SECTION 238219 - FAN COIL UNITS

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 fan coil units 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:

Ductless fan coil units and accessories.

Ducted fan coil units and accessories.

* + - 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.

Include rated capacities, operating characteristics, and furnished specialties and accessories.

* + - * 1. Shop Drawings:

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 diagrams for power, signal, and control wiring.

Retain "Samples for Initial Selection" and "Samples for Verification" paragraphs below for two-stage Samples.

* + - * 1. Samples for Initial Selection: For units with factory-applied color finishes.
        2. Samples for Verification: For each type of fan coil unit indicated.

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, based on input from installers of the items involved:

Suspended ceiling components.

Structural members to which fan coil units 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.

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

* + - * 1. Seismic Qualification Certificates: For fan coil units, accessories, and components, from manufacturer.

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.

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

Retain "Field quality-control reports" paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
        2. Sample Warranty: For special warranty.
      1. CLOSEOUT SUBMITTALS
         1. Operation and Maintenance Data: For fan coil units to include in emergency, operation, and maintenance manuals.

In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

Maintenance schedules and repair part lists for motors, coils, integral controls, and filters.

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

Fan Coil Unit Filters: Furnish **<Insert number>** spare filters for each filter installed.

Retain "Fan Belts" subparagraph below only for fan coil units with belt-driven fans.

Fan Belts: Furnish **<Insert number>** spare fan belts for each unit installed.

* + - 1. QUALITY ASSURANCE
         1. Comply with NFPA 70.

"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, humidification and dehumidification, drain pan construction and connection, finned-tube 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/IES 90.1 Compliance" paragraph below may be required to comply with Project requirements or authorities having jurisdiction. Sustainable design systems require minimum efficiency equal to requirements in ASHRAE/IES 90.1.

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

Delete this article if fan coil units are wall or floor mounted.

Revise first paragraph below to delete or add types of construction that penetrate or are supported by ceilings.

* + - * 1. Coordinate layout and installation of fan coil units and suspension system components with other construction that penetrates or is supported by ceilings, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

Retain paragraph below for units with outdoor air.

* + - * 1. Coordinate size and location of wall sleeves for outdoor-air intake.
      1. WARRANTY

When warranties are required, verify with Director’s Representative's that special warranties stated in this article are not less than remedies available to Director’s Representative under prevailing local laws.

Warranties vary among manufacturers from covering the whole unit for up to four years, to only the compressor for five to 10 years, or only the condenser coil for five years. Extended special warranties are limited to units in the 1- to 5-ton (3.5- to 17.6-kW) range, and then are usually restricted to residential applications.

* + - * 1. Special Warranty: Manufacturer agrees to repair or replace components of condensing units that fail in materials or workmanship within specified warranty period.

Failures include, but are not limited to, the following:

Compressor failure.

Condenser coil leak.

Verify available warranties and warranty periods for units and components.

Warranty Period: **[Four] [Five] [10] <Insert number>** years from date of Substantial Completion.

Warranty Period (Compressor Only): **[Five] [10] <Insert number>** years from date of Substantial Completion.

1. PRODUCTS

See Editing Instruction No. 1 in the Evaluations for cautions about named manufacturers and products. For an explanation of options and Contractor's product selection procedures.

* + - 1. SYSTEM DESCRIPTION
         1. 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.
         2. Factory-packaged and -tested units rated according to AHRI 440, ASHRAE 33, and UL 1995.
      2. DUCTLESS FAN COIL UNITS

Many additional features, which vary with each manufacturer, are available for this product. Include all features for fan coil units that are required for Project, and identify additional features for specific units in the Fan Coil Unit Schedule on Drawings.

* + - * 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 Global Corporation.

Daikin Applied.

[Engineered Air](http://www.specagent.com/Lookup?uid=123457076540).

[Greenheck Fan Corporation](http://www.specagent.com/Lookup?uid=123457076543).

[Trane Inc](http://www.specagent.com/Lookup?uid=123457076550).

USA Coil & Air.

YORK; brand of Johnson Controls International plc, Building Solutions North America.

Approved equivalent.

Fan coil units come with various coil configurations, the most typical being split coil systems with one heating and three cooling coils. The coils tend to be row split rather than face split, although both configurations are available. Units can also come with either a two-pipe or a four-pipe system, depending on Project design requirements.

* + - * 1. Fan Coil Unit Configurations: **[Row] [Face]** split.

Number of Heating Coils: **[One] <Insert number>** with two-pipe system.

Number of Cooling Coils: **[One] [Three] with [two][four]**-pipe system.

