

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and Divisions 00 and 01, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following humidifiers:

1. Atomizing.
2. Steam injection.
3. Self-contained.
4. Heated pan.
5. Heat exchanger.

1.3 DEFINITION

- A. 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.

1.4 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Detail fabrication and installation of humidifiers. Include piping details, plans, elevations, sections, details of components, manifolds, and attachments to other work.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. 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:
 - 1. Structural members to which humidifiers will be attached.
 - 2. Size and location of initial access modules for acoustical tile.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For humidifiers to include in operation and maintenance manuals.

1.5 CODES AND STANDARDS

- A. Codes and Standards shall be the current version adopted by the Authority Having Jurisdiction.

1.6 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.
- B. Comply with ARI 640, "Commercial and Industrial Humidifiers."

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Supply one replacement electrode cylinder with each self-contained humidifier.

1.8 COORDINATION

- A. Coordinate location and installation of humidifiers with manifolds in ducts and air-handling units or occupied space. Revise locations and elevations to suit field conditions and to ensure proper humidifier operation.

PART 2 – PRODUCTS

2.1 WATER-PRESSURE ATOMIZING HUMIDIFIERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide [the product indicated on Drawings] <Insert manufacturer's name; product name or designation> or a comparable product by one of the following:
 - 1. Carel USA, LLC.
 - 2. Hermidifier.
 - 3. Mee Industries Inc.
 - 4. <Insert manufacturer's name.>
 - 5. Or Approved Equal.
- D. Nozzles: ASTM A 666, Type [304] [316] stainless steel.
- E. Manifold: ASTM A 269, Type [304] [316] stainless-steel piping.
- F. Droplet Filter: Biocide-treated polyethylene with maximum 0.30-inch wg resistance.
- G. Piping and Fittings: ASTM A 269, Type [304] [316] stainless-steel pipe and fittings.
- H. Piping and Fittings: ASTM B 88, Type L copper pipe and wrought-copper fittings with brazed joints.
- I. Water Pump: Enclosed belt-drive ceramic plunger pump with [stainless-steel] [bronze] heads, and [single] [variable]-speed, totally enclosed, fan-cooled motor.

- J. Final Water-Filter Efficiency: Minimum [98] <Insert number> percent retention of suspended particles [10] [20] <Insert size> microns and larger from makeup water.
- K. Final Water-Filter Pressure Drop: Maximum [2 psig] <Insert value> at design flow when clean [, and <Insert value> when dirty].
- L. Pump Controls:
 - 1. [Cycle] [Vary speed of] motor to satisfy humidistat.
 - 2. High-pressure solenoid valve for each control zone shown on Drawings.
 - 3. Building automation system interface for each control zone for start/stop and status indication and control at central workstation.
- M. Dispersion Fan:
 - 1. Aluminum blade propeller fan with finger guard and single-speed motor interlocked to operate with humidifier.
 - 2. Fan Mounting: Above and behind manifold on bracket integral to wall-mounting manifold.
- N. Accessories:
 - 1. Humidistat: [Wall] [Return-duct]-mounting, solid-state, electronic-sensor controller capable of full-modulation or cycling control.
 - 2. Duct-mounting, high-limit humidistat.
 - 3. Airflow switch for preventing humidifier operation without airflow.
- O. Capacities and Characteristics:
 - 1. Humidification Rate: <Insert lb./h.>
 - 2. Dry-Bulb Air Temperature at Discharge: <Insert deg F.>
 - 3. Wet-Bulb Air Temperature at Discharge: <Insert deg F.>
 - 4. Number of Nozzles: <Insert number.>
 - 5. Nozzle Spacing: <Insert inches.>
 - 6. Maximum Absorption Distance: <Insert inches.>
 - 7. Minimum Makeup Water Supply Pressure: <Insert psig.>
 - 8. Water Pump:
 - a. Discharge Pressure: [1000 psig] [2000 psig] <Insert pressure>.
 - b. Motor Horsepower: <Insert horsepower.>
 - 9. Dispersion Fan:
 - a. Airflow: <Insert cfm.>
 - b. Motor Horsepower: <Insert horsepower.>
 - 10. Electrical Characteristics: Single point of connection.
 - a. Volts: <Insert value.>
 - b. Phase: <Insert value.>
 - c. Hertz: <Insert value.>
 - d. Full-Load Amperes: <Insert value.>
 - e. Minimum Circuit Ampacity: <Insert value.>

