SECTION 238413.23 - DIRECT-STEAM-INJECTION HUMIDIFIERS

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

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:

Direct-steam-injection distributer tube humidifiers.

Direct-steam-injection panel distribution manifold humidifiers.

Area-type direct-steam-injection humidifiers.

Condensate drain coolers.

* + - 1. DEFINITIONS

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

* + - * 1. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
      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, furnished specialties, and accessories.
         5. Shop Drawings: Detail fabrication and installation of humidifiers. Include piping details, plans, elevations, sections, details of components, distributer tubes/manifolds, and attachments to other work.

Include diagrams for power, signal, and control wiring.

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: Detail humidifiers and adjacent equipment. Show support locations, type of support, weight on each support, required clearances, 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:

Structural members to which humidifiers will be attached.

Size and location of initial access modules for acoustical tile.

Retain "Seismic Qualification Data" paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 230548 "Vibration and Seismic Controls for HVAC" and Section 260548 "Vibration and Seismic Controls for Electrical Systems." See ASCE/SEI 7 for certification requirements for equipment and components.

* + - * 1. Seismic Qualification Data: Certificates, for humidifiers, 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.
      1. CLOSEOUT SUBMITTALS
         1. Operation and Maintenance Data: For humidifiers to include in operation and maintenance manuals.
      2. COORDINATION
         1. Coordinate location and installation of humidifiers with distributer tubes/manifolds in ducts and plenums or occupied space. Revise locations and elevations to suit field conditions and to ensure proper humidifier operation.

1. PRODUCTS

Manufacturers and products listed in SpecAgent and Masterworks Paragraph Builder are neither recommended nor endorsed by the AIA or AVITRU. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications.

* + - 1. PERFORMANCE REQUIREMENTS
         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. Comply with AHRI 640.
         3. Comply with **<Insert standard>**.

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: Direct-steam-injection humidifiers shall withstand the effects of earthquake motions determined according to **[ASCE/SEI 7] <Insert requirement>**.

Retain first 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]**."

For life-safety components required to function after an earthquake (such as fire-sprinkler systems, components that contain hazardous content, and storage racks in structures open to the public), the Component Importance Factor is 1.5. For other components, the Component Importance Factor is 1.0 unless the structure is in Seismic Use Group III and component is necessary for continued operation of facility or failure of component could impair continued operation of facility, in which case the Component Importance Factor is 1.5.

Component Importance Factor: **[1.5] [1.0]**.

See ASCE/SEI 7, Coefficients for Architectural Component Table and Seismic Coefficients for Mechanical and Electrical Components Table for requirements to be inserted in subparagraph below.

**<Insert requirements for Component Amplification Factor and Component Response Modification Factor>**.

If retaining an insulated option in "Insulation" paragraph in "Direct-Steam-Injection Distributer Tube Humidifiers" Article and in "Insulation" subparagraph in "Direct-Steam-Injection Panel Distribution Manifold Humidifiers" Article, retain "Surface-Burning Characteristics" subparagraph below.

* + - * 1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Flame-Spread Index: **[25] <Insert value>** or less.

Smoke-Developed Index: **[50] <Insert value>** or less.

* + - 1. DIRECT-STEAM-INJECTION DISTRIBUTER TUBE HUMIDIFIERS
         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:

Armstrong International, Inc.

Carel USA, LLC.

DRI-STEEM Humidifier Company.

Hygromatik; Spirax Sarco.

Neptronic; National Environmental Products, Inc.

Nortec Industries Inc.

Pure Humidifier Company.

Approved equivalent.

If Project has more than one type or size of humidifier, delete "Capacities and Characteristics" paragraph below and schedule humidifiers on Drawings.

* + - * 1. Capacities and Characteristics:

Humidification Rate: **<Insert lb/h>**.

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

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

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

Maximum Absorption Distance: **<Insert inches>**.

Number of Distributer Tubes: **<Insert number>**.

* + - * 1. Steam Distributer Tube(s): Single or multiple, steam-jacketed tubes suitable for pressurized steam applications.

If specific type of stainless steel is not desired, retaining first option in "Material" subparagraph below will allow for the greatest number of manufacturers to comply. Consider type 316 stainless steel for steam generated from deionized or reverse osmosis water. Not all manufacturers offer a type 316 stainless-steel option. Coordinate with retained manufacturers.

