver] [extruded-aluminum bar grille]**.

* + - * 1. Fan:

Airflow: **<Insert cfm>**.

External Static Pressure: **<Insert inches wg>**.

Fan Speed: **<Insert rpm>**.

Motor Horsepower: **<Insert value>**.

* + - * 1. Heating Capacity:

Output: **<Insert Btu/h>**.

Entering-Air Temperature: **<Insert deg F>**.

Air-Temperature Rise: **<Insert deg F>**.

* + - * 1. Hot-Water Heating Coil:

Water Flow: **<Insert gpm>**.

Water-Side Pressure Loss: **<Insert feet wg>**.

Entering-Water Temperature: **<Insert deg F>**.

* + - * 1. Steam Heating Coil:

Inlet Steam Pressure: **<Insert psig>**.

Condensing Capacity: **<Insert lb/h>**.

* + - * 1. Electric-Resistance Heating Coil:

Capacity: **<Insert kilowatts>**.

Number of Steps: **<Insert number>**.

* + - * 1. Filters:

Face Area: **<Insert sq. ft.>**.

Thickness: **[1/2 inch] [1 inch] <Insert dimension>**.

* + - * 1. Electrical Characteristics for Single-Point Connection:

Volts: **<Insert value>**.

Phase: **<Insert value>**.

Hertz: **<Insert value>**.

Full-Load Amperes: **<Insert value>**.

Minimum Circuit Ampacity: **<Insert value>**.

Maximum Overcurrent Protection: **<Insert amperage>**.

1. EXECUTION
   * + 1. EXAMINATION
          1. Examine areas to receive cabinet unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
          2. Examine roughing-in for **[piping and ]**electrical connections to verify actual locations before unit-heater installation.
          3. Proceed with installation only after unsatisfactory conditions have been corrected.
       2. INSTALLATION

Retain first paragraph below for vertical, wall-mounted cabinet unit heaters with wall boxes and outdoor-air intake louvers.

* + - * 1. Install wall boxes in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Section 079200 "Joint Sealants."
        2. Install cabinet unit heaters to comply with NFPA 90A.
        3. Suspend cabinet unit heaters from structure with elastomeric hangers**[ and seismic restraints]**. Vibration isolators**[ and seismic restraints]** are specified in **[Section 230548 "Vibration and Seismic Controls for HVAC."] [Section 230548.13 "Vibration Controls for HVAC."]**

Retain first paragraph below if controls are provided by unit-heater manufacturer. To comply with requirements of the Americans with Disabilities Act, verify mounting height with authorities having jurisdiction.

* + - * 1. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.
        2. Install new filters in each fan-coil unit within two weeks of Substantial Completion.
      1. CONNECTIONS

Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified in piping systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Piping installation requirements are specified in Section 232113 "Hydronic Piping," Section 232116 "Hydronic Piping Specialties," Section 232213 "Steam and Condensate Heating Piping," and Section 232216 "Steam and Condensate Heating Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.
        2. Install piping adjacent to machine to allow service and maintenance.
        3. Connect piping to cabinet unit heater's factory, hot-water piping package. Install the piping package if shipped loose.

Retain first paragraph below for concealed cabinet unit heaters. Coordinate duct installation requirements with Drawings and with requirements specified in Section 233113 "Metal Ducts," Section 233116 "Nonmetal Ducts," and Section 233300 "Air Duct Accessories."

* + - * 1. Connect supply and return ducts to cabinet unit heaters with flexible duct connectors specified in Section 233300 "Air Duct Accessories."

Retain first paragraph below for cabinet unit heaters with either hot-water or steam coils.

* + - * 1. Comply with safety requirements in UL 1995.

Retain first paragraph below for cabinet unit heaters if factory piping package is not required.

* + - * 1. Unless otherwise indicated, install union and gate or ball valve on supply-water connection and union and calibrated balancing valve on return-water connection of cabinet unit heater. Hydronic specialties are specified in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties."

Retain first paragraph below for steam cabinet unit heaters.

* + - * 1. Unless otherwise indicated, install union and gate or ball valve on steam-supply connection and union, strainer, steam trap, and gate or ball valve on condensate-return connection of cabinet unit heater. Steam specialties are specified in Section 232216 "Steam and Condensate Heating Piping Specialties."
        2. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
        3. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
      1. FIELD QUALITY CONTROL
         1. Perform the following tests and inspections**[ with the assistance of a Company Field Advisor per OGS Spec Section 014216]**:

Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

Retain first subparagraph below for units that have electric-resistance heating coils.

Operate electric heating elements through each stage to verify proper operation and electrical connections.

Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

* + - * 1. Units will be considered defective if they do not pass tests and inspections.
        2. Prepare test and inspection reports.
      1. ADJUSTING

Retain this article if control devices are specified in this Section; delete if they are specified in Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC."

* + - * 1. Adjust initial temperature set points.
        2. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to **[two] <Insert number>** visits to Project during other-than-normal occupancy hours for this purpose.
      1. DEMONSTRATION

Delete this article if factory-authorized service representative is not required.

* + - * 1. Engage a Company Field Advisor per OGS Spec Section 014216 to train Director’s Representative's Facility’ maintenance personnel to adjust, operate, and maintain cabinet unit heaters.

END OF SECTION 238239.13