

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. SKG4 Gas fired humidifier 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 SKG4 GAS FIRED HUMIDIFICATION SYSTEM

- A. General:

1. Provide self-contained, microprocessor controlled humidifiers as indicated, of size and capacity as scheduled.
 2. Humidifier shall meet the requirements of IAS 12-94 and CGA/CSA-2.17 standards to comply with ETL certification.
- B. Humidifier cabinet:
1. The humidifier casing shall be constructed of 14-gauge steel and finished with powder coat paint 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 mechanical, plumbing, gas and electrical sections, preventing heat, humidity or water transfer to the electrical section and ensuring that the evaporation chamber remains isolated.
 4. The plumbing compartment shall be equipped with a drip tray.
 5. The access doors shall be locked to restrict access by unauthorized personnel.
- C. Evaporation chamber:
1. Steam shall be generated by a 316 stainless steel submerged combustion chamber, heat exchanger and 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, hot surface igniter and manual reset high temperature safety cut-out switch will be easily accessible for maintenance.
 4. 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. Flue outlet:
1. The humidifier shall be equipped with a stainless steel round flue outlet, in order to vent the combustion products.
 2. The humidifier shall be certified to use Type BH Vent Class I flue materials.
- 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 shall have an electronic temperature sensor inside the evaporation chamber.
- 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 each humidifier module shall be controlled by one quiet 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. Each humidifier module shall have one 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. Integral water tempering:
1. Water tempering shall be done by the microprocessor controller to mix cold water to the evaporation chamber water to discharge a water temperature of 140°F (60°C).
- J. 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.
- K. 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.
- L. USB connection:
1. The unit shall be equipped with a USB port, to allow on-site firmware upgrades.
- M. 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.
- N. 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.
- O. 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.
- P. 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.
- Q. 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 shall be achieved through speed modulation of the air/gas premix blower.
 4. To avoid accelerated aging of the gas train components and the hot surface igniter, Time Proportioning modulation will not be acceptable.
- R. 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.
- S. 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.
- T. 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*ft²*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.
- U. OSHPD:
1. The humidifier shall conform to the requirements of the OSHPD seismic certification.
- V. 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. STO2-11 outdoor temperature sensor: Set point reset from an external temperature sensor to prevent condensation on windows.
 7. SHW0-11 window temperature sensor: Set point reset from an external temperature sensor to prevent condensation on windows.
 8. 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).
 9. 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).
 10. 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.
 11. 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.
 12. BACnet MS/TP: BACnet Master Slave/Token Passing (MS/TP) network interface shall be provided to connect BACnet client devices with Neptonic humidifier devices.
 13. BACnet IP: BACnet IP interface shall be provided to allow for data transfer to and from devices over Ethernet using the BACnet IP Protocol.
 14. 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 Neptonic humidifier devices.
 15. 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 Neptonic humidifier devices.
 16. LonWorks: Echelon LonWorks FTT 2 wires communication network protocol shall be provided for use in building automation applications.
- W. Duct distribution manifold complete with supply hose.
- X. Weather enclosure:
1. The humidifier shall be protected against outdoor climate.
 2. The evaporation chamber water temperature shall be maintained above the freezing point.
 3. The enclosure shall be covered with a 1" thick (25mm) rigid fiberglass insulation.
 4. The water supply pipe inside the enclosure shall be equipped with an electric heating cable to prevent the water from freezing. In conjunction with the humidifier AntiFreeze temperature feature, the entire unit shall be maintained above the freezing temperature.
 5. The humidifier shall be equipped with a normally open motorized drain valve, in order to evacuate the water from the evaporation chamber and prevent it from freezing during an electrical power failure.

6. The humidifier shall be equipped with a fan assisted electric heater, in order to provide additional heat and maintain the temperature of the enclosure above freezing point.

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 as required by ASHRAE 62.1-2004.
- B. Seal humidifier manifold duct or plenum penetrations.
- 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 ASHRAE 62.1-2004.
 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 drip leg upstream from steam trap a minimum of 12 inches (305 mm) tall for proper operation of trap.
- G. Install access doors or panels in adjacent ducting.
- H. Install humidifier level on concrete base. Concrete base is specified in Division 23 Section "Common Work Results for HVAC".
- I. Install gas fired humidifier according to NFPA 54.
- J. Install exterior gas fired humidifier level on roof or roof curb.

3.4 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. Connect gas piping full size to gas fired humidifier with union. Gas piping materials and specialties are specified in Division 23 Section "Fuel Gas Piping."
- D. Connect breeching full size to the flue outlet of the humidifier. Venting materials are specified in Division 23 Section "Breechings, Chimneys, and Stacks."
- E. Connect the combustion-air inlet intake terminal using PVC piping with solvent-cemented joints. Run from the humidifier connection to outside and terminate adjacent to the flue termination as shown on plans.
- F. Install piping from safety relief valves to nearest floor drain.
- 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 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