PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Ultrasonic humidifiers.
2. Evaporative humidifiers and spray pumps.
3. Evaporative pan humidifiers.

1.3 DEFINITIONS

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.

B. BAS: Building Automation System or Direct Digital Control (DDC) System.

1.4 REFERENCES

A. Air-Conditioning and Refrigeration Institute (AHRI)

2. AHRI 610 – Performance Rating of Central System Humidifiers.
3. AHRI 630 - Selection, Installation and Servicing of Humidifiers.
4. AHRI 640 – Performance Rating of Commercial and Industrial Humidifiers

B. SMACNA (Sheet Metal and Air Conditioning Contractors’ National Association) - HVAC Duct Construction Standards, Metal and Flexible.

C. UL 900 (Underwriters Laboratories, Inc.) - Test Performance of Air Filter Units.

1.5 ACTION SUBMITTALS

A. Section 013300 - Submittal Procedures.
B. Product Data: Submit catalog sheets indicating general assembly; dimensions, weights, materials and duct and service connections; certified performance ratings and operating characteristics; furnished specialties and accessories; electric nameplate data; and power, signal and control wiring diagrams.

C. Shop Drawings: Detail fabrication and installation of humidifiers. Include piping details, plans, elevations, sections, details of components, manifolds, and attachments to other work.

D. Manufacturer's Installation Instructions: Submit assembly and setting operations.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

### 1.6 INFORMATIONAL SUBMITTALS

A. 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.

B. Field quality-control test reports.

### 1.7 CLOSEOUT SUBMITTALS

A. Section 017700 - Execution Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, maintenance and repair data, including instructions for lubrication, filter replacement, cleaning and spare parts lists.

### 1.8 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes and laws as well as the Stanford University Facilities Design Guidelines and all Stanford University Contract documents.

B. 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.

C. Comply with AHRI 640, "Commercial and Industrial Humidifiers."

### 1.9 WARRANTY

A. Coordinate warranty with Section 016000 - Product Requirements.

B. Provide a five year factory warranty.
PART 2 - PRODUCTS

2.1 EVAPORATIVE HUMIDIFIERS

A. Manufacturers:
   1. OEM equipment compatible only

B. Construction: Factory assembled accordance with AHRI 610 consisting of casing, tank, filters, and spray pumps, water and drain connections.

C. Casing
   1. Assembly: Stainless steel, minimum 0.0635 inch, reinforced and braced with galvanized steel angles, cadmium plated cap screws.
   2. Connection: 1-1/2 inch flanges on inlet and outlet with ¼ x 1 inch adhesive backed neoprene gasket.
   3. Doors: Quick opening access door on one side with ¼ inch thick Plexiglas inspection window.
   4. Finish: Two coats of zinc chromate, iron oxide, phenolic resin.
   5. Gasket and flange pipe penetrations, inspection panels, access doors, and other openings in casing.

D. Drain Tank
   2. Connections: 3/4 inch adjustable float valve assembly with brass rod and brass float; 2 inch drain and overflow with removable copper suction screen.
   3. Fabrication: Lap and weld corners watertight. Weld fittings and piping supports to tank.

E. Filters
   1. Two rows of neoprene coated filter mats in removable frames.

F. Spray Pump
   1. Type: Horizontal shaft, Single stage, close coupled, radially split casing, for 125 psig maximum working pressure.
   2. Case: Cast iron with gage ports, drain plug, flanged suction and discharge.
   3. Impeller: Bronze, fully enclosed, keyed to motor shaft extension.
   5. Seal: Carbon rotating against a stationary ceramic seat.

2.2 EVAPORATIVE PAN HUMIDIFIERS

A. Manufacturers:
   1. OEM equipment compatible only
B. Units: AHRI 610; evaporative pan with stand or cabinet enclosure, humidistat, heating coil, pre-wired except for humidistat, for use with heating hot water, steam or electronic heating elements.

C. Components

1. Pan, Cover, Screws and Bolts: Stainless steel.
2. Overflow and Drainage Fittings: Copper or Brass.
3. Float Valve Mechanism: Stainless steel or brass with ¼-inch fill connection.
4. Coil Steam or Hot Water: 7/8 inch OD copper.
5. Coil Electric: Shielded electric immersion heating element with safety cutout switch set at 225 degrees F to disconnect electric heating element on low water level in pan.
7. Floor Stand: Extruded aluminum.
9. Control: Humidistat cycles blower fan and opens inlet solenoid valve to steam or hot water for electric coils energizes electric heating element.
10. Flush Cycle: Timers allow one to four flushes per day of three to 120 minutes duration by shutting off power to heating element and opening drain valve.

