Operating principle

The operating characteristics of Fisair series HEF2 and HEF3 are based on the natural effect of water evaporation when an air stream passes over a wet surface. Air picks up water vapour which decreases the air temperature since the heat of evaporation comes from the air.

This principle ensures that a gas to air mixture occurs without any liquid water being released.

Only when carry over occurs can water droplets be released to the air stream. This is the major difference between the media pad and water spray humidifiers, providing the air velocity is correct there is no carry over of droplets.

Media Pad

FISAIR Humidifiers are available with two different media pad materials.

• The HUMI-KOOL pad, basically cellulose paper impregnated with chemicals to provide stability and wettability. The corrugated and cross channels configuration ensure an expanded surface for evaporation contact with the air coupled with minimum resistance. The material is not incombustible but it represents an economically priced option.

• HU-CELL pads are glass fibre sheet with wetting agents and water adsorbent additives. Using the same corrugated and cross channel configuration as the HUMI-KOOL, but with smaller apertures, the media has a compact structure maintaining optimum performance at low pressure drop. As HU-CELL pads are inorganic. they are fireproof.

Both types of pad are assembled in sheet steel frames with an integral watering system and handle to enable them to be easily incorporated into a humidifier unit.

CONSTRUCTION

Standard components

- Water basin
- Automatic float water filling valve
- Overflow and deconcentration device
- Drain and overflow nozzles
- Water pump
- Watering & bleed-off PVC piping
- Water flows control valves
- Evaporative media pad cassettes
- Side and top frames

Optionals / Ancillary components

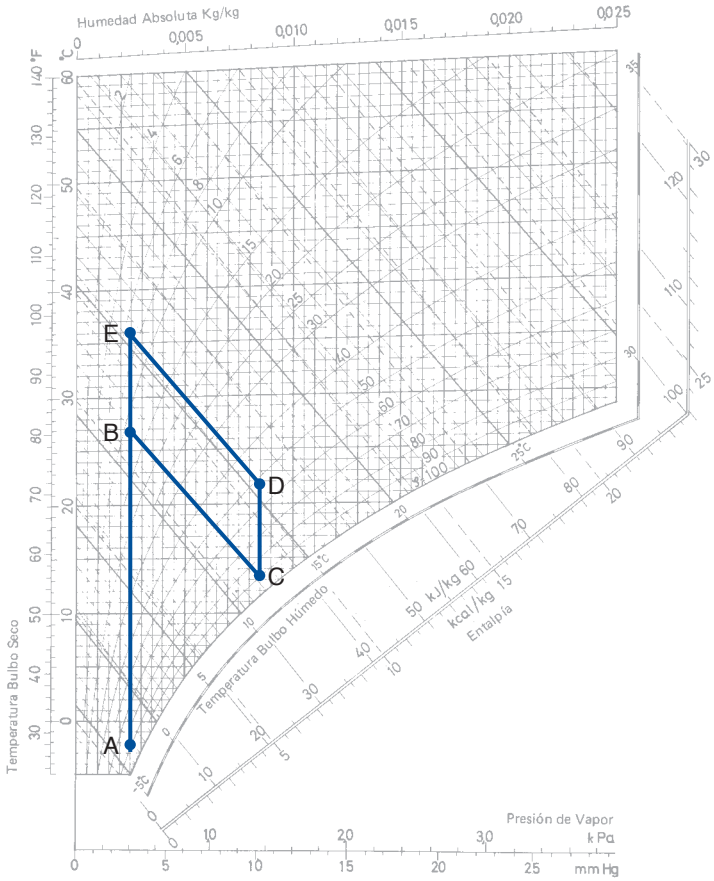
- Solenoid water filling valve (NC/NO)
- Solenoid water drain valve
- Partial watering with solenoid valves for two or more step control
- Water level (pneumatic/electric) control
- Watering flow meter
- U.V. lamps
- Integral droplets separator
- Electric protection and control panel.