Retain one of two "Coil Section Insulation" paragraphs below for coil section insulation.

Closed-cell insulation with foil or matt facing is provided by some manufacturers to reduce the possibility of fibers from glass-fiber insulation being introduced into the conditioned space.

* + - * 1. Coil Section Insulation: **[1/2-inch-] [1-inch-] <Insert dimension> thick, [coated glass fiber] [foil-covered, closed-cell foam] [matte-finish, closed-cell foam]** complying with ASTM C1071 and attached with adhesive complying with ASTM C916.

Surface-Burning Characteristics: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E84 by a qualified testing agency.

"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. Coil Section Insulation:

Surface-Burning Characteristics: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E84 by a qualified testing agency.

"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.

Removable drain pans are an extra feature with some manufacturers.

"(Main and Auxiliary ) Drain Pans" paragraph below may be required to comply with Project requirements or authorities having jurisdiction. Sustainable design systems require compliance with ASHRAE 62.1.

* + - * 1. **[Main and Auxiliary ]Drain Pans: [Plastic] [Stainless steel] [Insulated galvanized steel with plastic liner]**. Fabricate pans and drain connections to comply with ASHRAE 62.1.**[ Drain pans shall be removable.]**
        2. Chassis: Galvanized steel where exposed to moisture**[, with baked-enamel finish and removable access panel][, with powder-coat finish and removable access panel]**. Floor-mounting units shall have leveling screws.

Coordinate custom-color requirements in "Cabinet" paragraph below with sample submittal requirements. Coordinate field painting with Section 099114 "Exterior Painting" and Section 099123 "Interior Painting."

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

Vertical Unit Front Panels: Removable, steel, with **[integral stamped] [polyethylene] [steel]** discharge grille and channel-formed edges, cam fasteners, and insulation on back of panel.

Horizontal Unit Bottom Panels: Fastened to unit with cam fasteners and hinge and attached with safety chain; with **[integral stamped] [cast-aluminum]** discharge grilles.

Retain "Stack Unit Discharge and Return Grille" subparagraph below for stack-type fan coil unit.

Stack Unit Discharge and Return Grille: Aluminum double-deflection discharge grille, and louvered- or panel-type return grille; color as selected by Architect from manufacturer's **[standard] [custom]** colors. Return grille shall provide maintenance access to fan coil unit.

Steel recessing flanges for recessing fan coil units into ceiling or wall.

Retain "Outdoor-Air Wall Box" paragraph below for fan coil units with outdoor-air intake.

* + - * 1. Outdoor-Air Wall Box: Minimum 0.1265-inch- thick, aluminum, rain-resistant louver and box with integral eliminators and bird screen.

Louver Configuration: [**Horizontal**] [**Vertical**], rain-resistant louver.

Louver Material: [**Aluminum**] [**Steel**].

Bird Screen: 1/2-inch mesh screen on interior side of louver.

Decorative Grille: On outside of intake.

Finish: [**Anodized aluminum**] [**Baked enamel**], color as selected by Architect from manufacturer's [**standard**] [**custom**] colors.

Outdoor-air dampers are furnished for wall-mounting, vertical, exposed units only.

* + - * 1. Outdoor-Air Damper: Galvanized-steel blades with edge and end seals and nylon bearings; with **[electronic] [pneumatic], [two-position] [modulating]** actuators.

Verify available filter types with manufacturer. Indicate filter thickness in "Capacities and Characteristics" paragraph or in the Fan Coil Unit Schedule on Drawings.

For further information on air filters and air filter ratings, see Section 234100 "Particulate Air Filtration."

* + - * 1. Filters: Minimum arrestance and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2 and all addendums.

Retain "MERV Rating" subparagraph below to require compliance with ASHRAE 62.1, which requires a MERV rating of 6 or higher. Also, retain subparagraph for sustainable design systems that require that filters have a minimum MERV 13 rating for systems that deliver air to occupied spaces

MERV Rating: **[6] [13] <Insert number>** when tested according to ASHRAE 52.2.

Retain one or more of three subparagraphs below. Indicate filter type in the Fan Coil Unit Schedule on Drawings. 2-inch- thick washable foam is unavailable. Retain third subparagraph for sustainable design systems, which require compliance with ASHRAE 62.1, which requires a MERV rating of 6 or higher.

Washable Foam: 70 percent arrestance and MERV**[ 3]**.

Glass Fiber Treated with Adhesive: 80 percent arrestance and MERV**[ 5]**.

