Section 23 84 13 - HUMIDIFIERS

PART 1 General

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following humidifiers:

1. SKE4 Electric steam humidifiers and accessories.

1.3 DEFINITION

A. Low Voltage: As defined in NFPA70 for circuits and equipment operating at less than 50V or for remote control, signalling 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.

D. Instructions: Submit manufacturer's installation, operation and maintenance manuals.

E. Field quality control test reports.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices and Accessories: Listed and labelled as defined in NFPA70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked intended use.

B. Comply with ARI 640, “Commercial and Industrial Humidifiers.”

C. Quality management system shall comply with ISO 9001:2015 certification.

1.6 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.

1.7 DELIVERY, STORAGE AND HANDLING

A. Waste Management and Disposal:

1. Remove from site and dispose of packaging materials at appropriate recycling facilities.

1.8 WARRANTY

A. Product shall be warranted to be free from defects in materials and fabrication for a period of two years from the ship date.

PART 2 PRODUCTS

2.1 SELF-CONTAINED HUMIDIFIERS

A. Manufacturer: Subject to compliance with requirements, provide products by

1. Neptronic

2.2 SKE4 ELECTRIC RESISTIVE STEAM HUMIDICATION SYSTEM

A. General:

1. Provide self-contained, microprocessor controlled, wall mounted, electric resistive steam humidifiers as indicated, of size and capacity as scheduled. Electrode technology is not acceptable.
2. Humidifier shall meet the requirements of UL 998 and CSA C22.2 No.104 standards to comply with ETL certification.

B. Humidifier cabinet:

1. The humidifier casing shall be constructed of cold roll steel and stainless steel base with baked enamel finish to prevent rust.
2. For safety and security reasons, all components, electrical wiring and plumbing connections will not be exposed and must be contained within the cabinet of the unit.
3. The compartmentalized enclosure shall separate the plumbing, controls, and high-voltage sections, preventing heat, humidity or water transfer to the electrical sections and ensuring that the evaporation chamber remains isolated.
4. The plumbing compartment shall be equipped with a drip tray.
5. The front of the unit and the high voltage compartment shall have a lockable door to restrict access by unauthorized personnel.

C. Evaporation chamber:

1. Steam shall be generated in a stainless steel cleanable evaporation chamber.
2. The evaporation chamber shall be easily serviceable and removable from the unit. No tools are required during servicing.
3. The electronic level sensing assembly remains permanently fixed and separate from the evaporation chamber.
4. The heating elements and manual reset high temperature safety cut-out switch remain fixed in place, even as the evaporation chamber is removed for service cleaning.
5. The evaporation chamber shall have a water port designed to minimize the risk of blockage caused by sediment build-up. The water port will be easily detachable for servicing by means of a single quick connect assembly.

D. Immersion heating element(s):

1. Steam shall be generated by self-cleaning 800/825 Incoloy electric heating immersion elements.
2. The heating elements shall have a high expansion factor, minimizing mineral deposits and enabling most of them to break off and fall to the bottom of the chamber.

E. Water level control:

1. The water level detection system shall be self-cleaning, self-calibrating and equipped with a redundancy system, consisting of a high-resolution capacitive sensor and two fail-safe resistive sensors.
2. The humidifier must have the ability to sense foam and take a corrective action by going into drain cycle.
3. For safe temperature operation, the humidifier must have both an electronic temperature sensor inside the evaporation chamber and an external bimetallic temperature cut-off.

F. Water requirements:

1. The humidifier shall operate under all types of water including tap, deionized and reverse osmosis water, with no additional parts required.

G. Feed water:

1. The supply water to the unit shall be controlled by a quiet three port solenoid valve equipped with flow regulators, to supply water into the evaporation chamber, temper the hot water during a drain and clean the water level sensors.
2. To conserve energy, any hot water skimming during normal FILLING cycle is not acceptable.
3. The humidifier shall have a check valve in the fill water line to prevent backflow of hot contaminated water into the water supply system.
4. The humidifier shall have a pulsed fill mode to ensure that boiling does not stop while the humidifier is refilling, in order to maintain a constant steam output.