The evaporative process into the i-x chart

The side picture shows a sample of the usual design process for evaporative humidification into the Mollier chart: Starting from outside air at –3ºC and 80% R.H. to get air at 22ºC and 50% R.H. there are two different methods:

a) Pre-heating+humidification+post heating (line A-B-C-D).
b) Heating+humidification (line A-E-D).

Both ways have absolute humidity (Δx) increase, that is, from 0.0025 Kg/Kg to 0,0085 Kg/Kg, but the humidification device has a different performance in each method since line B-C covers almost all allowable evaporative humidification while line E-C does it partially only. Because of that, one can define the so called.



SATURATION EFFICIENCY

As the ratio between the requested and the maximum allowable one, which can be stated as the ratio between the process air dry bulb temperature decrease and the process air dry/wet bulb temperature difference. For the above mentioned examples, the respective efficiencies are:

– Line B-C: 21-13 / 21-12 = 89%.
– Line E-D: 36-22 / 36-15,5: 68%.

HUMIDIFIER SELECTION

Once the requested humidification saturation efficiency is known, by means of the tables below and depending of the chosen media pad type, one may obtain the operating face velocity for the humidifier. With this data and the specific airflow, the net cross section is defined, and from that the combination length x height to suit each single installation.

Technical data of media pads (*)

Saturation efficiencies & pressure drops of HUMI-KOOL celloluse media pad

Face velocity, m/s	2.0		2.5		2.75		3.0		3.5		4.0	
Pad thickness, mm.	100	200	100	200	100	200	100	200	100	200	100	200
Saturation efficiency, %	72	92	68	90	67	89	66	89	65	88	61	88
Pressure drop, Pa	30	70	55	105	65	125	75	145	90	180	115	250

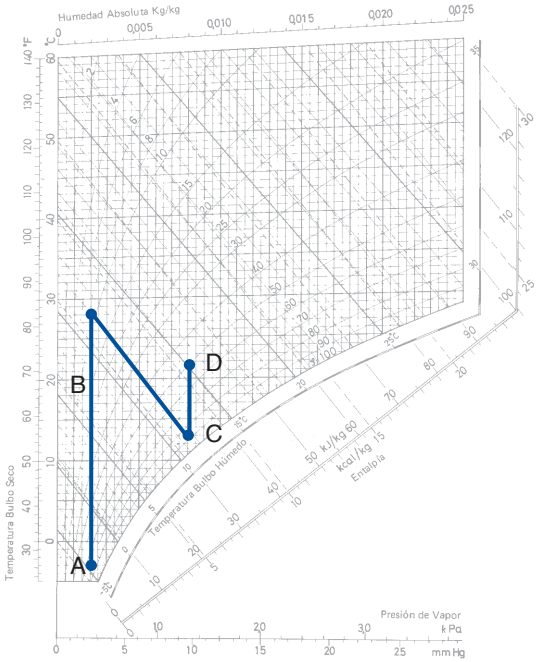
Saturation efficiencies & pressure drops of HU-CELL glass fiber media pad

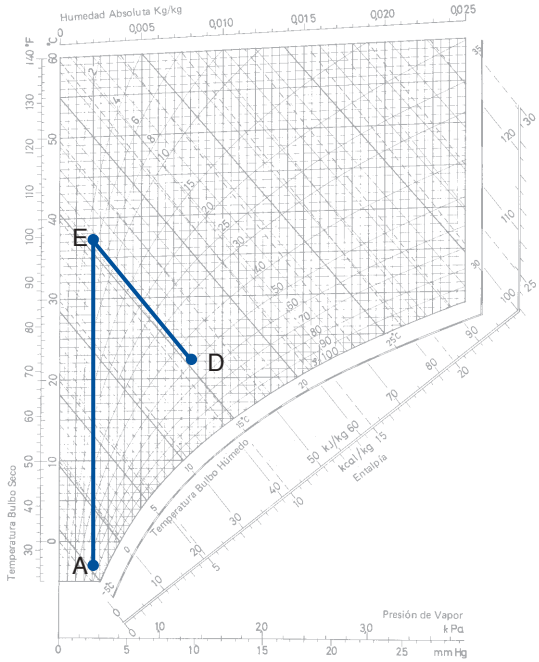
Face velocity, m/s	2.0			2.5			2.7			3.0			3.5			4.0		
Pad thickness, mm.	75	100	150	75	100	150	75	100	150	75	100	150	75	100	150	75	100	150
Saturation efficiency, %	77	86	94	74	84	93	73	83	92	72	82	91	71	81	91	68	78	90
Pressure drop, Pa	11	16	32	17	24	46	20	28	54	25	33	60	35	45	77	48	60	95