Pleated Cotton-Polyester Media: 90 percent arrestance and MERV**[ 7]**.

* + - * 1. Hydronic Coils: Copper tube[ with corrosion-resistant coating], with mechanically bonded aluminum fins spaced no closer than 0.1 inch, 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 valve.

Retain "Indoor Refrigerant Coils" paragraph below only when the fan coil unit includes refrigerant coils working in conjunction with a remote condenser unit. Remote condensing units are specified in Section 236200 "Packaged Compressor and Condenser Units."

* + - * 1. Indoor Refrigerant Coils: **[Copper] [Stainless-steel]** tube**[ with corrosion-resistant coating]**, with mechanically bonded **[aluminum] [stainless-steel]** fins spaced no closer than 0.1 inch and brazed joints at fittings. Comply with AHRI 210/240, and leak test to minimum 450 psig for a minimum 300-psig working pressure. Include thermal expansion valve.
        2. Steam Coils: Copper**[ distributing]** tube**[ with corrosion-resistant coating]**, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 75 psig.

"Corrosion-Resistant Coating" paragraph below will allow either a phenolic or an epoxy coating that meets the requirements below. If one of the two types of coating is preferred, consult with manufacturer.

Note that ASTM B117 does not specify the duration of a salt test, only testing conditions.

* + - * 1. Corrosion-Resistant Coating: Coat coils with a corrosion-resistant coating capable of withstanding a **[3,000] <Insert time>**-hour salt-spray test according to ASTM B117.

Standards:

ASTM B117 for salt spray.

ASTM D2794 for minimum impact resistance of 100 in-lb.

ASTM D3359 for cross hatch adhesion of 5B.

Application: **[Immersion] [Spray]**.

Thickness: **[1 mil] <Insert measurement>**.

Gloss: Minimum gloss of 50 gloss units on a single angle 60 degree meter.

"UV Protection" subparagraph below is an option.

UV Protection: Spray applied topcoat.

Some manufacturers limit air-to-air heat pumps to electric supplemental heating coils.

* + - * 1. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a 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.
        2. Fan and Motor Board: Removable.

Fan: Forward curved, 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, add 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 Termination: Connect motor to chassis wiring with plug connection.

Retain "Factory, Hydronic Piping Package" paragraph below to suit Project. Delete if factory piping package is not required.

* + - * 1. Factory, Hydronic Piping Package: **[ASTM B88, Type L] [ASTM B88, Type M]** 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 for dual-temperature coil.

**[Two][Three]**-way, **[two-position] [modulating]** control valve for chilled-water coil.

**[Two][Three]**-way, **[two-position] [modulating]** control valve for hot-water heating coil.

**[Two][Three]**-way **[two-position] [modulating]** control valve for hot-water reheat coil.

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 fan coil unit 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 venturi, connections for portable differential pressure meter with integral seals, threaded ends, and 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 with plus or minus 10 percent over differential pressure range of 2 to 80 psig.

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

Wrought-Copper Unions: ASME B16.22.

Retain "Risers" subparagraph below for stack-type units with hydronic coils.

Risers: **[ASTM B88, Type L] [ASTM B88, Type M]** copper pipe with hose and ball valve for system flushing.

* + - * 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."

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

* + - * 1. Basic Unit Controls:

Control voltage transformer.

Verify control features with manufacturer.

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

Heat-cool-off switch.

Fan on-auto switch.

Retain first subparagraph below if multispeed motors are specified.

Fan-speed switch.

**[Manual] [Automatic]** changeover.

Adjustable deadband.

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

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

**[Degree F] [Degree C]** indication.

**[Wall-mounting] [Unit-mounted]** humidistat.

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

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

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

Unoccupied-period-override push button.

Data entry and access port.

Input data includes room temperature, and humidity set points and occupied and unoccupied periods.

Output data includes room temperature and humidity, 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 Operation: **[Two] <Insert number>** hours.

Unit Supply-Air Fan Operation:

Occupied Periods: Fan runs continuously.

Unoccupied Periods: Fan cycles to maintain room setback temperature.

Hydronic-Cooling-Coil Operation:

Occupied Periods: **[Open] [Modulate]** control valve to maintain room temperature.

Unoccupied Periods: Close control valve.

Retain "Refrigerant-Coil Operation" subparagraph below only when the fan coil unit includes refrigerant coils working in conjunction with a remote condenser unit. Remote condensing units are specified in Section 236200 "Packaged Compressor and Condenser Units."

Refrigerant-Coil Operation:

Occupied Periods: Start compressor to maintain room temperature or humidistat set point.