- f. Maximum Overcurrent Protection: <Insert amperage.>

2.2 COMPRESSED-AIR ATOMIZING HUMIDIFIERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide [the product indicated on Drawings] <Insert manufacturer's name; product name or designation> or a comparable product by one of the following:
1. Carel USA, LLC.
 2. Hermidifier.
 3. Mee Industries Inc.
 4. <Insert manufacturer's name.>
 5. Or Approved Equal.
- D. Nozzles: ASTM A 666, Type [304] [316] stainless steel.
- E. Manifold: ASTM A 269, Type [304] [316] stainless-steel piping.
- F. Droplet Filter: Biocide-treated polyethylene with maximum 0.30-inch wg resistance.
- G. Piping and Fittings: ASTM A 269, Type [304] [316] stainless-steel pipe and fittings.
- H. Compressed-Air [and Water] Piping and Fittings: ASTM B 88, Type L copper pipe and wrought-copper fittings with soldered joints.
- I. Final Water-Filter Efficiency: Minimum [98] <Insert number> percent retention of suspended particles [10] [20] <Insert size> microns and larger from makeup water.
- J. Final Water-Filter Pressure Drop: Maximum [2 psig] <Insert value> at design flow when clean [, and <Insert value> when dirty].
- K. Air and Water Solenoid Controls:
1. Cycle valves to satisfy humidistat.
 2. Solenoid valves for each control zone shown on Drawings.
 3. Building automation system interface for each control zone for start/stop and status indication and control at central workstation.
- L. Dispersion Fan:
1. Aluminum blade propeller fan with finger guard and single-speed motor interlocked to operate with humidifier.
 2. Fan Mounting: Above and behind manifold on bracket integral to wall-mounting manifold.
- M. Accessories:

1. Humidistat: [Wall] [Return-duct]-mounting, solid-state, electronic-sensor controller capable of full-modulation or cycling control.
2. Duct-mounting, high-limit humidistat.
3. Airflow switch for preventing humidifier operation without airflow.

N. Capacities and Characteristics:

1. Humidification Rate: <Insert lb./h.>
2. Dry-Bulb Air Temperature at Discharge: <Insert deg F.>
3. Wet-Bulb Air Temperature at Discharge: <Insert deg F.>
4. Number of Nozzles: <Insert number.>
5. Nozzle Spacing: <Insert inches.>
6. Maximum Absorption Distance: <Insert inches.>
7. Minimum Makeup Water Supply Pressure: <Insert psig.>
8. Compressed Air:
 - a. Airflow: <Insert cfm.>
 - b. Pressure: <Insert psig.>
9. Dispersion Fan:
 - a. Airflow: <Insert .>
 - b. Motor Horsepower: <Insert horsepower.>
10. Electrical Characteristics: Single point of connection.
 - a. Volts: <Insert value.>
 - b. Phase: <Insert value.>
 - c. Hertz: <Insert value.>
 - d. Full-Load Amperes: <Insert value.>
 - e. Minimum Circuit Ampacity: <Insert value.>
 - f. Maximum Overcurrent Protection: <Insert amperage.>

2.3 STEAM-INJECTION HUMIDIFIERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide [the product indicated on Drawings] <Insert manufacturer's name; product name or designation> or a comparable product by one of the following:
 1. Armstrong International, Inc.
 2. Carel USA, LLC.
 3. DRI-STEEM Humidifier Company.
 4. Herrmidifier.
 5. Hygromatik; Spirax Sarco, Inc.
 6. Nortec Industries Inc.
 7. Pure Humidifier Company.
 8. <Insert manufacturer's name.>
 9. Or Approved Equal.