* + - * 1. Material: **[Stainless steel] [Stainless steel, type 304] [Stainless steel, type 316]**.

Retain one of three options in "Insulation" paragraph below. ASHRAE/IES 90.1-2013 requires minimum R-0.5 insulation of humidifier distributer tubes, with certain exceptions; however, most manufacturers do not publish specific R-value information for the insulation they offer. If retaining the last option, verify specific availability with manufacturer. Some manufacturers consider airspace between double tube walls to be insulation. Coordinate with retained manufacturers.

* + - * 1. Insulation: **[Uninsulated] [Insulated] [Insulated, minimum R-0.5]**.

Consider type 316 stainless steel for steam generated from deionized or reverse osmosis water. Not all manufacturers offer a type 316 stainless-steel option. Coordinate with retained manufacturers.

* + - * 1. Steam Separator: **[Cast iron] [Stainless steel, type 304] [Stainless steel, type 316]**.
        2. Humidifier Control Valve:

Retain one of two "Actuator" subparagraphs below.

Actuator: **[Pneumatic] [Electric]** modulating with spring return.

Actuator: As specified in Section 230923.11 "Control Valves."

Retain one option in "Body" subparagraph below. Consider type 316 stainless steel for steam generated from deionized or reverse osmosis water. Not all manufacturers offer a type 316 stainless-steel option. If specific type of stainless steel is not desired, retain second option in "Body" subparagraph below. Coordinate with retained manufacturers.

Body: **[Bronze] [Stainless steel] [Stainless steel, type 304] [Stainless steel, type 316]**.

* + - * 1. Steam Trap:

Consider type 316 stainless steel for steam generated from deionized or reverse osmosis water. Not all manufacturers offer a type 316 stainless-steel option. If specific type of stainless steel is not desired, retaining second option in "Material" subparagraph below will allow for the greatest number of manufacturers to comply. Manufacturers do not offer both trap-type options. Coordinate with retained manufacturers.

Material: **[Cast iron] [Stainless steel] [Stainless steel, type 304] [Stainless steel, type 316]**.

If specific type of trap is not desired, retaining all three options in "Type" subparagraph below will allow for the greatest number of manufacturers to comply.

Type: **[Inverted-bucket] [or] [Float and thermostatic]**.

Capacity: Sized for a minimum of **[3 times] <Insert value>** the maximum rated condensate flow of humidifier at **[1/2-psig] <Insert value>** differential pressure.

* + - * 1. Accessories:

Delete items in subparagraphs below that are specified in individual Division 23 Control Sections.

A humidistat is a device that senses and controls directly. A humidity sensor is a device that senses only, with control being accomplished via DDC system. In first two subparagraphs below, retain the humidistat options for self-contained control. Retain sensor options for control via DDC system. Most manufacturers provide these optional accessories, but some do not. Coordinate with retained manufacturers.

**[Humidistat] [Humidity Sensor]: [Wall] [Return-duct]** mounted.

Duct-mounted high-limit **[humidistat] [humidity sensor]**.

If DDC system is specified in other Division 23 control Sections, retain second option below.

**[Aquastat] [Temperature sensor]** mounted on steam condensate return piping to prevent cold operation of humidifier.

Consider type 316 stainless steel for steam generated from deionized or reverse osmosis water. Not all manufacturers offer a type 316 stainless-steel option. If specific type of stainless steel is not desired, retaining first option in "In-Line Strainer, Y-Pattern" subparagraph below will allow for the greatest number of manufacturers to comply. Coordinate with retained manufacturers.

In-Line Strainer, Y-Pattern: **[Stainless-steel] [Stainless-steel, type 304] [Stainless-steel, type 316] [Cast-iron]** body with **[20] <Insert number>**-mesh **[type 304] [type 316]** stainless-steel screen.

Airflow switch for preventing humidifier operation without airflow.

Not all manufacturers offer a self-contained controls option. Coordinate with retained manufacturers.

Humidifier Controller:

Digital, with keypad and display.

Not all manufacturers offer building automation system interface. Manufacturers that do offer building automation system interface do not offer each communication protocol. Coordinate communication protocol with retained manufacturers.