Unoccupied Periods: Stop compressor cooling and cycle compressor for heating to maintain setback temperature.

**[Supplemental ]**Heating-Coil Operation:

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 first subparagraph below only when the fan coil unit includes refrigerant coils working in conjunction with a remote condenser unit. Remote condensing units are specified in Section 236200 "Packaged Compressor and Condenser Units."

Switch refrigerant-reversing valve to operate supplemental coil for heating when outdoor temperature is below **[25 deg F] <Insert temperature>**.

Dual-Temperature Hydronic-Coil Operation:

Occupied Periods: When chilled water is available, **[open] [modulate]** control valve if room temperature exceeds thermostat set point. When hot water is available, open control valve if temperature falls below thermostat set point.

Unoccupied Periods: When chilled water is available, close control valve. When hot water is available, **[open] [modulate]** control valve if room temperature falls below thermostat setback temperature.

Reheat-Coil Operation:

Retain "Humidity Control for Occupied Periods" and "Humidity Control for Unoccupied Periods" subparagraphs below if reheat coil provides reheating only.

Humidity Control for Occupied Periods:

Humidistat **[opens control valve] [modulates control valve] [energizes electric-resistance coil]** to provide heating. As space temperature rises above set point, cooling-coil valve **[opens] [modulates]** to maintain room temperature.

Humidity Control for Unoccupied Periods: **[Close control valve] [De-energize]**.

Retain "Occupied Periods" and "Unoccupied Periods" subparagraphs below if reheat coil provides heating and reheating.

Occupied Periods:

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

Humidity-Control Operations: Humidistat **[opens control valve] [modulates control valve] [energizes electric-resistance coil]** to provide heating. As space temperature rises above set point, cooling-coil valve **[opens] [modulates]** to maintain room temperature.

Unoccupied Periods: Start fan and **[open control valve] [modulate control valve] [energize electric-resistance coil]** if room temperature falls below setback temperature. Humidity control is not available.

Retain first "Outdoor-Air Damper Operation" subparagraph below for fixed, minimum outdoor-air intake.

Outdoor-Air Damper Operation:

Occupied Periods: Open damper to fixed position for **[25] <Insert number>** percent outdoor air.

Unoccupied periods: Close damper.

Retain "Outdoor-Air Damper Operation" subparagraph below for outdoor-air economizer cycle.

Outdoor-Air Damper Operation:

Occupied Periods:

Outdoor-Air Temperature below Room Temperature: If room temperature is above thermostat set point, modulate outdoor-air damper to maintain room temperature (outdoor-air economizer). If room temperature is below thermostat set point, position damper to fixed minimum position.

Outdoor-Air Temperature above Room Temperature: Position damper to fixed minimum position for **[25] <Insert number>** percent outdoor air.

Unoccupied Periods: Close damper.

Retain "Outdoor-Air Damper Operation (Enthalpy Based)" subparagraph below for outdoor-air economizer cycle based on enthalpy.

Outdoor-Air Damper Operation (Enthalpy Based):

Occupied Periods:

Outdoor-Air Enthalpy below Room Enthalpy: If room temperature is above room-temperature set point, modulate outdoor-air damper to maintain room temperature (outdoor-air economizer). If room temperature is below set point, position damper to fixed minimum position for **[25] <Insert number>** percent outdoor air.

Outdoor-Air Enthalpy above Room Enthalpy: Position damper to fixed minimum position for **[25] <Insert number>** percent outdoor air.

Unoccupied Periods: Close outdoor-air damper and open return-air 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 the central workstation.

Provide **[BACnet] [or] [LonWorks]** interface for central DDC system for HVAC workstation for the following functions:

Adjust set points.

Fan coil unit start, stop, and operating status.

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

Occupied and unoccupied schedules.

* + - * 1. Electrical Connection: Factory wire motors and controls for a single electrical connection.

If Project has more than one type or configuration of fan coil unit, delete "Capacities and Characteristics" paragraph below and schedule fan coil units on Drawings.

* + - * 1. Capacities and Characteristics:

Fan:

Airflow: **<Insert cfm>**.

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

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

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

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

Drive: **[Direct] [Belt]**.

Cooling Capacity:

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

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

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

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

Chilled-Water Coil:

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

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

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

Air-Side Pressure Drop: **<Insert inches wg>**.

Retain "Refrigerant Coil" subparagraph below only when the fan coil unit includes refrigerant coils working in conjunction with a remote condenser unit. Remote condensing units are specified in Section 236200 "Packaged Compressor and Condenser Units."

