



Adiabatic Fluid Coolers

OPERATION,
INSTALLATION AND
MAINTENANCE
MANUAL

HFCG Series

Where water
means business.



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1. Safety information

This manual is to serve as a guide for installing, operating, and maintaining the equipment. Improper installation, operation, and maintenance can lead to poor performance and/or equipment damage. Use qualified installers and service technicians for all installation and maintenance of this equipment.

This manual is for our standard product. The information in this manual is general in nature. Unit-specific drawings and supplemental documents are included with the equipment as needed. Additional copies of documents are available upon request.

Due to the ever-changing nature of applicable codes, ordinances, and other local laws pertaining to the use and operation of this equipment, we do not reference them in this manual.

1.1 Safety symbols

 WARNING
Addresses a hazardous situation which, if encountered, will result in death or serious injury.
 WARNING
Addresses a hazardous situation which, if encountered, might result in death or serious injury.
 WARNING
Addresses a hazardous situation which, if encountered, could result in minor or moderate injury.
NOTICE
Indicates instructions that pertain to safe equipment operation. Failure to comply with these instructions could result in damage to the equipment.

1.2 Safety instructions

- Installation and maintenance must only be carried out by qualified personnel who are familiar with this type of equipment.
- Always wear safety glasses, gloves and head protection when working on the equipment.
- Avoid contact with sharp edges and exposed finned surfaces as these can cause painful lacerations.
- All units must be properly evacuated prior to charging the system.
- Ensure all power sources are disconnected prior to any service work being done on the units.
- Never apply heat to a sealed refrigeration system.
- Keep hands away from fans when the unit is running.
- Ensure all mounting bolts are tight and are the correct length for the specific application.
- Maintain all safety labels on the unit in good condition: If required replace with new.

1.3 Refrigerant / Fluid safety

WARNING

Although halocarbon refrigerants are classified as safe refrigerants; certain precautions must be observed when handling them. Refrigerant can be harmful if inhaled. When released to the atmosphere in the liquid state refrigerants evaporate rapidly freezing anything they contact. Refrigerants must be used and recovered responsibly.

Failure to follow this warning may result in personal injury or death.

WARNING

Anhydrous Ammonia (NH₃):

Specific precaution must be adhered to when people are working with or are exposed to Anhydrous Ammonia.

Ammonia is considered a high health hazard because it is corrosive to the skin, eyes, and lungs. Exposure to 300 parts per million (ppm) is life threatening. Ammonia is also flammable at concentrations of approximately 15% to 28% by volume in air. When mixed with lubricating oils, its flammable concentration range is increased. It can explode if released in an enclosed space with a source of ignition present or if a vessel containing anhydrous ammonia is exposed to fire.

Personal protective equipment must be worn at all times when working with Ammonia. For systems that have an operating charge greater than 10,000 lbs. a process safety management program is mandatory. More information on this topic is available from OSHA.

Failure to follow this warning may result in personal injury or death.

2. General information

Adiabatic condensers and dry coolers are designed to provide optimum efficiency and an extended life when properly installed, operated, and maintained. It is therefore highly recommended that a comprehensive maintenance schedule be developed and undertaken on a regular pre-determined basis. This manual will assist in developing such a schedule.

The installation, operation, maintenance, and servicing should only be carried out by suitable individuals who are qualified to carry out these functions. These individuals shall also be familiar with and comply with all applicable governmental standards and regulations pertaining to these functions.

NOTICE

The type of refrigerant must comply with what is indicated on the submittal drawings and/or the unit's nameplate. Design operating pressures, as indicated on the nameplate, must never be exceeded!

NOTICE

Adiabatic dry coolers and all piping systems must be correctly evacuated prior to charging the system with refrigerant to ensure the complete removal of moisture and non-condensables from the entire refrigerant circuit.

WARNING

Failure to comply with any of these requirements could result in serious damage to the equipment and/or the property where it is installed as well as personal injury and/or death to themselves and/or people at the specific location.

3. Receiving and inspection

All equipment is packaged for easy handling and storage. Upon delivery inspect all components for possible shipping damage and/or shortages.

NOTICE

A specific visual inspection of the cooling pads (media) should be done to confirm that these have not been damaged during shipment.

NOTICE

Record any unit damage or shortages on the Bill of Lading and report to the carrier and factory immediately. Shipping and handling damages are not warranty items.

