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SECTION 238219 - FAN COIL UNITS

This Section includes requirements for the LEED Rating System. However, equipment specified in this Section may not qualify for LEED Rating System prerequisites and credits. Verify, with manufacturers, that the requirements for prerequisites and credits can be met. To achieve prerequisites and obtain credits, 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.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes fan-coil units and accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. LEED Submittals:

Coordinate "Product Data for Credit EA 4" Subparagraph below with requirements for refrigerants.

- 1. Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.
- 2. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
- C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

"ASHRAE Compliance" Paragraph below may be required to comply with Project requirements or authorities having jurisdiction. LEED Prerequisite IEQ 1 requires 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.

- B. 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. LEED Prerequisite EA 2 requires minimum efficiency equal to requirements in ASHRAE/IESNA 90.1.

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

Edit this Article with the Fan-Coil-Unit Schedule on Drawings, in which manufacturers and products, or manufacturers only, are named. See Section 016000 "Product Requirements" for an explanation of the terms "Available Manufacturers," "Manufacturers," and "Basis-of-Design Product" and the effect these terms have on "Comparable Product" and "Product Substitution" requirements.

- A. In the Fan-Coil-Unit Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
3. Basis-of-Design Product: The design for each fan-coil unit is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 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.

- A. Description: Factory-packaged and -tested units rated according to ARI 440, ASHRAE 33, and UL 1995.
- B. Coil Section Insulation: [1/2-inch (13-mm)] [1-inch (25-mm)] <Insert thickness> thick, [coated glass fiber] [foil-covered, closed-cell foam] [matte-finish, closed-cell foam] complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.
 1. Fire-Hazard Classification: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.

"Airstream Surfaces" Subparagraph below may be required to comply with Project requirements or authorities having jurisdiction. Retain subparagraph to comply with LEED Prerequisite IEQ 1.

2. 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. LEED Prerequisite IEQ 1 requires compliance with ASHRAE 62.1.

- C. 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**].
- D. Chassis: Galvanized steel where exposed to moisture. Floor-mounting units shall have leveling screws.

Coordinate custom-color requirements in paragraph below with sample submittal requirements. Coordinate field painting with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

- E. 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]**.
1. 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.
 2. Horizontal Unit Bottom Panels: Fastened to unit with cam fasteners and hinge and attached with safety chain; with **[integral stamped]** **[cast-aluminum]** discharge grilles.
 3. Steel recessing flanges for recessing fan-coil units into ceiling or wall.

Verify available filter types with manufacturer. Indicate filter thickness in the Fan-Coil-Unit Schedule on Drawings.

- F. Filters: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

Retain one or more of three subparagraphs below. Retain third subparagraph if applying for LEED certification. LEED Prerequisite IEQ 1 requires compliance with ASHRAE 62.1, which requires a MERV rating of 6 or higher.

1. Washable Foam: 70 percent arrestance and 3 MERV.
 2. Glass Fiber Treated with Adhesive: 80 percent arrestance and 5 MERV.
 3. Pleated Cotton-Polyester Media: 90 percent arrestance and 7 MERV.
- G. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), rated for a minimum working pressure of 200 psig (1378 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain valve.
- H. 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.
- I. Fan and Motor Board: Removable.
1. Fan: Forward curved, double width, centrifugal; directly connected to motor. Thermoplastic or painted-steel wheels, and aluminum, painted-steel, or galvanized-steel fan scrolls.
 2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
 3. Wiring Termination: Connect motor to chassis wiring with plug connection.
- J. Factory, Hydronic Piping Package: **[ASTM B 88, Type L (ASTM B 88M, Type B)]** **[ASTM B 88, Type M (ASTM B 88M Type C)]** copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet, and outlet.

Retain one or more of first three subparagraphs below.