Building Automation System Interface:

Full Communication Interface: [BACnet] [Modbus] [Lontalk] [Ethernet] [Johnson Controls N2] <Insert interface type>.

* + - 1. DIRECT-STEAM-INJECTION PANEL DISTRIBUTION MANIFOLD HUMIDIFIERS
         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:

Armstrong International, Inc.

Carel USA, LLC.

DRI-STEEM Humidifier Company.

Hygromatik; Spirax Sarco.

Neptronic; National Environmental Products, Inc.

Nortec Industries Inc.

Pure Humidifier Company.

Approved equivalent.

If Project has more than one type or size of humidifier, delete "Capacities and Characteristics" paragraph below and schedule humidifiers on Drawings.

* + - * 1. Capacities and Characteristics:

Humidification Rate: **<Insert lb/h>**.

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

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

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

Maximum Absorption Distance: **<Insert inches>**.

Number of Distribution Manifolds: **<Insert number>**.

* + - * 1. Panel Distribution Manifold:

Prefabricated steam dispersion grid assembly.

Designed for short absorption distance.

Suitable for pressurized steam applications.

Extending the full width and height of duct or plenum.

Not all manufacturers offer each configuration combination. Coordinate with retained manufacturers. If retaining horizontal headers, vertical tubes are applicable. If retaining vertical headers, horizontal tubes are applicable. If either configuration is acceptable, retain both and "or" option.

**[Horizontal] [or] [vertical]** header with multiple **[vertical] [or] [horizontal], [nonsteam-jacketed] [steam-jacketed]** tubes, designed for dry-steam injection, within short absorption distance.

**[Nozzles/metered orifices in conjunction with nonsteam-jacketed manifolds] [or] [punched orifices/no nozzles in conjunction with steam-jacketed manifolds]** spaced evenly along manifold tubes and providing dry and uniform steam distribution.

Headers and Distribution Tubes:

If specific type of stainless steel is not desired, retaining first option in "Material" subparagraph below will allow for the greatest number of manufacturers to comply. Consider type 316 stainless steel for steam generated from deionized or reverse osmosis water. Not all manufacturers offer a type 316 stainless-steel option. Coordinate with retained manufacturers.

Material: **[Stainless steel] [Stainless steel, type 304] [Stainless steel, type 316]**.

Retain one of three options in "Insulation" subparagraph below. ASHRAE/IES 90.1-2013 requires minimum R-0.5 insulation of humidifier distribution tubes, with certain exceptions; however, most manufacturers do not publish specific R-value information for the insulation they offer. If retaining the specific R-value option, verify specific availability with manufacturers. Some manufacturers consider airspace between double tube walls to be insulation. Coordinate with retained manufacturers.

Insulation: **[Uninsulated] [Insulated] [Insulated, minimum R-0.5]**.

* + - * 1. Steam Separator: External separator, or separator/baffles integral to header, to provide condensate-free steam to the distribution tubes.

If specific type of stainless steel is not desired, retaining first option in "Material" subparagraph below will allow for the greatest number of manufacturers to comply. Consider type 316 stainless steel for steam generated from deionized or reverse osmosis water. Not all manufacturers offer a type 316 stainless-steel option. Coordinate with retained manufacturers.

Material: **[Stainless steel] [Stainless steel, type 304] [Stainless steel, type 316]**.

* + - * 1. Humidifier Control Valve:

Retain one of two "Actuator" subparagraphs below.

Actuator: **[Pneumatic] [Electric]** modulating with spring return.

Actuator: As specified in Section 230923.11 "Control Valves."

Consider type 316 stainless steel for steam generated from deionized or reverse osmosis water. Not all manufacturers offer a type 316 stainless-steel option. If specific type of stainless steel is not desired, retain second option in "Body" subparagraph below. Coordinate with retained manufacturers.

Body: **[Bronze] [Stainless steel] [Stainless steel, type 304] [Stainless steel, type 316]**.

* + - * 1. Steam Trap:

Consider type 316 stainless steel for steam generated from deionized or reverse osmosis water. Not all manufacturers offer a type 316 stainless-steel option. If stainless steel is desired but specific type of stainless steel is not required, retaining first stainless-steel option in "Material" subparagraph below will allow for the greatest number of manufacturers to comply. Coordinate with retained manufacturers.