Take photos of all damaged equipment and components. Damaged items are the responsibility of the designated carrier and should not be returned to the manufacturer unless prior approval is given to do so. Confirm that all items listed on bill of lading are received; especially all components required for the water distribution system and any loose items such as media pads, when shipped loose.

The unit(s) can be lifted using extended forks underneath the skid completely traversing the width of the unit and generally centered along its length. Do not allow the forks to make contact with the unit. Refer to the rigging instructions applicable to the specific condenser or dry cooler for greater detail.

4. Rigging

4.1 Pre-rigging inspection

Confirm that all components are secured in position and that nothing has come loose during shipment. Confirm all fasteners, brackets and piping connections are tight. Ensure the cooling pad supports are firmly in place and all cooling media pads are securely in position.

4.2 Rigging and installation

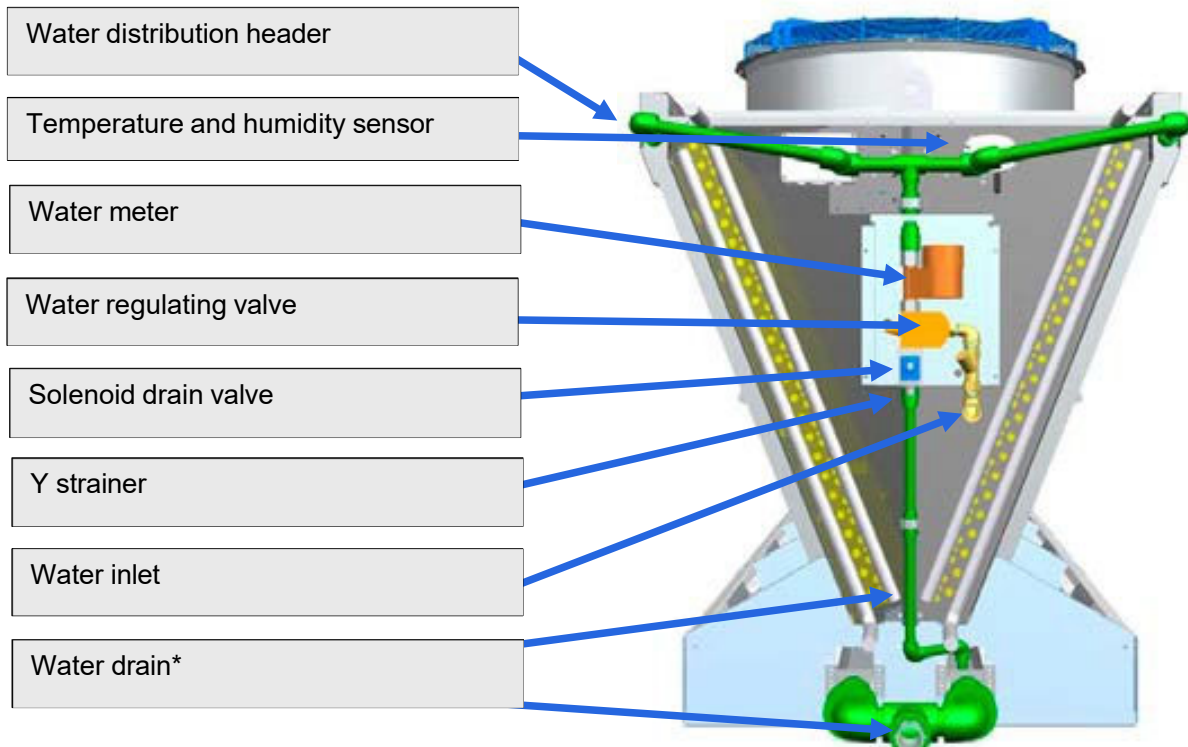
Refer to the rigging and installation instructions within the IOM for the respective unit.

⚠ WARNING

Ensure that the unit is level. This is critical for the HFCG as the gutter has an inclination to allow the water to free drain. If the unit is not level, this inclination could be compromised to a point where water is allowed to stand in the gutter.

5. HFCG Series Water distribution system

Figure 1. Major components of the HFCG Series Adiabatic Cooling System image below:



* 2x8 and 2x9 models have 2 drain connections

The HFCG Series also includes the following major components not shown above:

- Ambient humidity and temperature sensor
- Evaporative cooling pads
- Water collection gutter
- The Hydro Management Controller (HM) which manages the water system.
- The Motor Management Controller (MM) which is wired and mounted in factory

NOTICE

All connecting piping to the water distribution system must be supported independently. The unit and associated piping are not designed to bear any additional piping loads. Failure to comply with this will result in damage to the system and void all warranties.