2.3 ULTRASONIC HUMIDIFIERS

A. Manufacturers:

1. Stulz
2. No known equal.

B. The system shall be comprised of a self-contained, ultrasonic[, multiple-banked] humidifier unit and control panel.

C. The humidifier unit shall be UL listed as an assembly.

D. Humidifier components shall include a water supply module; one or more nebulizing modules with piezoelectric converter (transducer); corresponding transducer printed circuit control board (print plate); and fitted nebula distribution device cover. The casing and distribution components shall be constructed of stainless steel.

1. Each nebulizing module shall be equipped with two oscillatory circuits with each using the “thickness vibration method” of humidification via the transducer.
2. The water supply shall be automatically controlled by a solenoid valve. Water level control shall be via two separate (high and low) float level controllers. The low level controller shall act as dry running protection. In the case of disruption of the water supply, overheating, or detection of high mineral content levels in feed water supply, safety circuits shall shut off the humidifier. A heat sink dissipater shall be used to serve as
temperature protection for the print plate and shall be located in the nebulizing module’s water tank.

3. An internal solenoid valve shall provide for drain and flush commands from the controller and automatic drain if the humidifier is idle for 72 hours.

E. Where humidifier is to be installed in air handling systems, provide the following accessories:

1. Air handler system vertical mounting rack.
2. Stainless steel drain pan.
3. Mist eliminators.
4. Stainless steel equalizing grids.
5. Access door(s) with viewing window(s).
6. Booster fans where terminal velocity falls below manufacturer’s recommended operating range.

F. Where humidifier is to be installed as stand-alone, direct room, provide the following accessories:

1. Mounting brackets and associated supports and/or hangers.

G. Electrical

1. Provide [115V/60 Hz, single phase][208V/60 Hz, single phase][460V/60 Hz, three-phase] power to each humidifier control unit.
2. Provide nominal 48V/60 Hz, single-phase between humidifier control unit and corresponding humidifier(s). Capacity output shall be 100% at 48 volts supplied to the transducer.
3. Isolate humidifier from power source via circuit breaker.

H. Plumbing

1. Supply reverse osmosis (RO) or de-ionized (DI) water to the humidifier.
   a. Resistivity shall be greater than 0.2 Mega-Ohms.
   b. Conductance shall be less than 5 microsiemens.
2. Water pressure range at humidifier inlet shall be 30 to 75 psi.
3. Water temperature range at inlet shall be 40 to 104 degrees F.
4. RO/DI pipes shall be non-corrosive and meet local Code requirements.
5. Coordinate piping material.

I. Control Panel:

1. Unless specifically allowed by University’s Representative, provide one control panel per humidifier.
2. Each control panel shall be ETL/UL listed as complete assembly and equipped/supplied with the following:
   a. A microprocessor based controller to monitor, operate, and control the humidifier system.
   b. Wall-mount enclosure designed for indoor use.
c. Main power disconnect.
d. Component circuit protection.
e. 48 VDC power supply.
f. Humidifier contactor.
g. Conductivity circuit board.
h. Water quality indicator lights.
i. Water conductivity probe, shipped loose.
j. Cabinet thermostat controlled fan.
k. Proportional (0 to 100%) output control dependent based on either:
   1) Humidity sensor and high limit humidistat outputs.
   2) Analog output and high limit signals, respectively, from Building Automation (BAS) system.
l. Remote start/stop.
m. Backlit panel display/user interface.

n. Password protected menus.
o. Weekly timer and night setback function.
p. Time stamping event log for 100 events.
q. Ability to control up to 16 humidifiers per system.
r. Run hour meter function.
s. Manual and periodic, timed drain/flush cycles for cleaning and/or freeze protection.
t. [Wall-][Duct-][Wall- or Duct-]mounted, proportional humidity control sensor, as [as scheduled,] shipped loose.
u. On/off switch.
v. Remote shut down.
w. [Wall-][Duct-][Wall- or Duct-]mounted, on/off control humidistat, [as scheduled,] shipped loose.