Refrigerant Coil:

Air-Side Pressure Loss: **<Insert inches wg>**.

Suction Temperature: **<Insert deg F>**.

Heating Capacity:

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

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

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

Hot-Water Heating Coil:

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

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

Air-Side Pressure Drop: **<Insert inches wg>**.

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

Steam Heating Coil:

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

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

Air-Side Pressure Drop: **<Insert inches wg>**.

Electric-Resistance Heating Coil:

Capacity: **<Insert kilowatts>**.

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

Air-Side Pressure Drop: **<Insert inches wg>**.

Reheat Capacity:

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

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

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

Filters:

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

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

Electrical Characteristics for Single-Point Connection:

Voltage/Phase/Hertz: **<Insert values>**.

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

Maximum Circuit Amperes: **<Insert value>**.

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

* + - 1. DUCTED FAN COIL UNITS

Many additional features, which vary with each manufacturer, are available for this product. Include all features for fan coil units that are required for Project, and identify additional features for specific units in the Fan Coil Unit Schedule on Drawings.

* + - * 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:

Carrier Global Corporation.

Daikin Applied.

[Engineered Air](http://www.specagent.com/Lookup?uid=123457076556).

[Greenheck Fan Corporation](http://www.specagent.com/Lookup?uid=123457076559).

[Trane Inc](http://www.specagent.com/Lookup?uid=123457076566).

USA Coil & Air.

[YORK; brand of Johnson Controls International plc, Building Solutions North America](http://www.specagent.com/Lookup?uid=123457076568).

Approved equivalent.

Fan coil units come with various coil configurations, the most typical being split coil systems with one heating and three cooling coils. The coils tend to be row split rather than face split, although both configurations are available. Units can also come with either a two-pipe or a four-pipe system, depending on Project design requirement.

* + - * 1. Fan Coil Unit Configurations: **[Row] [Face]** split.

Number of Heating Coils: **[One]** with two-pipe system.

Number of Cooling Coils: **[One] [Three]** with **[two][four]**-pipe system.

Closed-cell insulation with foil or matt facing is provided by some manufacturers to reduce the possibility of fibers from glass-fiber insulation being introduced into the conditioned space. If fan coil unit cabinet is constructed from double-wall insulated panels, then coil unit may not be insulated separately. Retain one of two "Coil Section Insulation" paragraphs below for coil section insulation.

* + - * 1. Coil Section Insulation: **[1/2-inch-] [1-inch-] <Insert dimension>** thick, **[coated] [foil-faced]** glass fiber complying with ASTM C1071 and attached with adhesive complying with ASTM C916.

Surface-Burning Characteristics: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E84 by a qualified testing agency.

"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. Coil Section Insulation: Insulate coil section according to Section 230616 "HVAC Equipment Insulation."

Surface-Burning Characteristics: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E84 by a qualified testing agency.

"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.

Removable drain pans are an extra feature with some manufacturers.

"(Main and Auxiliary) Drain Pans" Removable drain pans are an extra feature with some manufacturers. paragraph below may be required to comply with Project requirements or authorities having jurisdiction and is required for sustainable design systems.

* + - * 1. [Main and Auxiliary ]Drain Pans: **[Plastic] [Stainless steel] [Insulated galvanized steel with plastic liner]**. Fabricate pans and drain connections to comply with ASHRAE 62.1.
        2. Chassis: Galvanized steel where exposed to moisture[, with baked-enamel finish and removable access panel][, with powder-coat finish and removable access panel]. Floor-mounting units shall have leveling screws.
        3. Cabinets: Steel with baked-enamel finish in manufacturer's standard paint color.

Supply-Air Plenum: Sheet metal plenum finished and insulated to match the chassis**[ with mill-finish, aluminum, double-deflection grille]**.

Retain "Return-Air Plenum" or "Mixing Plenum" subparagraph below.

Return-Air Plenum: Sheet metal plenum finished to match the chassis.

Mixing Plenum: Sheet metal plenum finished and insulated to match the chassis with outdoor- and return-air, formed-steel dampers.

Dampers: Galvanized steel with extruded-vinyl blade seals, flexible-metal jamb seals, and interlocking linkage.

Verify available filters with fan coil unit manufacturer. Indicate filter thickness in "Capacities and Characteristics" paragraph or in the Fan Coil Unit Schedule on Drawings.

For further information on air filters and air filter ratings, see Section 234100 "Particulate Air Filtration."

* + - * 1. Filters: Minimum arrestance and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2 and all addendums.