6. Start-up

6.1 System inspection

Ensure that all piping and components for the water distribution system are tight and secure. Check to ensure that all media pads are securely held in position and that there are no visible gaps between the pads. If required, clean the media pads using low pressure water in a range from 30 to 45 psig (2 to 3 bar).

It is recommended to clean and flush the distribution headers prior to allowing any water to flow over the pads, opening the drain header valve/cap. After flush, close the valve/cap.

This can be accomplished by opening the valve/cap at the end of the distribution header on the opposite end to the water inlet side and allowing water to flow through the headers until no dust, dirt or debris is visible.

Figure 2. Service ball valve for cleaning and flushing distribution header



Confirm that all drain piping has been completed and water flows freely out of the gutters. Drain piping installation on site shall avoid overflow in gutters.

6.2 Preliminary operation mode

The inlet water pressure must be in accordance with Table 2 and Table 3. HFCG Series systems has been set according to factory setting table below:

Table 1. Parameters required for start-up water control system

1. Parameters required for Start-up	
Parameter	Factory setting
Geodetic height (in meters)	540 (Monterrey)*
Airflow (xx*1000 m3h)	According to model**
Air speed (m/s)	According to model**
Max. Water Flow (l/h)	According to model**
Drive parameter (EC, FU, PC)	EC
Electric power (kW) fans	According to model**
2. Parameters required after Start-up	
Parameter	Factory setting
Wetting	
Humidification on	98%
Humidification off	85%
Outdoor temperature	72°F (22°C)6*
Draining	
Non-operating	24 h
Outdoor temperature T<	43°F (6°C)
Water parameter	
Water threshold (Base value)	According to model**
Full load mode	100%
Increment	0%
Delay	3 min
Max H2O supply	1.3
H2O Offset	1.0
Selection IP/SI	
Selection	*SI

*Adjustable value on field by customer according with each site or Customer requirements.

**Variable value according with each unit depending on unit model and fan quantity. Find this value on datasheet or Table 2 and Table 3 of this IOM.

There are only two set points, which must be modified in field by the customer before startup of the unit:

- Geodetic Height: This value needs to be entered to HM in order to consider the air density depending the height where the unit will be placed. This is a metric value, and must be entered in meters above sea level.
- Outdoor temperature: The switch point setting needs to be entered in the HM. This set point will initiate the water flow over the adiabatic pads. This value can be a preset ambient temperature, or a specific fluid temperature.

Prior to system start-up, verify the operation of the water distribution system with the following steps:

1. Enter an outdoor temperature set point that is lower than the actual ambient temperature on the HM controller
2. Enter a water threshold (minimum water flow required to turn on the HFCG Series system) 10% lower than the unit requires
3. Modify set point on MM to a value 20 °F (-7°C) lower than the actual process temperature
4. Once finished points 1 to 3 mentioned before, verify that the water regulating valve has being activated and allow water flow through media pads (The discoloration of the media, once wetted, will be clearly visible). This confirms a properly functioning of the HFCG Series system

Figure 3. The regulating valve will automatically meter the exact water flow rate to be evaporated as required by the HM controller.



Figure 4. Water distributes from above the media pads, which transition from dry to saturated.



5. Ensure that there is no water carry over outside of the pad area.

NOTICE

If water carry over outside the unit occurs, please contact Customer Service to evaluate the case. Please note that 5% of water carry over is permissible.

6. Confirm that all water caught in the gutters is able to free drain unobstructed.

6.3 Operation mode

1. Enter the desired ambient temperature set point in the HM. This will be the switch point at which time, water supply to the adiabatic pads may be initiated.
2. The minimum water threshold is preset in the HM and is dependent on the unit size.
3. Enter the desired temperature set point in the MM.

Only when all three of the above parameters are met, will the water supply to the adiabatic pads be initiated.