(*) Typical design data. For better accuracy please ask for pad manufacturer operating graphics.
Remark: Shadow datas may produce droplets carry-over. Provide with droplets separator.

Control of operation

The two main operating methods explained in the previous page correspond to two different methods of operation control for the FISAIR evaporative humidifiers.





A. Air Handling Units with pre and post-heating coils.

The performance control can be achieved by a temperature sensor located after the humidifier and a temperature controller with the "C"-temperature set point (13ºC).

The water pump / humidifier works always at 100% capacity while the three-way hot water valve regulates the requested hot water flow to reach the necessary air temperature before the humidifier, to work on the B-C constant wet bulb temperature line.

B. Air Handling Units with pre-heating coil only

The performance control can be achieved by an ON-OFF hygrostat acting on the pump motor contactor or (in large units) by ON-OFF valves which split the watering of the pads in two or more steps, through the corresponding step-controller.

The control action on the watering flow is not often recommended since the evaporative humidifiers work with extra water flow to obtain the scale washing effect over the contact surfaces and therefore the flow control would be only effective in the lower figures as well as such washing effect would be lost.

Specification

FISAIR media pad evaporative air humidifier, series HEF(x)

Construction

- Water basin and side & top frames in (1)
- Evaporative casettes: (1) frames and (2) media pad
- Water supply by: (3)
- Pads watering by (4) with PVC-piping and flow control valve
- Deconcentration by integral continuous bleed-off with flow control valve.
- Overflow device and drain nozzles.
- Other ancillary items (5)

Operating datas

- Minimum net cross section: L x H, m^2
- Overall dimensions: L x H x D, mm.
- Process airflow: N_1 m^3/h.
- Saturation efficiency: N_2, %
- Pressure drop: N_3, Pa.

Options

x = 2 for A.H.U.
x = 3 for air duct

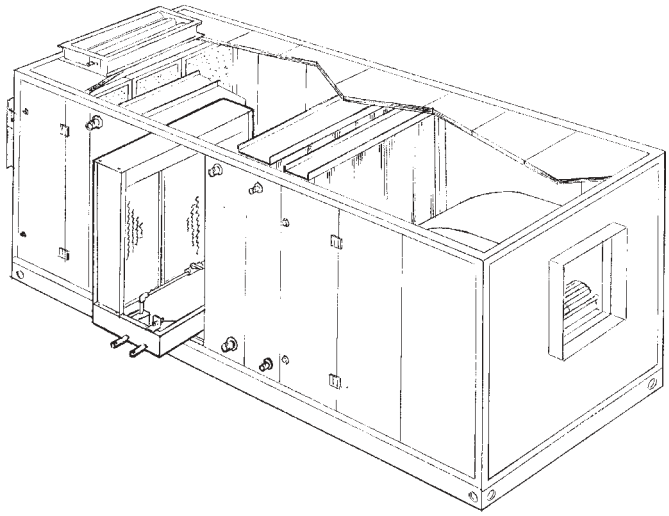
(1) Stainless or galvanised Steel sheet.
(2) Cellulose or glass fiber paper basis.
(3) Automatic (stainless st. or brass) float valve or solenoid (NO/NC) with level control (electric/pneumatic).
(4) Mains direct water or recirculating pump for 230/400V-IIIph 50Hz (or other supplies)

(5) Flowmeter, solenoid drain (NO/NC) valve, control panel, etc.