Material: **[Cast iron] [Stainless steel] [Stainless steel, type 304] [Stainless steel, type 316]**.

If specific type of trap is not desired, retaining all three options in "Type" subparagraph below will allow for the greatest number of manufacturers to comply. Manufacturers do not offer both trap options. Coordinate with retained manufacturers.

Type: **[Inverted-bucket] [or] [Float and thermostatic]**.

Capacity: Sized for a minimum of **[3] <Insert number>** times the maximum rated condensate flow of humidifier at **[1/2-psig] <Insert value>** differential pressure.

* + - * 1. Accessories:

Delete items in subparagraphs below that are specified in individual Division 23 control Sections.

A humidistat is a device that senses and controls directly. A humidity sensor is a device that senses only, with the control being accomplished via DDC system. In first two subparagraphs below, retain humidistat options for self-contained control. Retain sensor options for control via DDC system. Most manufacturers provide these optional accessories, but some do not. Coordinate with retained manufacturers.

**[Humidistat] [Humidity Sensor]: [Wall] [Return-duct]** mounted.

Duct-mounted, high-limit **[humidistat] [humidity sensor]**.

An aquastat is a device that senses and controls directly. A temperature sensor is a device that senses only, with the control being accomplished via DDC system. In the first subparagraph below, retain first option for self-contained control. Retain second option for control via DDC system. Most manufacturers provide these optional accessories, but some do not. Coordinate with retained manufacturers.

**[Aquastat] [Temperature sensor]** mounted on steam condensate return piping to prevent cold operation of humidifier.

Consider type 316 stainless steel where steam is generated from deionized or reverse osmosis water. Not all manufacturers offer a type 316 stainless-steel option. If specific type of stainless steel is not desired, retaining first option in "In-Line Strainer, Y-Pattern" subparagraph below will allow for the greatest number of manufacturers to comply. Coordinate with retained manufacturers.

In-Line Strainer, Y-Pattern: **[Stainless steel] [Stainless steel, type 304] [Cast iron]** body with **[20] <Insert number>**-mesh **[stainless steel] [stainless steel, type 304] [stainless steel, type 316]** screen.

Airflow switch for preventing humidifier operation without airflow.

Not all manufacturers offer a self-contained controls option. Coordinate with retained manufacturers.

Humidifier Controller:

Digital, with keypad and display.

Not all manufacturers offer building automation system interface. Manufacturers that do offer building automation system interface do not offer each communication protocol. Coordinate communication protocol with retained manufacturers.

Building Automation System Interface:

Full Communication Interface: **[BACnet] [Modbus] [Lontalk] [Ethernet] [Johnson Controls N2] <Insert interface type>**.

* + - 1. DIRECT-STEAM-INJECTION AREA HUMIDIFIERS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=12846) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Armstrong International, Inc](http://www.specagent.com/Lookup?uid=123457068618).

[DRI-STEEM Humidifier Company](http://www.specagent.com/Lookup?uid=123457068619).

[Hygromatik; Spirax Sarco](http://www.specagent.com/Lookup?uid=123457068620).

[Pure Humidifier Company](http://www.specagent.com/Lookup?uid=123457068621).

Approved equivalent.

If Project has more than one type or size of humidifier, delete "Capacities and Characteristics" paragraph below and schedule humidifiers on Drawings.

* + - * 1. Capacities and Characteristics:

Humidification Rate: **<Insert lb/h>**.

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

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

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

Maximum Absorption Distance: **<Insert inches>**.

Dispersion Fan:

Airflow: **<Insert cfm>**.

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

Electrical Characteristics: Single point of connection.

Volts: **<Insert number>** V.

Phase: **[Single] [Three]** phase.

Hertz: **[60] <Insert number>** Hz.

Full-Load Amperes: **<Insert number>** A.

Minimum Circuit Ampacity: **<Insert number>** A.

Maximum Overcurrent Protection: **<Insert number>** A.

* + - * 1. Discharge Nozzle and Dispersion Fan:

Steam-jacketed discharge nozzle, aluminum blade propeller fan with finger guard, and motor interlocked to operate with humidifier.

Fan Mounting: Above and behind discharge outlet on bracket integral to discharge outlet.