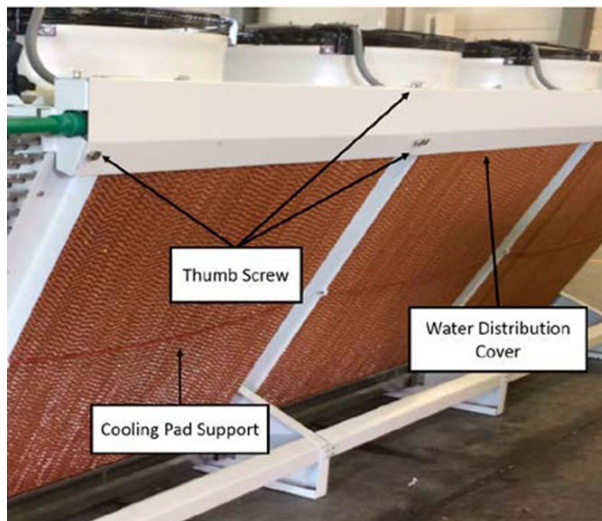
NOTICE

When the ambient temperature drops below 43°F (6°C) the water distribution system will drain automatically.

The end-user's water supply and piping to the metering valve are not protected from freezing. **This protection must be supplied by the customer with heat trace and insulation or other satisfactory method.**

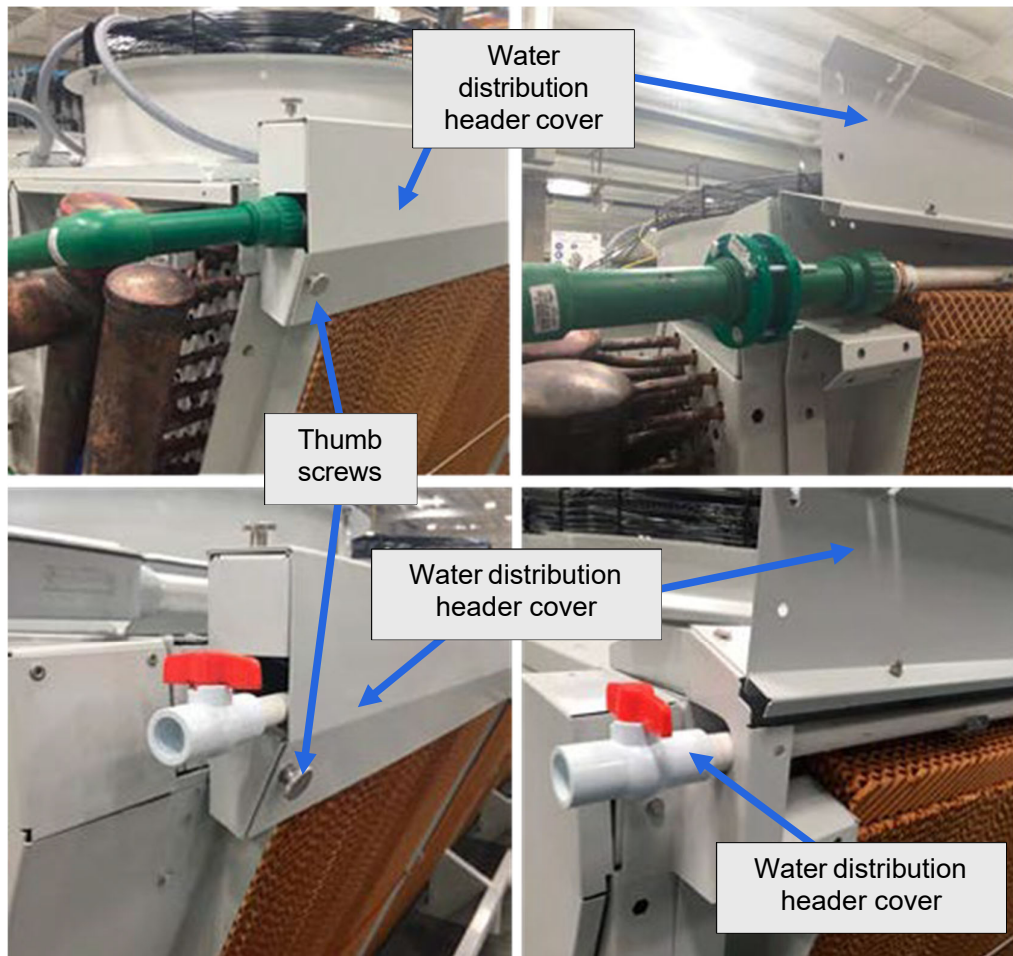
7. Extended shut down

- If the system will be shut down for a period of three weeks or more, please ensure the following: Lock out, and tag all electrical power supplies.
- The HFCG Series water system uses a normally open solenoid valve to ensure water is drained from the system in the event of a power outage. Assure that drain solenoid valve is open.
- The media pads must be removed from the unit and placed in a well-ventilated storage area and not exposed to sunlight.