- D. Manifold: ASTM A 666, Type 304 stainless steel [, steam jacketed;] [; insulated with 1/2-inch fiberglass and stainless-steel jacket; and] extending the full width of duct or plenum with mounting brackets at ends.
- E. Discharge Nozzle and Dispersion Fan:
 - 1. Steam-jacketed discharge nozzle, aluminum blade propeller fan with finger guard, and single-speed motor interlocked to operate with humidifier.
 - 2. Fan Mounting: Above and behind discharge outlet on bracket integral to discharge outlet.
- F. Steam Separator: [Cast iron] [ASTM A 666, Type 304 stainless steel] with [separate] humidifier control valve.
- G. Humidifier Control Valve:
 - 1. Actuator: [Pneumatic] [Electric] modulating with spring return.
 - 2. Actuator: As specified in Division 23 Section "Instrumentation and Control for HVAC."
- H. Steam Trap: Inverted-bucket type, sized for a minimum of 3 times the maximum rated condensate flow of humidifier at 1/2-psig inlet pressure.
- I. Accessories:
 - 1. [Wall] [Return-duct]-mounting humidistat.
 - 2. Duct-mounting, high-limit humidistat.
 - 3. Aquastat mounted on steam condensate return piping to prevent cold operation of humidifier.
 - 4. In-line strainer.
 - 5. Airflow switch for preventing humidifier operation without airflow.
- J. Capacities and Characteristics:
 - 1. Humidification Rate: <Insert lb./h.>
 - 2. Steam Supply Pressure: <Insert psig.>
 - 3. Dry-Bulb Air Temperature at Discharge: <Insert deg F.>
 - 4. Wet-Bulb Air Temperature at Discharge: <Insert deg F.>
 - 5. Maximum Absorption Distance: <Insert inches.>
 - 6. Number of Manifolds: <Insert number.>
 - 7. Dispersion Fan:
 - a. Airflow: <Insert cfm.>
 - b. Motor Horsepower: <Insert horsepower.>
 - 8. Electrical Characteristics: Single point of connection.
 - a. Volts: <Insert value.>
 - b. Phase: <Insert value.>
 - c. Hertz: <Insert value.>
 - d. Full-Load Amperes: <Insert value.>
 - e. Minimum Circuit Ampacity: <Insert value.>
 - f. Maximum Overcurrent Protection: <Insert amperage.>

2.4 SELF-CONTAINED HUMIDIFIERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide [the product indicated on Drawings] <Insert manufacturer's name; product name or designation> or a comparable product by one of the following:
 - 1. Armstrong International, Inc.
 - 2. Carel USA, LLC.
 - 3. Carnes Co., Inc.
 - 4. Herrmidifier.
 - 5. Hygromatik; Spirax Sarco, Inc.
 - 6. Nortec Industries Inc.
 - 7. <Insert manufacturer's name.>
 - 8. Or Approved Equal.
- D. Electric-Resistance Heater Container: Cleanable, ASTM A 666, Type [304] [316] stainless steel. Comply with UL 499.
- E. Electrode Cylinder: Replaceable plastic assembly [with disposable ionic bed inserts]. Comply with UL 499.
- F. Gas-Fired Steam Generator: Factory assembled and tested.
 - 1. Standard: Fabricate and label steam generator to comply with CSA.
 - 2. Maximum Steam Pressure: 10 inches wg.
 - 3. Burner Type: [Natural-gas] [Propane] fired with modulating, low NOx infrared burner, minimum [82] <Insert number> percent efficient.
 - 4. Gas Train: Safety shutoff valves, gas cock, strainer, pressure-regulating valve.
 - 5. Ignition: Hot-surface ignition with flame safety system.
 - 6. Combustion Chamber: Sealed with outdoor-air and flue-vent connections.
 - 7. Heat-Exchanger Tank: Cleanable, ASTM A 666, Type [304] [316] stainless steel with corrosion-resistant coating [and disposable ionic bed inserts].
- G. Manifold: Stainless-steel tube with integral fan to discharge vapor directly into occupied space.
- H. Manifold: ASTM A 666, Type [304] [316] stainless-steel tube extending across entire width of duct or plenum and equipped with mounting brackets on ends.
- I. Cabinet: Sheet metal enclosure for housing heater cylinder, electrical wiring, components, controls, and control panel. Enclosure shall include baked-enamel finish, hinged or removable access door, and threaded outlet in bottom of cabinet for drain piping.
- J. Control Panel:
 - 1. Factory-wired disconnect switch.
 - 2. Liquid-crystal display.
 - 3. Programmable keyboard.
 - 4. Set-point adjustment.
 - 5. Warning signal indicating end of replaceable cylinder [or ionic bed insert] life.