Steam Separator: External separator, or separator/baffles integral to the nozzle assembly, to provide condensate-free steam to the discharge nozzle.

If specific type of stainless steel is not desired, retaining first option in "Dispersion Nozzle Material" subparagraph below will allow for the greatest number of manufacturers to comply. Consider type 316 stainless steel for steam generated from deionized or reverse osmosis water. Not all manufacturers offer a type 316 stainless-steel option. Coordinate with retained manufacturers.

Dispersion Nozzle Material: **[Stainless steel] [Stainless steel, type 304] [Stainless steel, type 316]**.

* + - * 1. Humidifier Control Valve:

Retain one of two "Actuator" subparagraphs below.

Actuator: **[Pneumatic] [Electric]** modulating with spring return.

Actuator: As specified in Section 230923.11 "Control Valves."

Consider type 316 stainless steel for steam generated from deionized or reverse osmosis water. Not all manufacturers offer a type 316 stainless-steel option. If specific type of stainless steel is not desired, retain second option in "Body" subparagraph below. Coordinate with retained manufacturers.

Body: **[Bronze] [Stainless steel] [Stainless steel, type 304] [Stainless steel, type 316]**.

* + - * 1. Accessories:

A humidistat is a device that senses and controls directly. A humidity sensor is a device that senses only, with control being accomplished via DDC system. In first subparagraph below, retain humidistat option for self-contained control. Retain sensor option for control via DDC system. Most manufacturers provide these optional accessories, but some do not. Coordinate with retained manufacturers.

**[Humidistat] [Humidity Sensor]**: Wall mounted.

Consider type 316 stainless steel where steam is generated from deionized or reverse osmosis water. Not all manufacturers offer a type 316 stainless-steel option. If specific type of stainless steel is not desired, retaining first option in "In-Line Strainer, Y-Pattern" subparagraph below will allow for the greatest number of manufacturers to comply. Coordinate with retained manufacturers.

In-Line Strainer, Y-Pattern: **[Stainless steel] [Stainless steel, type 304] [Stainless steel, type 316] [Cast iron] body with [20] <Insert number>**-mesh **[stainless steel] [stainless steel, type 304] [stainless steel, type 316]** screen.

Not all manufacturers offer a self-contained controls option. Coordinate with retained manufacturers.

Humidifier Controller:

Digital, with keypad and display.

Not all manufacturers offer building automation system interface. Manufacturers that do offer building automation system interface do not offer each communication protocol. Coordinate communication protocol with retained manufacturers.

Building Automation System Interface:

Full Communication Interface: **[BACnet] [Modbus] [Lontalk] [Ethernet] [Johnson Controls N2] <Insert interface type>**.

Retain "Condensate Drain Coolers" Article when discharging condensate to drain and not returning by gravity or by pump back to main steam condensate return system.

* + - 1. CONDENSATE DRAIN COOLERS
         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:

Armstrong International, Inc.

DRI-STEEM Humidifier Company.

Neptronic; National Environmental Products, Inc.

Nortec Industries Inc.

Pure Humidifier Company.

Approved equivalent.

If Project has more than one type or configuration of condensate drain cooler, delete "Capacities and Characteristics" paragraph below and schedule condensate drain coolers on Drawings.

* + - * 1. Capacities and Characteristics:

Hot Condensate in: **<Insert gpm>**.

Hot Condensate Temperature: **<Insert deg F>**.

Cold Water in **<Insert gpm>**.

Cold Water Temperature: **<Insert deg F>**.

Tempered Water out **<Insert gpm>**.

Tempered Water Temperature: **<Insert deg F>**.

* + - * 1. Description: Mixes hot condensate with a cold water supply to reduce the drain temperature, as required by state and local codes.

If DDC system is specified in Division 23 control Sections, retain second option in "Cold Water Tempering Valve" paragraph below. If standalone pneumatic or electric control is required, retain first option.

* + - * 1. Cold Water Tempering Valve: Bronze body, **[thermostatic self-actuated with aquastat] [24 V ac electric actuated with temperature sensor]**.
        2. Drain Temperature Set-Point Range: Field adjustable between 115 deg F and 140 deg F. Drain sensor to control cold water tempering valve to limit drain discharge temperature to set point.

