[High pressure adiabatic humidifier: humiFog Multizone Touch]

1. **GENERAL**
    a. **DESCRIPTION**
        i. High pressure atomising adiabatic humidifier, ideal for rooms/AHUs/ducts; works on drinking and demineralised water. Pressure is provided by a piston pump (max. pressure 80 bars) without the aid of compressed air.
    b. **WORK REQUIRED**
        i. Installation according to the manufacturer's specifications, performed by technical personnel *[selected by the customer]*.
        ii. System commissioning performed by *[manufacturer's technical personnel, or technical personnel authorised by the manufacturer]*.
    c. **DOCUMENTATION**
        i. Technical manual for installation, instructions on safety, configuration and operation, complete with dimensions, technical specifications, performance, water circuit and wiring diagrams, standards and specifications for safe installation, guide for commissioning and operation, diagnostics, list and identification of spare parts, 2D/3D drawings, BIM/Revit files.
    d. **QUALITY**
        i. CE (EMC: EN 61000-6-2, EN 61000-6-4; LVD: EN 60204-1; RoHS: EN IEC 63000)
        ii. ETL (in accordance with UL 998 and UL 508A)
        iii. EAC
        iv. VDI 6022 part 1: 2018-01
        v. VDI 3803 part 1: 2020-05
        vi. SWKI VA 105-1: 2015-08
        vii. ÖNORM H 6021: 2016-08
        viii. WaterMark WMTS 101
        ix. ISO 9001:2015 - ISO 14001:2015 - ISO 45001:2018 (manufacturer)

2. **PRODUCT**
    a. **[generic definition of the apparatus, technology]**
        i. High pressure atomising adiabatic humidifier, consisting of:
            - a *main* cabinet containing the controller and the volumetric pump
            - a *secondary* cabinet containing the controller for each zone (up to a maximum of 1*2 zones in total with a single pumping station)*
            - a high pressure *rack* atomisation system, customised for each application in UTA
            - Direct in room customised distribution system
    b. **[general features and construction]**
        i. Volumetric piston pump
        ii. Pressure gauge upstream of the pump
        iii. Feedwater and outlet water pressure gauges
        iv. Built-in conductivity meter
        v. Pressure sensor (0.5 bars) to avoid air lock inside the pump
        vi. Safety valve (5.5 bars) on pump bypass
        vii. Safety valve (80 bars) on outlet
        viii. Bypass water temperature probe, drain solenoid valve and thermostatic valve (63°C, redundant safety) to avoid pump overheating
        ix. Maximum pressure switch (90 bars, redundant safety on outlet safety valve) for unit shutdown and safety drain

x. Pulsation damper

c. [models, capacities and variants]

i. model capacities:
- 150, 300, 500, 800, 1200 kg/h.

ii. control type:
- Single zone:
  a. variable flow-rate control
  b. constant pressure control
- Multi zone (up to 12 independent zones)

iii. pump material variants:
- Model with brass volumetric pump;
- Model with AISI 316 stainless steel volumetric pump;
- Model with silicone-free AISI 316 stainless steel volumetric pump.

d. [feedwater and drain water]

i. The humidifier shall only use demineralised drinking water (0.054 - 50 µS/cm).

e. [power supply specifications]

i. Cabinet-pumping station power supply:
- 208 VAC 1-phase 50/60 Hz on sizes 150 - 500 kg/h UL certified
- 230 VAC 1-phase 50/60 Hz on sizes 150 - 500 kg/h CE or UL certified
- 400 VAC 3-phase 50/60 Hz on sizes 800 - 1200 kg/h CE certified
- 460 VAC 3-phase 50/60 Hz on sizes 800 - 1200 kg/h UL certified

ii. Secondary cabinet power supply:
- 208 VAC 1-phase 50/60 Hz UL certified
- 230 VAC 1-phase 50/60 Hz CE or UL certified

f. [control, characteristics]

i. 2 analogue inputs for humidity/temperature probes or external request signal. The type of electrical signal for both can be selected on the keypad between: on/off (humidistat), NTC, 0- 10 V, 2-10 V, 0- 1 V, 0- 20 mA and 4- 20 mA

ii. Analogue input for auxiliary temperature probe

iii. ON/OFF digital input to enable the remote pumping station

iv. ON/OFF digital input to enable the remote high pressure atomising rack connected to the pumping station.

v. ON/OFF digital input to enable signal from external air flow/pressure switch.

vi. ON/OFF digital input reserved for any alarm signals from an external reverse-osmosis water treatment system.