6. Low-voltage, control circuit.
7. Diagnostic, maintenance, alarm, and status features.
8. High-water [sensor] [float] to prevent overfilling.

K. Controls:

1. Microprocessor-based control system for modulating or cycling control, and start/stop and status monitoring for interface to central HVAC instrumentation and controls.
2. Solenoid-fill and automatic drain valves to maintain water level and temper hot drain water.
3. Field-adjustable timer to control drain cycle for flush duration and interval.
4. Controls shall drain tanks if no demand for humidification for more than 72 hours.
5. [Conductivity] [Float]-type level controls.

L. Accessories:

1. Humidistat: [Wall] [Return-duct]-mounting, solid-state, electronic-sensor controller capable of full modulation or cycling control.
2. Duct-mounting, high-limit humidistat.
3. Airflow switch for preventing humidifier operation without airflow.

M. Capacities and Characteristics:

1. Humidification Rate: <Insert lb./h.>
2. Dry-Bulb Air Temperature at Discharge: <Insert deg F.>
3. Wet-Bulb Air Temperature at Discharge: <Insert deg F.>
4. Number of Manifolds: <Insert number.>
5. Maximum Absorption Distance: <Insert inches.>
6. Minimum Makeup Water Supply Pressure: <Insert psig.>
7. Electric-Resistance Heater Container or Electrode Cylinder:
 - a. Power Input per Container or Cylinder: <Insert kilowatts.>
 - b. Number of Containers or Cylinders: <Insert number.>
8. Gas-Fired Generator:
 - a. Fuel Input: <Insert Btu/h.>
 - b. Fuel Pressure: <Insert inches wg.>
9. Dispersion Fan:
 - a. Airflow: <Insert cfm.>
 - b. Motor Horsepower: <Insert horsepower.>
10. Electrical Characteristics: Single point of connection.
 - a. Volts: <Insert value.>
 - b. Phase: <Insert value.>
 - c. Hertz: <Insert value.>
 - d. Full-Load Amperes: <Insert value.>
 - e. Minimum Circuit Ampacity: <Insert value.>
 - f. Maximum Overcurrent Protection: <Insert amperage.>