1. [Two] [Three]-way, [two-position] [modulating] control valve for dual-temperature coil.
 2. [Two] [Three]-way, [two-position] [modulating] control valve for chilled-water coil.
 3. [Two] [Three]-way, [two-position] [modulating] control valve for heating coil.
 4. Hose Kits: Minimum 400-psig (2758-kPa) working pressure, and operating temperatures from 33 to 211 deg F (0.5 to 99 deg C). Tag hose kits to equipment designations.
 - a. Length: [24 inches (600 mm)] [36 inches (900 mm)] <Insert dimension>.
 - b. Minimum Diameter: Equal to fan-coil-unit connection size.
 5. Two-Piece Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig (4140-kPa) minimum CWP rating and blowout-proof stem.
 6. Calibrated-Orifice Balancing Valves: Bronze body, ball type; 125-psig (860-kPa) working pressure, 250-deg F (121-deg C) maximum operating temperature; with calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, threaded ends, and equipped with a memory stop to retain set position.
 7. Automatic Flow-Control Valve: Brass or ferrous-metal body; 300-psig (2070-kPa) working pressure at 250 deg F (121 deg C), 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 (13.8 to 552 kPa).
 8. Y-Pattern Hydronic Strainers: Cast-iron body (ASTM A 126, Class B); 125-psig (860-kPa) working pressure; with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 (DN 15) hose-end, full-port, ball-type blowdown valve in drain connection.
 9. Wrought-Copper Unions: ASME B16.22.
- K. Control devices and operational sequences are specified in Section 230900 "Instrumentation and Control for HVAC" and Section 230993 "Sequence and Operations for HVAC Controls."

Retain paragraph above and delete paragraph and subparagraphs below if controls are part of overall temperature-control system.

L. Basic Unit Controls:

1. Control voltage transformer.

Verify control features with manufacturer.

2. [Wall-mounting] [Unit-mounted] thermostat with the following features:
 - a. Heat-cool-off switch.
 - b. Fan on-auto switch.

Retain first subparagraph below if multispeed motors are specified.

- c. Fan-speed switch.
- d. [Manual] [Automatic] changeover.
- e. Adjustable deadband.
- f. [Concealed] [Exposed] set point.
- g. [Concealed] [Exposed] indication.
- h. [Degree F] [Degree C] indication.

3. **[Wall-mounting] [Unit-mounted]** temperature sensor.
4. Unoccupied-period-override push button.
5. Data entry and access port.
 - a. Input data includes room temperature set points and occupied and unoccupied periods.
 - b. Output data includes room temperature, supply-air temperature, entering-water temperature, operating mode, and status.

Retain first paragraph and subparagraphs below and coordinate with "Basic Unit Controls" Paragraph and subparagraphs above or with control devices specified in Section 230900 "Instrumentation and Control for HVAC."

M. **[DDC]** Terminal Controller:

1. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.
2. Unoccupied Period Override Operation: **[Two]** <Insert number> hours.
3. Unit Supply-Air Fan Operation:
 - a. Occupied Periods: Fan runs continuously.
 - b. Unoccupied Periods: Fan cycles to maintain room setback temperature.
4. Hydronic-Cooling-Coil Operation:
 - a. Occupied Periods: **[Open] [Modulate]** control valve to maintain room temperature.
 - b. Unoccupied Periods: Close control valve.
5. Heating-Coil Operation:
 - a. Occupied Periods: **[Open control valve] [Modulate control valve] [Energize electric-resistance coil]** to provide heating if room temperature falls below thermostat set point.
 - b. Unoccupied Periods: Start fan and **[open control valve] [modulate control valve] [energize electric-resistance coil]** if room temperature falls below setback temperature.
6. Dual-Temperature Hydronic-Coil Operation:
 - a. 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.
 - b. 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.
7. Controller shall have volatile-memory backup.

N. Electrical Connection: Factory wire motors and controls for a single electrical connection.

2.3 DUCTED FAN-COIL UNITS

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

- A. Description: Factory-packaged and -tested units rated according to ARI 440, ASHRAE 33, and UL 1995.
- B. Coil Section Insulation: [**1/2-inch (13-mm)**] [**1-inch (25-mm)**] <Insert thickness> thick [**coated**] [**foil-faced**] glass fiber complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.
 - 1. Fire-Hazard Classification: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.