Assembly examples

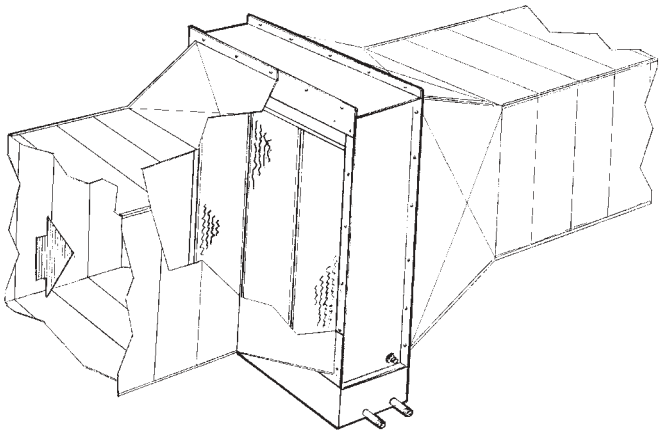
Into an air handling unit

The Fisair evaporative air humidifier series HEF2 is usually incorporated into an A.H.U. after the pre-heating coil and before the cooling coil, as shown by the side sketch. As the humidifier is serviced downstream, access provision on that face is normally enough.



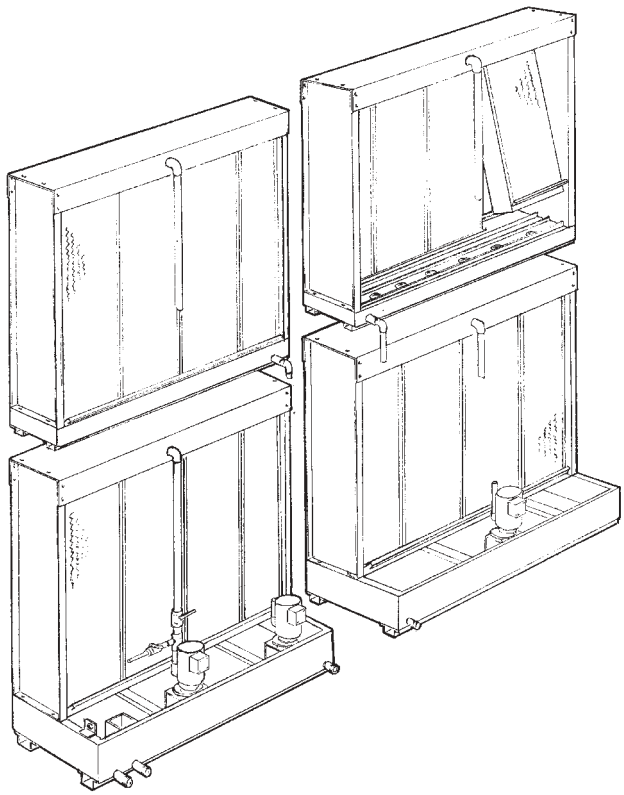
Into an air duct system

The series HEF3 Fisair humidifier can be easily integrated anywhere into an air duct system, as shown in the side sketch. Usually the designer must provide a duct section enlargement since air velocities into ducts use to be higher than the suitable ones for the humidifier. When it is not possible, there is the option to built a HEF3-unit with pads in “V” configuration and longer dimension in the airflow direction, having larger cross section/lower face velocity.



Into a large cross section

The Fisair humidifiers can be delivered in modules to build any size of “humidification bank” into a large A.H.U. for big airflows, as shown in the attached sketch.



Service

The Evaporative Fisair Humidifiers require little service as there are few moving parts, but a frequent visual check is recommended. Unless deconcentration is achieved by control of the bleed off and periodic drain down some pad clogging could occur.