vii. ON/OFF digital input reserved for a water leakage detector or flooding sensor.

viii. ON/OFF digital output to signal high pressure atomising rack status, active/inactive.

ix. ON/OFF digital output to signal low temperature inside the cabinet and possibly start/stop an external frost protection device.

x. Cumulative alarm relay to signal faults and/or malfunctions to a supervisory system.

xi. Digital output contact with configurable logic with 7 options:
- pump status (pump on/off)
- unit status (unit powered/not powered)
- maintenance warning (warning on/off)
- missing water warning (warning on/off)
- inlet water low pressure alarm (alarm on/off)
- freezing water alarm (alarm on/off)
- rack preheating probe low temperature warning (warning on/off)

xii. Backup/rotation: pump heartbeat signal to enable backup/rotation function on humiFog systems. The function allows one system to have two pumping stations connected to the

same distribution system, in order to create redundancy and thus guarantee service continuity and distribute operating hours between the two cabinets

xiii. 17 production and modulation algorithms available to the user:
- on/off
- on/off - modulating based on humidity limit probe rH%
- on/off - modulating based on temperature limit probe T
- Production proportional to external analogue signal
- Production proportional to external analogue signal + temperature limit probe
- Production proportional to external analogue signal + humidity limit probe
- Production proportional to temperature probe reading
- Production proportional to 2 temperature probes reading for direct in-room application (weighted average of the 2 probes)
- Production proportional to 2 temperature probes reading + humidity limit probe for direct in-room application (weighted average of the 2 probes)
- Production proportional to 3 temperature probes reading for direct in-room application (weighted average of the 3 probes)
- Production proportional to 2 humidity probes reading for direct in-room application (weighted average of the 2 probes)
- Production proportional to 3 humidity probes reading for direct in-room application (weighted average of the 3 probes)
- Production proportional to humidity probe reading
- Production proportional to temperature probe reading + temperature/humidity limit probe
- Production proportional to humidity probe reading + temperature/humidity limit probe
- Production proportional to dew point temperature
- Production proportional to dew point temperature +humidity limit probe

xiv. The humidifier shall be able to control atomised water production by reading the air temperature downstream of the AHU preheater

xv. Intuitive graphical 7'' touch display through which the whole humidification system can be configured and controlled

xvi. The touch display can be used to view and modify the system parameters, as well as reset any warnings or alarms.

xvii. Flow-rate control mode: continuous modulation from 5% (according to pump size) to 100% of the distribution system water flow-rate (the outlet pressure varies from 25 to 70 bars depending on the water flow-rate).

xviii. Pressure control mode: the outlet pressure is kept at the set point (70 bars), varying the pump speed when the load in the downstream water circuit changes; the pressure can be set by the user.

xix. Pressure control mode: up to 64 flow-rate control values.

xx. The pumping station can control up to 22 (models UA150 - UA1K2) external fill or drain valves.

xxi. The pipes that make up the atomising rack and room distribution systems are automatically emptied by opening the drain valves every time the system stops atomising, as required by the strictest applicable regulations, while also preventing the nozzles from dripping

xxii. The pipes that make up the atomising rack and room distribution systems are automatically washed when the humidifier is switched on

xxiii. The pipes that make up the atomising rack and room distribution systems are automatically emptied and washed periodically during periods of inactivity (the washing cycle can be set in relation to the needs of the application directly by the user); this guarantees compliance with the highest hygiene standards

xxiv. Atomisation is preceded by a complete filling cycle on all of the lines making up the system, until reaching the correct atomisation pressure. This ensures that there are no leaks from the nozzles during transient phases
xxv. Display of feedwater conductivity
xxvi. Display of water bypass temperature
xxvii. Selection of unit of measure (SI or IP)
xxviii. Automatic maintenance warning
xxix. The humidifier supplies water at constant pressure, even without any directly-controlled external valve
xxx. Weekly scheduler
xxxi. Manual procedure for testing individual devices
xxxii. Procedure for cooling the pipes inside the cabinet during extended periods of inactivity, which can be activated in the event of exposure of the cabinet or the equipment room to sunlight.
xxxiii. Configuration wizard executable during commissioning from the touch display for correctly setting up the entire system (all supplied zones). Configuration shall be possible by uploading a file from USB port.
xxxiv. Remote connectivity shall be available through dedicated cloud portal. The humidifier shall be able to be controlled and accessed remotely through an independent standalone connection to said cloud portal, especially for troubleshooting purposes. Checking and editing variables and an overview of the unit shall be made available through this system. Local connectivity shall be available through dedicated local supervisor. Checking and editing variables and an overview of the unit shall be made available through this system.
xxxv. Automatic step rotation: automatic rotation of the atomizing manifolds at partial load for an even distribution of the humidity in the space and to uniform solenoid valves working hours.