"Airstream Surfaces" Subparagraph below may be required to comply with Project requirements or authorities having jurisdiction. Retain subparagraph to comply with LEED Prerequisite IEQ 1.

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

"Drain Pans" Paragraph below may be required to comply with Project requirements or authorities having jurisdiction. LEED Prerequisite IEQ 1 requires compliance with ASHRAE 62.1.

- C. Drain Pans: [**Plastic**] [**Stainless steel**] [**Insulated galvanized steel with plastic liner**]. Fabricate pans and drain connections to comply with ASHRAE 62.1.
- D. Chassis: Galvanized steel where exposed to moisture, with baked-enamel finish and removable access panels.
- E. Cabinets: Steel with baked-enamel finish in manufacturer's standard paint color.
 - 1. Supply-Air Plenum: Sheet metal plenum finished and insulated to match the chassis [**with mill-finish, aluminum, double-deflection grille**].
 - 2. Return-Air Plenum: Sheet metal plenum finished to match the chassis.

Retain subparagraph above or first subparagraph below.

- 3. Mixing Plenum: Sheet metal plenum finished and insulated to match the chassis with outdoor- and return-air, formed-steel dampers.
- 4. 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 the Fan-Coil-Unit Schedule on Drawings.

- F. Filters: Minimum arresstance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

Retain one or more of three subparagraphs below. Indicate filter type in Fan-Coil-Unit Schedule on Drawings. 2-inch- (50-mm-) thick washable foam is not available. Retain third subparagraph if applying for LEED certification. LEED Prerequisite IEQ 1 requires compliance with ASHRAE 62.1, which requires a MERV rating of 6 or higher.

1. Washable Foam: 70 percent arrestance and 3 MERV.
 2. Glass Fiber Treated with Adhesive: 80 percent arrestance and 5 MERV.
 3. Pleated Cotton-Polyester Media: 90 percent arrestance and 7 MERV.
- G. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), rated for a minimum working pressure of 200 psig (1378 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain.
- H. 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- stainless-steel hardware.
- I. 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.

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

- J. 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.

Retain subparagraph below with either of last two paragraphs above.

1. Motors: Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
- K. Factory, Hydronic Piping Package: [ASTM B 88, Type L (ASTM B 88M, Type B)] [ASTM B 88, Type M (ASTM B 88M Type C)] copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet, and outlet.

Retain one or more of first three subparagraphs below.

1. [Two] [Three]-way, [two-position] [modulating] control valve for chilled-water coil.
2. [Two] [Three]-way, [two-position] [modulating] control valve for heating coil.
3. [Two] [Three]-way, [two-position] [modulating] control valve for dual-temperature coil.
4. Hose Kits: Minimum 400-psig (2758-kPa) working pressure, and operating temperatures from 33 to 211 deg F (0.5 to 99 deg C). Tag hose kits to equipment designations.
 - a. Length: [24 inches (600 mm)] [36 inches (900 mm)] <Insert dimension>.

- b. Minimum Diameter: Equal to fan-coil-unit connection size.
- 5. Two-Piece Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig (4140-kPa) minimum CWP rating and blowout-proof stem.
- 6. Calibrated-Orifice Balancing Valves: Bronze body, ball type; 125-psig (860-kPa) working pressure, 250 deg F (121 deg C) maximum operating temperature; with calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, threaded ends, and equipped with a memory stop to retain set position.
- 7. Automatic Flow-Control Valve: Brass or ferrous-metal body; 300-psig (2070-kPa) working pressure at 250 deg F (121 deg C); 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 (13.8 to 552 kPa).
- 8. Y-Pattern Hydronic Strainers: Cast-iron body (ASTM A 126, Class B); 125-psig (860-kPa) working pressure, with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 (DN 15) hose-end, full-port, ball-type blowdown valve in drain connection.
- 9. Wrought-Copper Unions: ASME B16.22.