H. Drain:

1. The humidifier shall have a drain pump which provides a quick drain cycle, minimizing the down time.

2. The humidifier shall have four draining strategies: periodic full drain cycle, water dilute system, AFEC and configurable drain schedule, ensuring maximum energy efficiency, optimal steam output stability and minimal steam output interruptions.
3. To enhance safety and minimize energy consumption, the humidifier shall vary the drain time periods according to variations in water conditions.
4. After 72 hours of no demand, the humidifier will go into "Tank Rinse" or end of season mode, completely draining the unit to eliminate stagnant water.

I. Manual drain valve:

1. The humidifier shall be supplied with a manual drain valve which ensures that the unit can be drained even during a power failure.

J. Disconnect switch:

1. For safety reasons and to conform to local regulations, the humidifier shall have a built-in factory wired disconnect switch, to easily turn off the power without opening any access doors, ensuring that the power is off when accessing the electrical panels. An external disconnect switch is not required.

K. Controller:

1. The humidifier shall have an alphanumeric display and control module with 8 function buttons for fast configuration and operation.
2. The Idle Screen shall display common information including humidity demand, actual steam output and state of operation. It will also indicate special diagnostic parameters such as abnormal operation, time delays, etc.
3. The humidifier shall be programmable using the menu buttons to view and configure settings including control method, %R.H. set point, control signal type, and indication on number of actual service hours.
4. After the maximum number of hours of operation before servicing is due has been exceeded, the unit will display a need for servicing and the Status Display LED on the control panel will turn red.

L. SD card:

1. The unit shall be equipped with an SD card slot, to allow for simplified troubleshooting, by storing a history log of all humidifier trends and alarms.
2. The SD card shall allow for on-site firmware upgrades.

M. USB connection:

1. The unit shall be equipped with a USB port, to allow on-site firmware upgrades.

N. Scheduling system:

1. The humidifier shall be equipped with a configurable and independent scheduling system for unit operation and drain cycle, ensuring that the unit does not operate or drain when not necessary.

O. User rights management:

1. The electronic controller shall be equipped with a user rights management system, which simplifies operation and protects the humidifier from unwanted access by displaying only the features associated to the type of user logged in.

P. Building automation systems:

1. The humidifier shall be equipped with communication protocols, including BACnet MS/TP, Modbus RTU, LonWorks, BACnet UDP/IP, or Modbus TCP/IP, for integration with a building management system (BMS).
2. These protocols shall be available via a plug-in module for simple upgrade of units already in the field.

Q. Web services:

1. The humidifier shall be equipped with web services enabling humidifier parameter configuration, and access to diagnostics and other functions remotely using the internet.

R. Modulating control:

1. The control modulating signal shall be 0-10 VDC or 2-10 VDC, 4-20 mA or 0-20 mA to modulate 0-100% of the capacity.
2. The maximum output (SPAN) can be minimized by using the electronic "MAX OUTPUT" setting.

3. Modulation of all elements shall be achieved using silent SSR's with zero voltage crossing detection and firing. The SSR's will be backed up by an electro-mechanical contactor.
4. To avoid harmonics and peak electrical loads, Time Proportioning modulation using only electro-mechanical relays will not be acceptable.

S. Space distribution unit (SDU):

1. Stainless steel manifold with integral fan to discharge vapour directly into occupied space.

T. Steam distribution manifold (S.A.M.):

1. Type 304 stainless steel manifold with brass nozzle inserts which provide uniform steam distribution over entire length.

U. Steam distribution manifold (S.A.M.E2):

1. Type 304 stainless steel manifold with brass nozzle inserts which provide uniform steam distribution over entire length, used in applications with restricted duct dimensions.

V. Steam dispersion panel (Multi-Steam SD):

1. Type 304 stainless steel non-insulated tubes and header, with brass insertion nozzles to prevent condensate from escaping.
2. All tubes shall be completely factory assembled with welded connections requiring no gaskets.
3. Each dispersion tube shall be fitted with one or two rows of dispersion brass nozzles.
4. The brass nozzles shall discharge steam in diametrically opposite directions, perpendicular to airflow.
5. The nozzles extend into the interior of the steam tube, preventing condensed droplets from being dropped into the duct.