To remove the cooling pads:

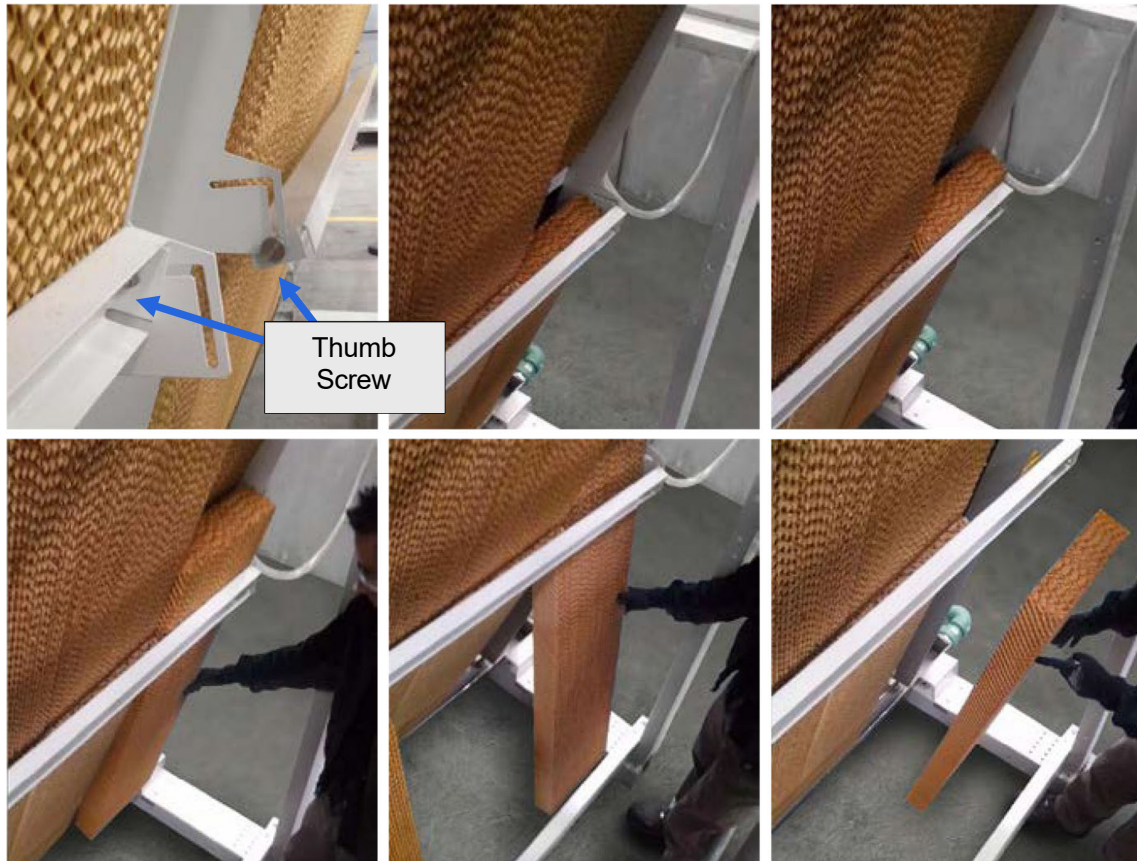
- Remove the thumb screws and lift to open the header cover.
- Water distribution header cover



- With the header cover open, remove the top cooling pads by simply lifting them up and out.



- Loosen the thumb screws on the cooling pad support and slide the cooling pad support out and down to create space for the removal of the bottom cooling pads.
- Lift the bottom cooling pads up out of the gutter and then out to remove.



8. HFCG Series operation

The HFCG Series is an adiabatic cooling process with an innovative and high technology control system which manages the water and energy consumption based in 4 main parameters.

1. Fluid temperature
2. Ambient condition (Outdoor temperature and humidity)
3. Fan speed
4. Water flow

The principle behind the adiabatic cooling process is that as water evaporates the surrounding air becomes cooler and more humid. This is a natural occurrence. Therefore, a portion of the water which is distributed over the media pads will evaporate. The heat that is needed for the evaporation process is removed from the air. The air that leaves the pad is therefore cooled and humidified simultaneously resulting in the temperature of the air entering the finned heat exchange surface being closer to the wet bulb temperature. This process permits a lower entering dry bulb temperature onto the finned heat exchange surface; effectively creating a greater approach and thereby utilizing less finned surface for the heat rejection requirement(s).