- L. Control devices and operational sequence are specified in Section 230900 "Instrumentation and Control for HVAC" and Section 230993 "Sequence and Operations for HVAC Controls."

Retain paragraph above and delete first paragraph and subparagraphs below if controls are part of overall temperature-control system.

- M. Basic Unit Controls:

- 1. Control voltage transformer.

Verify control features with manufacturer.

- 2. [**Wall-mounting**] [**Unit-mounted**] thermostat with the following features.
 - a. Heat-cool-off switch.
 - b. Fan on-auto switch.
 - c. Fan-speed switch.
 - d. [**Manual**] [**Automatic**] changeover.
 - e. Adjustable deadband.
 - f. [**Concealed**] [**Exposed**] set point.
 - g. [**Concealed**] [**Exposed**] indication.
 - h. [**Degree F**] [**Degree C**] indication.
- 3. [**Wall-mounting**] [**Unit-mounted**] temperature sensor.
- 4. Unoccupied-period-override push button.
- 5. Data entry and access port.
 - a. Input data includes room temperature set points and occupied and unoccupied periods.
 - b. Output data includes room temperature, supply-air temperature, entering-water temperature, operating mode, and status.

- N. [**DDC**] Terminal Controller:

1. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.
2. Unoccupied Period Override Operation: [**Two**] <Insert number> hours.
3. Unit Supply-Air Fan Operation:
 - a. Occupied Periods: Fan runs continuously.
 - b. Unoccupied Periods: Fan cycles to maintain room setback temperature.
4. Hydronic-Cooling-Coil Operation:
 - a. Occupied Periods: [**Open**] [**Modulate**] control valve to maintain room temperature.
 - b. Unoccupied Periods: Close control valve.
5. Heating-Coil Operation:
 - a. Occupied Periods: [**Open control valve**] [**Modulate control valve**] [**Energize electric-resistance coil**] to provide heating if room temperature falls below thermostat set point.
 - b. Unoccupied Periods: Start fan and [**open control valve**] [**modulate control valve**] [**energize electric-resistance coil**] if room temperature falls below setback temperature.
6. Dual-Temperature Hydronic-Coil Operation:
 - a. 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.
 - b. 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.

Retain subparagraph and associated subparagraphs below for fixed, minimum outdoor-air intake.

7. Outdoor-Air Damper Operation:
 - a. Occupied Periods: Open damper to fixed position for [**25**] <Insert percent> percent outdoor air.
 - b. Unoccupied Periods: Close damper.

Retain subparagraph and associated subparagraphs below for outdoor-air economizer cycle based on temperature.

8. Outdoor-Air Damper Operation:
 - a. Occupied Periods:
 - 1) 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.
- 2) Outdoor-Air Temperature above Room Temperature: Position damper to fixed minimum position for [25] <Insert percent> percent outdoor air.
- b. Unoccupied Periods: Close outdoor-air damper and open return-air damper.

Retain first subparagraph and associated subparagraphs below for outdoor-air economizer cycle based on enthalpy.

9. Outdoor-Air Damper Operation:

a. Occupied Periods:

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

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

10. Controller shall have volatile-memory backup.

O. Electrical Connection: Factory wire motors and controls for a single electrical connection.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fan-coil units to comply with NFPA 90A.
- B. 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.

- C. Verify locations of thermostats and other exposed control sensors with Drawings and room details before installation. Install devices [48 inches (1220 mm)] [60 inches (1525 mm)] <Insert dimension> above finished floor.
- D. Install new filters in each fan-coil unit within two weeks after Substantial Completion.

- E. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:
1. Install piping adjacent to machine to allow service and maintenance.
 2. Connect piping to fan-coil-unit factory hydronic piping package. Install piping package if shipped loose.
 3. Connect condensate drain to indirect waste.

Retain subparagraph below for concealed and ducted fan-coil units.

- a. Install condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.
- F. Connect supply and return 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.

3.2 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

Delete first subparagraph below if units do not have electric heat.

2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 238219