Retain "MERV Rating" paragraph below to require compliance with ASHRAE 62.1, which requires a MERV rating of 6 or higher. Also, retain paragraph for sustainable design systems, which require that filters have a minimum MERV 13 rating for systems that deliver air to occupied spaces.

* + - * 1. MERV Rating: [6] [13] <Insert number> when tested according to ASHRAE 52.2.

Retain one or more of three subparagraphs below. Indicate filter type in the Fan Coil Unit Schedule on Drawings. 2-inch-thick washable foam is unavailable. Retain third subparagraph for sustainable design systems, which require compliance with ASHRAE 62.1, which requires a MERV rating of 6 or higher.

Washable Foam: 70 percent arrestance and MERV**[ 3]**.

Glass Fiber Treated with Adhesive: 80 percent arrestance and MERV**[ 5]**.

Pleated Cotton-Polyester Media: 90 percent arrestance and MERV**[ 7]**.

* + - * 1. Hydronic Coils: Copper tube[ with corrosion-resistant coating], with mechanically bonded aluminum fins spaced no closer than 0.1 inch, 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.

Retain "Indoor Refrigerant Coils" paragraph below only when the fan coil unit includes refrigerant coils working in conjunction with a remote condenser unit. Remote condensing units are specified in Section 236200 "Packaged Compressor and Condenser Units."

* + - * 1. Indoor Refrigerant Coils: Copper tube**[ with corrosion-resistant coating]**, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and brazed joints at fittings. Comply with AHRI 210/240, and leak test to minimum 450 psig for a minimum 300-psig working pressure. Include thermal expansion valve.
        2. Steam Coils: Copper tube**[ with corrosion-resistant coating]**, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 75 psig.

"Corrosion-Resistant Coating" paragraph below will allow either a phenolic or an epoxy coating that meets the requirements below. If one of the two types of coating is preferred, consult with manufacturer.

Note that ASTM B117 does not specify the duration of a salt test, only testing conditions.

* + - * 1. Corrosion-Resistant Coating: Coat **[coils] [and] [fan guards]** with a corrosion-resistant coating capable of withstanding a **[3,000] <Insert time>**-hour salt-spray test according to ASTM B117.

Standards:

ASTM B117 for salt spray.

ASTM D2794 for minimum impact resistance of 100 in-lb

ASTM D3359 for cross hatch adhesion of 5B.

Application: **[Immersion] [Spray]**.

Thickness: **[1 mil] <Insert measurement>**.

Gloss: Minimum gloss of 50 gloss units on a single angle 60 degree meter.

"UV Protection" subparagraph below is an option.

UV Protection: Spray applied topcoat.

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

Retain "Direct-Driven Fans" or "Belt-Driven Fans" paragraph below. Retain both if multiple-type units are required. If retaining both, indicate fan type in the Fan Coil Unit Schedule on Drawings.

* + - * 1. Direct-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, multispeed motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and 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, add subparagraphs below to suit Project. Permanently lubricated ball bearings are available for motors up through 5 hp. Larger motors have grease-lubricated ball bearings.

Motors: Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

* + - * 1. Belt-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the cabinet. Aluminum or painted-steel wheels, and 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, add subparagraphs below to suit Project. Permanently lubricated ball bearings are available for motors up through 5 hp. Larger motors have grease-lubricated ball bearings.

Motors: Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

Retain "Factory, Hydronic Piping Package" paragraph below to suit Project. Delete if factory piping package is not required.

* + - * 1. Factory, Hydronic Piping Package: [ASTM B88, Type L] [ASTM B88, Type M] 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 for chilled-water coil.

**[Two][Three]**-way, **[two-position] [modulating]** control valve for heating coil.

**[Two][Three]**-way, **[two-position] [modulating]** control valve for dual-temperature coil.

**[Two][Three]**-way, **[two-position] [modulating]** control valve for reheat coil.

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 fan coil unit 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 venturi, connections for portable differential pressure meter with integral seals, threaded ends, and 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 with plus or minus 10 percent over differential pressure range of 2 to 80 psig.

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

Wrought-Copper Unions: ASME B16.22.

* + - * 1. Remote condensing units are specified in Section 236200 "Packaged Compressor and Condenser Units."
        2. Control devices and operational sequence are specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

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

* + - * 1. Basic Unit Controls:

Control voltage transformer.

Verify control features with manufacturer.

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

Heat-cool-off switch.

Fan on-auto switch.

Retain first subparagraph below if multispeed motors are specified.

Fan-speed switch.