If stainless steel is desired but specific type of stainless steel is not required, retain first option in "Reservoir Body Material" paragraph below. Consider type 316 stainless steel for steam generated from deionized or reverse osmosis water. Not all manufacturers offer a type 316 stainless-steel option. Coordinate with retained manufacturers.

* + - * 1. Reservoir Body Material: **[Stainless steel] [Stainless steel, type 304] [Stainless steel, type 316] [Cast iron or carbon steel]**.
        2. Mounting: Suitable for **[wall] [floor] [suspended]** mounting.
        3. Vacuum breaker or air vent connection.

1. EXECUTION
   * + 1. EXAMINATION
          1. Examine ducts, air-handling units, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
          2. Examine roughing-in for piping systems to verify actual locations of piping connections before humidifier installation.
          3. Proceed with installation only after unsatisfactory conditions have been corrected.
       2. INSTALLATION

Sustainable design systems require compliance with requirements in ASHRAE 62.1. ASHRAE 62.1, Section 5.12 - "Humidifiers and Water-Spray Systems," that limit obstructions downstream from humidifiers.

* + - * 1. Install humidifiers with required clearance for service and maintenance.**[ Maintain path, downstream from humidifiers, clear of obstructions as required by ASHRAE 62.1.]**
        2. Seal all duct and plenum penetrations with flange.
        3. Install humidifier assemblies in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."
        4. Install [galvanized] [stainless]-steel drain pan under each manifold mounted in duct.

Retain option in first subparagraph below to comply with sustainable design systems or if required by Project requirements or authorities having jurisdiction.

Construct drain pans with connection for drain; insulated**[ and complying with ASHRAE 62.1]**.

Connect to condensate trap and drainage piping.

Extend drain pan upstream and downstream from humidifier tube(s)/manifold a minimum distance recommended by manufacturer but not less than that required by ASHRAE 62.1.

* + - * 1. Install drip leg upstream from steam trap a minimum of **[12 inches] <Insert height>** tall for proper operation of trap.
        2. Equipment Mounting:

Retain one of two subparagraphs below. Retain first for projects in seismic areas; retain second for projects not in seismic areas. Indicate vibration isolation and seismic-control device type and minimum deflection in supported equipment schedule on Drawings.

Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

* + - * 1. Install all manufacturer-furnished accessories in accordance with manufacturer's written installation instructions.
      1. PIPING CONNECTIONS

Coordinate piping installations and specialty arrangements with 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.

Install piping adjacent to humidifiers to allow service and maintenance.

Where condensate drain cooler is used, install shutoff valve, strainer, backflow preventer, and union in tempering water makeup piping.

* + - * 1. Install piping specialties furnished by manufacturer but not factory mounted.

Retain subparagraph below if retaining "Direct-Steam-Injection Area Humidifiers" Article.

* + - * 1. Provide P-trap in atmospheric drain piping serving area humidifiers in accordance with manufacturer recommendations.
      1. ELECTRICAL CONNECTIONS
         1. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
         2. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
         3. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

Retain one of first two subparagraphs below. First subparagraph cross-references to Section 260553 "Identification for Electrical Systems" and should be retained for consistent electrical identification. Second subparagraph is an abbreviated version of the product specified in Section 260553 "Identification for Electrical Systems."

Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."

Nameplate shall be laminated acrylic or melamine plastic signs as layers of black with engraved white letters at least 1/2 inch high.

Locate nameplate where easily visible.

* + - 1. CONTROL CONNECTIONS
         1. Install control and electrical power wiring to field-mounted control devices.

Retain paragraphs below based on types of devices retained in Part 2.

* + - * 1. Connect control wiring between humidity sensors, high-limit humidity sensors, condensate temperature sensors, and **[DDC control system] <Insert system description>**.
        2. Connect control wiring between humidistats, thermostats, and control devices.
        3. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power 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 per OGS Spec Section 014216 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]**:

Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

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

Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

* + - * 1. Humidifier will be considered defective if it does not pass tests and inspections.
        2. Prepare test and inspection reports.
      1. DEMONSTRATION
         1. **[Engage a Company Service Advisor per OGS Spec Section 014216to train] [Train]** Director’s Representative's Facility’s maintenance personnel to adjust, operate, and maintain humidifiers.

END OF SECTION 238413.23