3. Options:
a. Dry contacts for remote shut down dry contacts.
b. [Wall-][Duct-][Wall- or duct-mounted, as scheduled,] On/off high-limit humidistat. Ship loose.
c. Dry contacts for remote indication of water quality alarms.
d. Air pressure fan proving switch, shipped loose.
e. Audible alarm.
f. Averaging control board for 2-4 sensors.
g. Proportional/Integral (PI) control.
h. Temperature compensated control.
i. Capacity assist control for groups of humidifiers.
j. Duct proximity control for multiple humidifiers.
k. Serial port for remote BAS communication and control over Modbus RTU, BACnet MS/TP, BACnet over Ethernet, BACnet over IP, HTTP, SNMP V1, V2c.
l. Air velocity sensor.
m. High RH limit, duct-mounted sensor. Ships loose.
n. Water leak / condensate pan detector.
4. Microprocessor shall be capable of all of the following alarms, outputs, displays, and signals. Coordinate information to be reported to Direct Digital Control (DDC) / Building Automation System (BAS).
   a. Alarms:
      1) Humidity too high.
      2) Humidity too low.
      3) Water conductivity (via probe supplied with humidifier).
      4) Sensor cable fault.
      5) EE-pron fault.
      6) Transmission error.
      7) Power supply.
      8) Common alarm.
   b. Outputs:
      1) Supply valve.
      2) Drain valve.
      3) Common alarm.
      4) Humidify 1.
      5) Humidify 2.
   c. Displays
      1) Operating condition.
      2) Pre-alarm.
      3) Common alarm.
      4) Supply valve activated.
      5) Drain valve activated.
      6) Unit output.
      7) Current humidity.
      8) Set-point value - input 1.
      9) Conductivity of water.
      10) Set-point value – pre-alarm.
      11) Set-point value – common alarm.
      12) Remaining time – cleaning interval.
      13) Operating mode.
      15) Maximum production.
      16) Set-point value – humidity alarm “too high”.
      17) Set-point value – humidity alarm “too low”.
      18) Set-point value – input 2.
   d. Adjustable Inputs:
      1) Set-point value.
      2) Prop. Band.
      3) Set-point value – limiting input.
      5) Digital input for remote ON/OFF.

J. Components shall be completely factory tested before shipment.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Evaporative and Evaporative Pan Humidifiers

1. Install in accordance with AHRI 630 and manufacturer’s instructions.
2. Connect evaporative pan humidifier to hot water supply. Provide gate or ball valve and solenoid valve on heating water supply line, and globe valve on heating water return line.
3. Connect evaporative pan humidifier to steam supply. Provide gate valve and solenoid valve on steam line and thermostatic steam trap on condensate.
4. Pipe all units, except for steam grid type, from overflow and manual drain with valve to equipment drain or other Code-accepted drain point.
5. Install evaporative pan humidifier piping with unions or flanges for easy removal of pan for servicing.
6. Connect evaporative pan humidifier to ducts. Keep duct runs minimum length and slope back to humidifier.
7. Insulate exterior of evaporative humidifiers as specified for ductwork.
8. Place evaporative humidifiers on 2-inch thick rigid insulation board same size as unit tank. Flash and counterflash with 0.0396 inch galvanized steel on entering and leaving sides.
9. Connect evaporative and evaporative pan humidifiers to domestic cold water supply. Provide gate or ball valve and pressure reducing valve (as needed) on water supply line. Provide ¾ inch hose bibb accessible from interior.
11. Provide evaporative humidifiers with globe valve and solenoid valve in ½ inch bleed line from drain.
12. Provide evaporative humidifiers with low water cut-off in drain pan to stop spray pump.

B. Ultrasonic Humidifiers

1. Install air handler humidifiers, racks, drain pans, and other accessories in accordance with manufacturer’s written installation instructions.
2. Provide sufficient clearance for connections, air movement and maintenance access.
3. Install loose humidifier equipment, wiring, options and accessories furnished by manufacturer.
4. Where humidifiers are installed within air handling or distribution systems:
   a. Adhere to recommended distances upstream of turns, duct liner and obstructions. Where this is not possible, provide and install mist eliminators.
   b. Install galvanized steel supports for distribution manifolds.
   c. Install equalizing grids upstream of humidifiers where air turbulent air is expected.
d. Install access door(s) adjacent to humidifier.
e. Where provided, install high-limit sensor and fan proving switch. Locate high-limit sensor downstream of mist absorption range.
f. Install booster fans where terminal velocity falls below manufacturer’s recommended operating range.

5. Where humidifiers are installed as stand-alone, direct room:
a. Locate per manufacturer’s recommendations and with consideration of HVAC system and smoke detector layout and occupied areas.
b. Install in level, horizontal position.

6. Plumbing
a. Connect water supply and drain systems to equipment with unions or flanges.
b. Install shutoff valve and strainer on water supply.
c. Install drain piping with trap of depth recommended by manufacturer. Refer to Section 222113 “Hydronic Piping”.

7. Electrical
a. Install control wiring associated with field-installed accessories.

END OF SECTION