**[Manual] [Automatic]** changeover.

Adjustable deadband.

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

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

**[Degree F] [Degree C]** indication.

**[Wall-mounting] [Unit-mounted]** humidistat.

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

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

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

Unoccupied-period-override push button.

Data entry and access port.

Input data includes room temperature, and humidity set points and occupied and unoccupied periods.

Output data includes room temperature and humidity, 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 Operation: **[Two] <Insert number>** hours.

Unit Supply-Air Fan Operation:

Occupied Periods: Fan runs continuously.

Unoccupied Periods: Fan cycles to maintain room setback temperature.

Hydronic-Cooling-Coil Operation:

Occupied Periods: **[Open] [Modulate]** control valve to maintain room temperature.

Unoccupied Periods: Close control valve.

Retain "Refrigerant-Coil Operation" subparagraph below only when the fan coil unit includes refrigerant coils working in conjunction with a remote condenser unit. Remote condensing units are specified in Section 236200 "Packaged Compressor and Condenser Units."

Refrigerant-Coil Operation:

Occupied Periods: Start compressor to maintain room temperature or humidistat set point.

Unoccupied Periods: Stop compressor cooling and cycle compressor for heating to maintain setback temperature.

**[Supplemental ]**Heating-Coil Operation:

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 first subparagraph below only when the fan coil unit includes refrigerant coils working in conjunction with a remote condenser unit. Remote condensing units are specified in Section 236200 "Packaged Compressor and Condenser Units."

Switch refrigerant-reversing valve to operate supplemental coil for heating when outdoor temperature is below **[25 deg F] <Insert temperature>**.

Dual-Temperature Hydronic-Coil Operation:

Occupied Periods: When chilled water is available, **[open] [modulate]** control valve if room temperature exceeds thermostat set point. When hot water is available, **[open] [modulate]** control valve if temperature falls below thermostat set point.

Unoccupied Periods: When chilled water is available, close valve. When hot water is available, **[open] [modulate]** control valve if room temperature falls below thermostat setback temperature.

Reheat-Coil Operation:

Retain "Humidity Control for Occupied Periods" and "Humidity Control for Unoccupied Periods" subparagraphs below if reheat coil provides reheating only.

Humidity Control for Occupied Periods:

Humidistat **[opens control valve] [modulates control valve] [energizes electric-resistance coil]** to provide heating. As room temperature rises above set point, cooling-coil valve **[opens] [modulates]** to maintain room temperature.

Humidity Control for Unoccupied Periods: **[Close control valve] [De-energize].**

Retain "Occupied Periods" and "Unoccupied Periods" subparagraphs below if reheat coil provides heating and reheating.

Occupied Periods:

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

Humidity-Control Operations: Humidistat **[opens control valve] [modulates control valve] [energizes electric-resistance coil]** to provide heating. As room temperature rises above set point, cooling-coil valve **[opens] [modulates]** to maintain room temperature.

Unoccupied Periods: Start fan and **[open control valve] [modulate control valve] [energize electric-resistance coil]** if room temperature falls below setback temperature. Humidity control is not available.

Retain first "Outdoor-Air Damper Operation" subparagraph below for fixed, minimum outdoor-air intake.

Outdoor-Air Damper Operation:

Occupied Periods: Open damper to fixed position for **[25] <Insert number>** percent outdoor air.

Unoccupied Periods: Close damper.

Retain "Outdoor-Air Damper Operation" subparagraph below for outdoor-air economizer cycle based on temperature.

Outdoor-Air Damper Operation:

Occupied Periods:

Outdoor-Air Temperature below Room Temperature: If room temperature is above room-temperature set point, modulate outdoor- and return-air dampers to maintain room temperature set point (outdoor-air economizer). If room temperature is below set point, position damper to fixed minimum setting.

Outdoor-Air Temperature above Room Temperature: Position damper to fixed minimum position for **[25] <Insert number>** percent outdoor air.

Unoccupied Periods: Close outdoor-air damper and open return-air damper.

Retain "Outdoor-Air Damper Operation (Enthalpy Based)" subparagraph below for outdoor-air economizer cycle based on enthalpy.

Outdoor-Air Damper Operation (Enthalpy Based):

Occupied Periods:

Outdoor-Air Enthalpy below Room Enthalpy: If room temperature is above room-temperature set point, modulate outdoor-air damper to maintain room temperature (outdoor-air economizer). If room temperature is below set point, position damper to fixed minimum position for **[25] <Insert number>** percent outdoor air.