Each unit fitted with the adiabatic cooling media pads has a high cooling efficiency with maximum water flow for optimum operation. This water flow and fan speed will be controlled by HM-MM controls according 4 main parameters settings, provide accuracy fluid temperature with smart control for water and energy saving.

The HFCG Series can operate at partial or full water flow, or dry, dependent on ambient conditions and the fluid temperature / pressure. Under normal operation, with either full or partial water flow, a portion of the water will be evaporated. Water which is not evaporated will flow across the pads, providing a “cleaning” function and into the gutter. The drain outlet (gutter outlet) should be routed to a waste water drain.

NOTICE

Partial wetting of the adiabatic pads is a normal operation for the HFCG Series ACS. The pads will only be completely wetted when water flow is at 100%.

⚠ WARNING

Inlet supply water pressure **MUST** be in accordance with Table 2 and Table 3.

Table 2. HFCG Series Water Flow

Model	Maximum water flow		Minimum water flow (Water Threshold)	
	l/hr	US GPM	l/hr	US GPM
1x2	705	3.1	68	0.3
1x3	1070	4.7	102	0.45
1x4	1410	6.2	136	0.6
IMPORTANT NOTE: Supplier water pressure must be 1.5 bar (20 psig) to 4 bar (60 psig)				

Table 3. HFCG Water Flow

Model	Maximum water flow for		Minimum water flow (Water Threshold)	
	l/hr	US GPM	l/hr	US GPM
2x2	975	4.3	91	0.4
2x3	1460	6.4	136	0.6
2x4	1950	8.6	182	0.8
2x5	2435	10.7	227	1
2x6	2920	12.9	273	1.2
2x7	3410	15.0	318	1.4
2x8	3900	17.2	363	1.6
2x9	4380	19.3	409	1.8
IMPORTANT NOTE: Supplier water pressure must be 1.75 bar (25 psig) to 4 bar (60 psig)				

9. Water quality guidelines

Typical municipal and well water supplies are suitable for use on the HFCG. The application of other water sources, cleaning agents, or treatments must be compatible with the materials of construction. The HFCG components include polypropylene piping, brass valves and fittings, PVC distribution headers, cellular media, and type 304L stainless steel frames and gutters.

Table 4. HFCG Series Water quality parameters.

Designation	Lower Limit	Upper Limit	Units
Conductivity	-	< 450	microSiemens/cm
Calcium Hardness (as CaCO ₃)	-	< 170	ppm [mg/l]
Chlorides (as Cl)	-	< 50	ppm [mg/l]
Total Alkalinity (as CaCO ₃)	-	< 170	ppm [mg/l]
pH	6.5	8.5	-
Sulfate (SO ₄ ²⁻)	-	< 250	ppm [mg/l]
Silica (as SiO ₂)	-	< 25	ppm [mg/l]
Iron (as Fe)	-	< 0.2	ppm [mg/l]
Oil and grease	-	< 2	ppm [mg/l]
Total dissolved solid	-	< 550	ppm [mg/l]
Suspended solids	-	< 5	ppm [mg/l]
Colony-forming units	-	< 50	ppm [CFU/ml]

⚠ WARNING

Failure to adhere to these water inlet quality parameters will reduce the lifespan of the adiabatic pads. Further, scaling, sometimes severe, can also occur.

10. Cooling pad media guidelines

The functionality of the HFCG Series system is such that the evaporation of the water occurs at the pad media surface as it flows over and through the pads. Standard water treatment practices are therefore somewhat different to standard heat exchanger practices. The methodology is to provide just the required water quantity to the pads to maintain the process temperature, or pressure, set point.

Many water related problems can be avoided if good system design and basic housekeeping practices are followed.

- The system is designed to operate with partial or completely wetted pad media. In some conditions excess water will flow into the gutter(s).
- Clean and flush distribution PVC headers on a regular basis to prevent buildup of deposits or microbiological growth.
- Replace damaged or spent pad media.
- At times or specific locations when the pad media experiences extreme evaporation, a flush cycle is recommended every 24 hours with the fan off.
- Locate the equipment and use appropriate water sources to minimize or avoid ingestion of contaminants that can clog or damage the media pads. Some examples include airborne dust/debris and exhaust air from other processes or equipment.

11. Cooling pad media maintenance

- Avoid harmful contaminants including dust, dirt, fumes and harsh cleaners.
- Use only low pressure water in a range from 30 to 45 psig (2-3 bar) to clean the pad media.
- Drain and disinfect the entire water distribution system quarterly with compatible concentrations of disinfectants with ball valve in PVC header open.