W. Steam dispersion panel (Multi-Steam HD):

1. Distribution Manifold: Provide multiple insulated tubes for uniform steam distribution without condensate drip or objectionable steam noise. Steam dispersion panel Multi-Steam: Type 304 stainless steel insulated tubes and header. All insulated tubes shall be completely factory assembled, requiring no gasket:
    1. Vertical steam distribution tubes are used to inject steam into the airflow, and shall span the distance between the header and top bracket.
    2. The tubes shall be equally spaced over the length of the header for a better steam distribution across the width of the duct or air handler.
    3. Tubes shall be made of 304 stainless steel double wall (24 gauge) with encapsulated Armacell UT/Solaflex™ foam insulation. Insulation thickness shall be ¼" (6 mm) on the side and ½" (13 mm) on the top of the tube.
    4. The inner part of the tube shall distribute steam over the full vertical length of the manifold. It shall be sealed with a continuous seam weld to prevent any steam leak.
    5. The outer shell shall be welded in place to fully cover the insulation and protect it from wear and tear. Airflow in direct contact with the tube insulation is not acceptable as to prevent dust accumulation.
    6. Each tube shall have a welded bottom plate, a gasket and 4 screws for a leak-proof mounting on the header in the field.
2. The insulating material used for tube and header insulation shall have the following properties:
    1. A maximum conductivity 'k' factor of 0.28 Btu*in/(hr*ft^2*F).
    2. A minimum thickness of 0.25" (6.35 mm) for the tube and 0.375" (9.5 mm) for the header.
    3. A continuous temperature rating of 300˚F (149˚C) without any loss of material properties.
    4. Comply with ASTM E84 Test Method for Flame Spread and Smoke Development.
    5. Comply with UL 181 Test method for Mold Growth.
    6. Comply with ASTM G22 for Fungi and Bacterial Resistance.
3. Steam dispersion eyelets shall have the following properties:
    1. Eyelets shall be made of type 304 stainless steel. It shall incorporate an internal slope to bring condensate generated within the eyelet back to the steam dispersion tube to prevent condensate ejection.

2. The eyelet steam ejection point shall be located at a distance from the steam dispersion grid's outer shell to prevent condensation on its surface.
3. Eyelets shall be mounted on both sides of the tubes to evenly distribute steam perpendicular to the airflow. They should be inserted in the tube inner sheath and be kept in place by a collar larger than the outer shell hole.
4. Rows of eyelets on opposite tubes shall be mounted staggered to prevent face to face steam injection of adjacent tubes.

4. Insulated header of the steam dispersion manifold shall have the following properties:
   1. The header shall be made of a 304 stainless steel (18 gauge) double wall with encapsulated 0.375" (9.5 mm) Armacell UT/Solaflex™ foam insulation.
   2. The header bottom shall slope towards the condensate connection to help condensate elimination and prevent any stagnant condensate in the header.
   3. The header inner wall shall be sealed with a continuous seam weld to prevent any steam leak.
   4. The outer shell shall be mounted in place to fully cover the insulation and protect it from wear and tear.
   5. Airflow in direct contact with the header insulation is not acceptable to prevent dust accumulation.
   6. The header shall incorporate an internal distribution tube which spans the length of the header to supply steam equally to all steam dispersion tubes.