g. [performance data]

i. relative humidity control accuracy shall be up to +/- 1 - 2% around relative humidity setpoint.

h. [safety, protection and hygiene devices]

i. No biocides need to be added to the water.

i. [communication interfaces, display, connectivity]

i. RS485 serial port to communicate with Modbus RTU, BACNet protocols, without requiring an additional external device.
ii. Ethernet port to communicate with Modbus RTU, BACNet protocols, without requiring an additional external device.

j. [distribution systems]

i. High pressure atomisation system for AHUs/ducts:
- The high pressure atomising rack can be installed up to a distance from the pumping station of:
  - 100 m linear
  - 20 m of vertical height difference
- High pressure atomising rack with pre-wired solenoid valves and labelled electrical cables
- High pressure atomising rack with AISI 303 nozzles and customised according to the inside dimensions of the duct.
- The atomisation system shall be automatically emptied when atomisation ends.
- Suitable for operation up to 100 bars, suitable for demineralised water with conductivity 0.054 - 50 µS/cm and microbiologically inert.

- Water racks and solenoid valve coils in compliance with DIN EN 846 and DVGW W 270
- Normally Closed fill valves, 24 VAC
- Normally Opened drain valves, 24 VAC
- Normally Opened ventilation valve, 24 VAC
- Atomising nozzles available with flow-rates 1.45; 2.8; 4.0 l/h at 70 bars, made from AISI 303, anti-drip ball valve and rotating internal body
- The atomisation system shall be available with dimensions up to 3092 mm width x 3117 mm height, with manifolds that can be placed horizontally or vertically at request
- The atomisation system shall be installed in all types of hazardous area as specified in the 1999/92/EC directive of 16th December 1999 (zone 0, 1, 2, 20, 21, 22) as defined in article 1 and 2 of the 2014/34/EU directive of 26th February 2014 and in clause 41 of the ATEX 2014/34/EU guidelines (1st edition – April 2016).
  These products don't have own potential sources of ignition.

ii. High pressure atomisation system for rooms:
- The high pressure atomising rack can be installed up to a distance from the pumping station of:
  - 100 m linear
  - 20 m of vertical height difference
- Suitable for operation up to 100 bars, suitable for demineralised water with conductivity 0.054 - 50 µS/cm and microbiologically inert
- The atomisation system shall be automatically emptied when atomisation ends
- Atomising manifolds and solenoid valve coils in compliance with DIN EN 846
- NC fill valves, 24 VAC
- NO drain valves, 24 VAC
- Atomising nozzles available with flow-rates 1.45; 2.8; 4 l/h at 70 bars, made from AISI 316, anti-drip ball valve and rotating internal body
- Atomisation system with blowers comprising nozzle manifolds and fans powered at 230 Vac 50 Hz / 110 Vac 60 Hz.
- Atomizing system with manifolds comprising nozzles spraying on one or two sides

k. [accessories]

i. Humidity probe rH% or temperature probe T for civil environments (rH% 10% - 90%; T -10°C - 60°C)
ii. Humidity probe rH% or temperature probe T for industrial environments, min. protection rating IP54 (rH% 10% - 90%; T -20°C - 70°C)
iii. Humidity probe rH% for ducts, min. protection rating IP40 (rH% 10% - 90%)
iv. Humidity limit probe rH% for ducts, min. protection rating IP40 (rH% 0% - 100%)
v. Rack distribution system temperature probe: humiFog can manage a probe positioned upstream of the rack so that atomisation is enabled when the temperature is optimal for correct absorption.
vi. The humidifier shall be able to communicate via the following protocols by default:
- BACnet Serial/IP
- ModBus Serial/IP

vii. *Secondary* zone cabinet for stand-alone control of up to 12 zones:
- The zone cabinet shall guarantee the same control logic as the *main* cabinet.

l. The type of apparatus shall be the CAREL [humiFog]

m. Approved manufacturers: Carel Industries SpA

3. EXECUTION

a. **Installation in compliance with the manufacturer's specifications**
b. **Installation in compliance with applicable local laws and regulations**
c. **Water quality as per manufacturer's specifications, under the responsibility of the user**