12. Maintenance

Recommended Inspection and Maintenance Frequencies	Start-Up	Weekly	Monthly	Quarterly	Annually	Shut-down
Inspect and Clean as required						
Visually inspect pads for bowing, sagging or dry streaks	X	X			X	X
Inspect gutters and remove any debris	X	X			X	X
Check water distribution system for leaks and clogged distribution holes	X	X			X	
Flush water distribution system			X		X	X
Drain and disinfect the entire water distribution system				X		
Check water flow rate and adjust if necessary	X		X		X	
Check water distribution is even across entire length of unit	X		X		X	
Remove all dirt and debris from the media pads			X			X
Clean the Y-Strainer's mesh	X			X		

13. Adiabatic cooling system controls

13.1 Hydro management (HM)

The wetting system is used to increase the capacity of heat exchangers at peak load times with high external temperatures and for more efficient heat dissipation with moderate ambient temperatures making efficient use of the water consumption. The adiabatic evaporation of the water on the media pads cools the air drawn in by the heat exchanger, which increases the heat exchanger's capacity. The wetting controller HM governs the regulation of the wetting process. The required water volume is calculated on the basis of the load state, the ambient temperature and the relative humidity. The HM sets the appropriate water volume using the water regulating valve. The system's frost protection is secured with automatic draining. The water supply to the unit must be protected separately against frost.

There are three possible operating conditions when the HFCG Series accessory is included on a unit when utilizing the Motor Management Controller.

- Dry mode
- HM Water Saving Model
- HM Energy Efficiency Mode
- HM Manual Mode

13.2 Dry mode

This is the standard operating mode for the unit when ambient temperature and process are within the design operating conditions. In this operating mode the Motor Management controls motors and regulate the speed to achieve the desired process set-point, no water is used in this operating condition.

13.3 HM Water saving mode

Only as much water as the media pads can evaporate is applied with this mode as standard.