X. OSHPD:

1. The humidifier shall conform to the requirements of the OSHPD seismic certification.

Y. Accessories: Include the following:

1. HRO20 humidity controller: Wall mounted, modulating device with electronic display and adjustment buttons that measures from 0-100% RH and provides selectable output signals, with a control range of 10% to 90% RH.
2. HRL24 humidity transmitter: Wall mounted, programmable device with electronic display and adjustment buttons that measures from 0-100% RH, with a control range of 10% to 90% RH.
3. SHR10 wall humidity sensor: Wall mounted device that measures from 0-100% RH range and provides a 0-10VDC output.
4. SHC80 duct humidity sensor: Duct mounted device that measures from 0-100% RH range and provides a 0-10VDC output.
5. SHS80 duct humidity sensor: Duct mounted device with high limit that measures from 0-100% RH range and provides a 0-10VDC output, with a high limit control range of 20% to 90% RH.
6. SHS20 high limit humidistat: Wall mounted, ON/OFF device with a control range of 20% to 90% RH, having a built-in humidity sensor.
7. HRC20 wall humidity controller: Wall mounted, ON/OFF device with a control range of 10% to 60% RH, having a built-in humidity sensor.
8. STO2-11 outdoor temperature sensor: Set point reset from an external temperature sensor to prevent condensation on windows.
9. SHW0-11 window temperature sensor: Set point reset from an external temperature sensor to prevent condensation on windows.
10. APS-ADJ: Air pressure switch shall be diaphragm operated with pitot tube for field installation. Switch shall have an adjustable set point range of 0.05"WC (1.3mmWC) to 2.0"WC (50mmWC).
11. APS: Air pressure switch shall be diaphragm operated with pitot tube for field installation. Switch shall have a fix control of 0.05" WG (1.3mmWC).
12. IDC: Provide an Internal Drain Cooler (IDC) to automatically limit drain discharge temperature. The drain water must not exceed 140°F (60°C) during normal operation.
13. Drain Cooler: Provide an External Condensate Cooler (with thermostatic valve) to automatically limit drain discharge temperature. The drain water must not exceed 140˚F (60˚C) during normal operation.
14. PUMP404CV condensate pump: High temperature device used to collect and automatically remove drain water produced by the humidifier.
15. BACnet MS/TP: BACnet Master Slave/Token Passing (MS/TP) network interface shall be provided to connect BACnet client devices with Neptronic humidifier devices.

16. BACnet IP: BACnet IP interface shall be provided to allow for data transfer to and from devices over Ethernet using the BACnet IP Protocol.
17. Modbus RTU: Modbus communication protocol shall be provided over serial line in the RTU mode, to provide a Modbus network interface between client devices and Neptronic humidifier devices.
18. Modbus IP: Modbus communication protocol shall be provided with a TCP interface running on Ethernet and to provide a Modbus network interface between client devices and Neptronic humidifier devices.
19. LonWorks: Echelon LonWorks FTT 2 wires communication network protocol shall be provided for use in building automation applications.

Z. Duct distribution manifold complete with supply hose.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 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.

3.3 INSTALLATION

A. Install humidifier with required clearance for service and maintenance and accordance with manufacturer's written instructions. Maintain path, downstream from humidifiers, clear of obstructions are required by ASHRAE 62.1-2004.

B. Seal humidifier manifold duct or plenum penetrations with flange.

C. Install humidifier manifolds in metal ducts and casings constructed according to SMACA's "HVAC Duct Construction Standards, Metal and Flexible."

D. Install stainless steel drain pan under each manifold mounted in duct.

1. Construct drain pans with connections for drain; insulated and complying with ASHRAE62.1-2004.
2. Connect to condensate trap and drainage piping.
3. Extend drain pan upstream and downstream from manifold a minimum distance recommended by manufacturer but not less than required by ASHRAE 62.1-2004.

E. Install manifold supply piping pitched to drain condensate back to humidifier.

F. Install access doors or panels in adjacent ducting.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialities.

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 specialities furnished by manufacturer but not factory mounted.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductor and Cables."

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Engage a factory-authorized representative to inspect components, assemblies and equipment installations, including connections, and to assist in testing.

B. 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 unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.6 DEMONSTRATION

A. Engage a factory-authorized representative to train Owner's maintenance personnel to adjust, operate, and maintain humidifiers. Refer to Division 23 Section "HVAC Demonstration and Training."

3.7 CLEANING

A. Perform cleaning operations as specified in Section [___] and in accordance with manufacturer's recommendations.

B. Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION 238413