Outdoor-Air Enthalpy above Room Enthalpy: Position damper to fixed minimum position for **[25] <Insert number>** percent outdoor air.

Unoccupied Periods: Close outdoor-air damper and open return-air 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 the central workstation.

Provide **[BACnet] [or] [LonWorks]** interface for central DDC system for HVAC workstation for the following functions:

Adjust set points.

Fan coil unit start, stop, and operating status.

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

Occupied and unoccupied schedules.

* + - * 1. Electrical Connection: Factory wire motors and controls for a single electrical connection.

If Project has more than one type or configuration of fan coil unit, delete "Capacities and Characteristics" paragraph below and schedule fan coil units on Drawings.

* + - * 1. Capacities and Characteristics:

Fan:

Airflow: **<Insert cfm>**.

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

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

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

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

Drive: **[Direct] [Belt]**.

Cooling Capacity:

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

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

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

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

Chilled-Water Coil:

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

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

Air-Side Pressure Drop: **<Insert inches wg>**.

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

Retain "Refrigerant Coil" subparagraph below only when the fan coil unit includes refrigerant coils working in conjunction with a remote condenser unit. Remote condensing units are specified in Section 236200 "Packaged Compressor and Condenser Units."

Refrigerant Coil:

Air-Side Pressure Loss: **<Insert inches wg>**.

Suction Temperature: **<Insert deg F>**.

Heating Capacity:

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

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

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

Hot-Water Heating Coil:

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

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

Air-Side Pressure Drop: **<Insert inches wg>**.

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

Steam Heating Coil:

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

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

Air-Side Pressure Drop: **<Insert inches wg>**.

Electric-Resistance Heating Coil:

Capacity: **<Insert kilowatts>**.

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

Air-Side Pressure Drop: **<Insert inches wg>**.

Reheat Capacity:

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

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

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

Filters:

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

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

Electrical Characteristics for Single-Point Connection:

Voltage/Phase/Hertz: **<Insert values>**.

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

Maximum Circuit Amperes: **<Insert values>**.

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

1. EXECUTION
   * + 1. EXAMINATION
          1. Examine areas, with Installer present, to receive fan coil units 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 fan coil unit installation.
          3. Proceed with installation only after unsatisfactory conditions have been corrected.
       2. INSTALLATION
          1. Install fan coil units level and plumb.
          2. Install fan coil units to comply with NFPA 90A.
          3. Install in accordance with all manufacturer’s Installation Manual

Retain first paragraph below for horizontal, suspended units.

* + - * 1. Suspend fan coil units from structure with elastomeric hangers. Vibration isolators are specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

Verify mounting height in first paragraph below with authorities having jurisdiction to comply with requirements of the Americans with Disabilities Act.

* + - * 1. Verify locations of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices **[48 inches] [60 inches] <Insert dimension>** above finished floor.
        2. Install new filters in each fan coil unit within two weeks after 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 other Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

Install piping adjacent to machine to allow service and maintenance.

Connect piping to fan coil unit factory hydronic piping package. Install piping package if shipped loose.

Connect condensate drain to indirect waste.

Retain subparagraph below for concealed and ducted fan coil units.

Install condensate trap of adequate depth to seal against fan pressure. Install cleanouts in piping at changes of direction.

Retain first paragraph below for ducted fan coil units. 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-air and return-air ducts to fan coil units with flexible duct connectors specified in Section 233300 "Air Duct Accessories." Comply with safety requirements in UL 1995 for duct connections.
        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

Retain "Testing Agency," "Manufacturer's Field Service," and "Perform the following tests and inspections" paragraphs below to identify who shall perform tests and inspections. If retaining second option in "Testing Agency" paragraph or if retaining "Manufacturer's Field Service" or "Perform the following tests and inspections" paragraph, retain "Field quality-control reports" paragraph in "Informational Submittals" Article.

Retain "Manufacturer's Field Service" paragraph below to require a factory-authorized service representative to perform tests and inspections.

* + - * 1. Manufacturer's Field Service: Engage a Company Service Advisor to test and inspect components, assemblies, and equipment installations, including connections.

Retain "Perform the following tests and inspections" paragraph below to require Contractor to perform tests and inspections.

* + - * 1. Perform the following tests and inspections**[ with the Company Service 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 if units have electric heat.

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. Remove and replace malfunctioning units and retest as specified above.
        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 and humidity 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 Service Advisor per OGS Spec Section 014216 to train] [Train]** Director’s Representative's Facility’s maintenance personnel to adjust, operate, and maintain fan coil units.

END OF SECTION 238219