2.5 HEATED-PAN HUMIDIFIERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide [the product indicated on Drawings] <Insert manufacturer's name; product name or designation> or a comparable product by one of the following:
 - 1. Armstrong International, Inc.
 - 2. DRI-STEEM Humidifier Company.
 - 3. Nortec Industries Inc.
 - 4. Pure Humidifier Company.
 - 5. <Insert manufacturer's name.>
 - 6. Or Approved Equal.
- D. Heat Source: [Hot water] [Steam] [Electric resistance].
- E. Comply with UL 499.
- F. Pan and Heat-Exchange Piping: ASTM A 666, Type [304] [316] stainless steel with corrosion-resistant coating, overflow, and drain fittings. [Include disposable ionic bed inserts.]
- G. Manifold: ASTM A 666, Type [304] [316] stainless-steel, duct-mounting, single- or manifold-grid connected to heated-pan housing with flexible hose and extending across width of duct or plenum. Manifold shall have mounting brackets at both ends.
- H. Manifold: Inverted, ASTM A 666, Type [304] [316] stainless-steel U-tube with humidifier mounted directly under the duct.
- I. Manifold: ASTM A 666, Type [304] [316] stainless-steel tube with flexible hose to connect to humidifier, integral fan to discharge vapor directly into occupied space, and wall- or ceiling-mounting brackets.
- J. Controls:
 - 1. Solenoid-fill and automatic drain valves to maintain water level and temper hot drain water.
 - 2. Field-adjustable timer to control drain cycle for flush duration and interval.
 - 3. [Conductivity] [Float]-type level controls.
- K. Piping Specialties: Inlet strainer, control valve, and steam trap.
- L. Piping Specialties: Inlet strainer and control valve.
- M. Accessories:
 - 1. Humidistat: [Wall] [Return-duct]-mounting, solid-state, electronic-sensor controller capable of full modulation or cycling control.
 - 2. Duct-mounting, high-limit humidistat.
 - 3. Airflow switch for preventing humidifier operation without airflow.
- N. Capacities and Characteristics:

1. Humidification Rate: <Insert lb./h.>
2. Dry-Bulb Air Temperature at Pan or Discharge: <Insert deg F.>
3. Wet-Bulb Air Temperature at Pan or Discharge: <Insert deg F.>
4. Pan Length: <Insert inches.>
5. Pan Width: <Insert inches.>
6. Number of Manifolds: <Insert number.>
7. Maximum Absorption Distance: <Insert inches.>
8. Minimum Makeup Water Supply Pressure: <Insert psig.>
9. Hot Water:
 - a. Water Flow: <Insert gpm.>
 - b. Pressure Loss Including Control Valve: <Insert feet.>
 - c. Entering Temperature: <Insert deg F.>
 - d. Leaving Temperature: <Insert deg F.>
10. Steam:
 - a. Supply Pressure at Control Valve Inlet: <Insert psig.>
 - b. Condensing Rate: <Insert lb./h.>
11. Electric-Resistance Heater Container or Electrode Cylinder:
 - a. Power Input: <Insert kilowatts.>
 - b. Number of Steps: <Insert number.>
12. Dispersion Fan:
 - a. Airflow: <Insert cfm.>
 - b. Motor Horsepower: <Insert horsepower.>
13. Electrical Characteristics: Single point of connection.
 - a. Volts: <Insert value.>
 - b. Phase: <Insert value.>
 - c. Hertz: <Insert value.>
 - d. Full-Load Amperes: <Insert value.>
 - e. Minimum Circuit Ampacity: <Insert value.>
 - f. Maximum Overcurrent Protection: <Insert amperage.>

2.6 HEAT-EXCHANGER HUMIDIFIERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide [the product indicated on Drawings] <Insert manufacturer's name; product name or designation> or a comparable product by one of the following:
 1. Armstrong International, Inc.
 2. Nortec Industries Inc.
 3. Pure Humidifier Company.