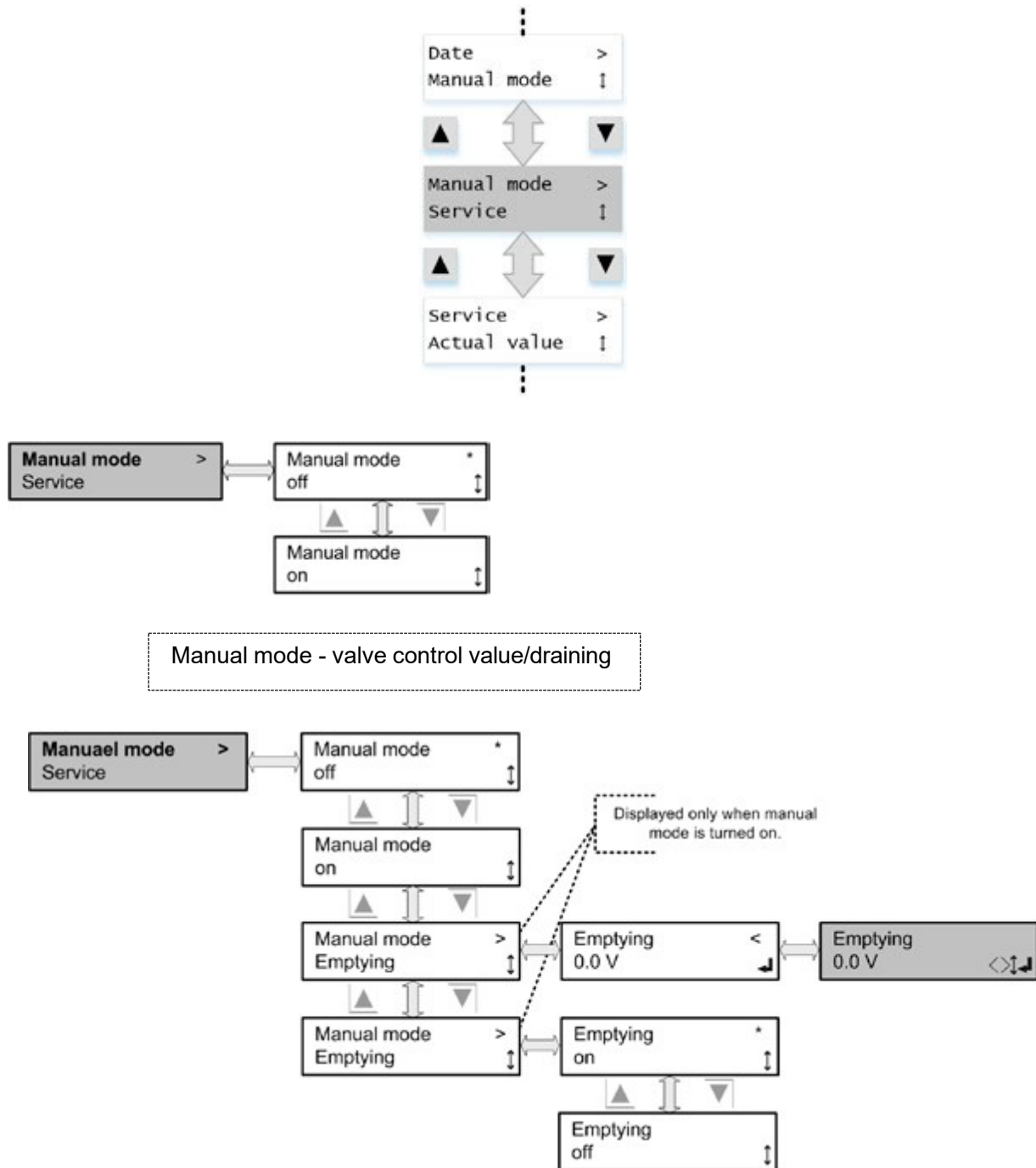
13.4 HM Energy efficiency mode

More water is used in this mode, as the focus is on conserving as much fan power as possible.

13.5 HM Manual mode

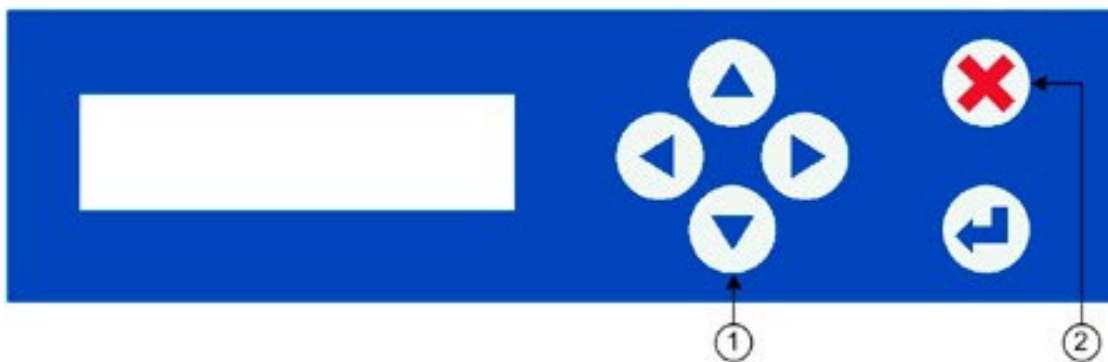
- Manual mode is used to operate the system's water inlet valve and drainage valve by hand.
- Manual mode does not depend on DI1 enabling.
- Manual mode has the highest priority and switches all other control types off.
- The prerequisite for switching on the manual mode is the set external temperature.
- This must be above the frost temperature, as otherwise the manual mode cannot be switched on. Wetting is not permitted in manual mode without recording the external temperature.
- The fact that manual mode is active is recorded permanently. In other words, it will still be active after you have switched the system off and back on.

13.6 Manual mode ON / OFF



13.7 Adjusting settings on the HM

- Cancel and return to INFO menu
- Enter key for function selection; change to EDIT mode and value acceptance
- Right arrow for moving to the next menu level
- Left arrow for moving to the previous menu level
- Up / down arrows for scrolling through the menu level



1. Use this key to move from the "INFO" menu to the Operating menu
2. Use this key to return to the "INFO" menu at any time

13.8 Edit mode

This mode is required to change values (control values, for example).



Select menu option you want (top line)

Humidification ON
Humidification OFF



Change to menu option

Humidification ON <
rpm > 60%



Change to writing mode
(cursor flashes)

Humidification ON <
rpm > 60%

Humidification ON <
rpm > 60% <>↑↓



Decimal point selection
(cursor flashes)

Humidification ON <
rpm > _0,0% <>↑↓

Humidification ON <
rpm > 60% <>↑↓



Change value

Humidification ON <
rpm > 65% <>↑↓

Humidification ON <
rpm > 65%



New value acceptance



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