4. <Insert manufacturer's name.>
 5. Or Approved Equal.
- D. Fabricate and label steam generator to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- E. Heat Exchanger: ASTM A 666, Type [304] [316] stainless steel with corrosion-resistant coating, overflow, and drain fittings. [Include disposable ionic bed inserts.]
- F. Manifold: ASTM A 666, Type [304] [316] stainless-steel [, steam-jacketed], duct-mounting, single- or manifold-grid connected to steam generator with flexible hose and extending across width of duct or plenum. Manifold shall have mounting brackets for both ends. [Insulate with 1/2-inch fiberglass and stainless-steel jacket extending full width of duct or plenum with mounting brackets at ends.]
- G. Manifold: ASTM A 666, Type [304] [316] stainless-steel tube with flexible hose to connect to humidifier and integral fan to discharge vapor directly into occupied space. Manifold shall have wall- or ceiling-mounting brackets.
- H. Controls:
 1. Solenoid-fill and automatic drain valves to maintain water level and temper hot drain water.
 2. Field-adjustable timer to control drain cycle for flush duration and interval.
 3. [Conductivity] [Float]-type level controls.
- I. Accessories:
 1. Humidistat: [Wall] [Return-duct]-mounting, solid-state, electronic-sensor controller capable of full modulation.
 2. Duct-mounting, high-limit humidistat.
 3. Airflow switch for preventing humidifier operation without airflow.
- J. Capacities and Characteristics:
 1. Humidification Rate: <Insert lb./h.>
 2. Dry-Bulb Air Temperature at Discharge: <Insert deg F.>
 3. Wet-Bulb Air Temperature at Discharge: <Insert .>
 4. Manifold Steam Supply Pressure: <Insert psig.>
 5. Number of Manifolds: <Insert number.>
 6. Maximum Absorption Distance: <Insert inches.>
 7. Minimum Makeup Water Supply Pressure: <Insert psig.>
 8. Steam:
 - a. Supply Pressure at Control Valve Inlet: <Insert psig.>
 - b. Condensing Rate: <Insert lb./h.>
 9. Dispersion Fan:
 - a. Airflow: <Insert cfm.>
 - b. Motor Horsepower: <Insert horsepower.>
 10. Electrical Characteristics: Single point of connection.

- a. Volts: <Insert value.>
- b. Phase: <Insert value.>
- c. Hertz: <Insert value.>
- d. Full-Load Amperes: <Insert value.>
- e. Minimum Circuit Ampacity: <Insert value.>
- f. Maximum Overcurrent Protection: <Insert amperage.>

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine ducts, air-handling units, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before humidifier installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install humidifiers with required clearance for service and maintenance.
- B. Seal humidifier manifold duct or plenum penetrations with flange.
- C. Install humidifier manifolds in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."
- D. Install [galvanized] [stainless]-steel drain pan under each manifold mounted in duct.
 - 1. Construct drain pans to comply with ASHRAE 62.
 - 2. Connect to condensate trap and drainage piping.
 - 3. Extend drain pan upstream and downstream from manifold a minimum of [24 inches] <Insert length> or as recommended by manufacturer.
- E. Install manifold supply piping pitched to drain condensate back to humidifier.
- F. Install drip leg upstream from steam trap a minimum of [12 inches] <Insert height> tall for proper operation of trap.
- G. Install steam generator level on concrete base. Concrete base is specified in Division 23 Section "Common Work Results for HVAC."
- H. Concrete Housekeeping Pads: Anchor steam generator to concrete base.
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
 - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.

5. Cast-in-place concrete materials and placement requirements are specified in Division 03.
- I. Install seismic restraints on humidifiers. Seismic restraints are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- J. Install gas-fired steam generators according to NFPA 54.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
 1. Install piping adjacent to humidifiers to allow service and maintenance.
 2. Install shutoff valve, strainer, backflow preventer, and union in humidifier makeup line.
- B. Install electrical devices and piping specialties furnished by manufacturer but not factory mounted.
- C. Install piping from safety relief valves to nearest floor drain.
- D. Connect gas piping full size to steam-generator, gas-train inlet with union. Gas piping materials and specialties are specified in Division 23 Section " [Facility Natural-Gas Piping] [Facility Liquefied-Petroleum Gas Piping]."
- E. Connect breeching full size to steam-generator outlet. Venting materials are specified in Division 23 Section "Breechings, Chimneys, and Stacks."
- F. Connect combustion-air inlet to intake terminal using PVC piping with solvent-cemented joints. Run from boiler connection to outside and terminate adjacent to flue termination.
- G. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- H. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Remove and replace malfunctioning units and retest as specified above.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain humidifiers. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION