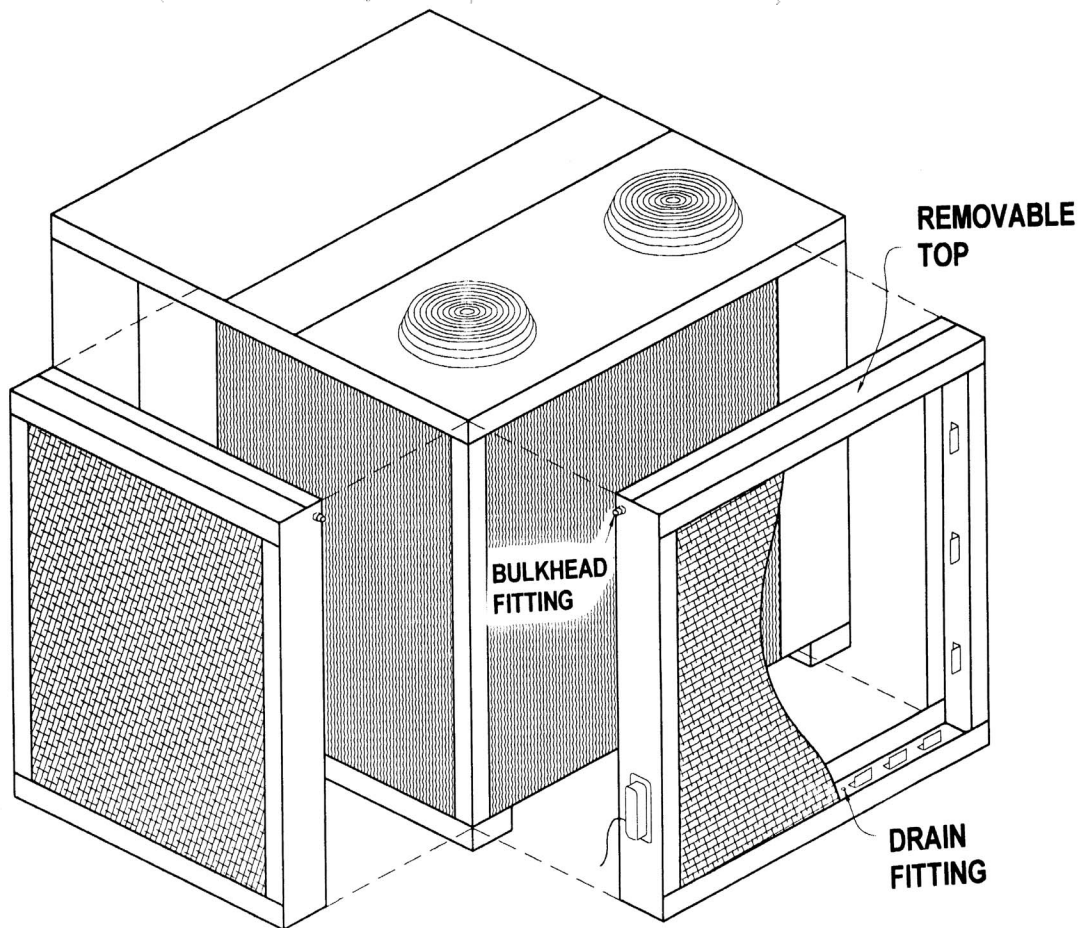


PRECOOLER

PRE-CONDENSER EVAPORATIVE COOLERS

Installation, Operation, and Maintenance Manual



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I - THEORY OF OPERATION

A. General

Most ENERGY SAVER Evaporative Precooler Systems are designed, engineered, and manufactured to attach directly to the condenser section of air conditioning or refrigeration equipment and utilize the airflow of the existing fan(s) for operation. The precooler unit is typically designed not to exceed 500 feet per minute face velocity at any time.

Evaporative Precoolers rely entirely on the evaporation of water for operation. As water moves downward through the media, drawn by the air velocity of the condenser fan, some of the water evaporates. This evaporation cools the air before it reaches the condenser coil. The condenser unit of the air conditioning system operates more efficiently than otherwise possible when temperatures exceed 80° dry bulb.

The media is cross-fluted and slopes at angles of 45 degrees towards the entering air face of the media and 15 degrees toward the leaving air face. The design of the media directs the water to flow towards the entering air face of the media, thereby preventing water carryover onto the condenser coil. This water flow also tends to minimize the collection of dust and other debris, which attempts to enter the air face of the evaporative media.

B. Detailed Description

1. Media

The 4 inch deep media consists of 78 lb. Kraft cellulose material impregnated with rigidifying agents, fungicides, and wetting agents to provide a self supporting, highly absorbent, non-decomposing unit.

The media is designed to provide equal airflow through flutes arranged at an angle 15 degrees to the horizontal airflow and consistent water flow through flutes 45 degrees to the horizontal airflow. Media construction provides at least 123 square feet of evaporative surface per cubic foot of media.

The 4 inch deep media pad has a static pressure drop not to exceed 0.09 inches (water gauge), at a face velocity of 500 fpm, when wet and develop a saturation efficiency of not less than 66%. The standard media pad has a dry weight of 1.98 lb/ft and wet weight of 4.16 lb/ft .

The media will not exceed ASTM-E84-94 Flame Spread 450 and Smoke Developed Value of 420. The media does not contain aspen, animal hair or other synthetic materials.

All precoolers are typically sized for a maximum face velocity of 500 FPM.

- 90 lb. High Performance Media is optional.
- Fire Resistant Fiberglass Media is optional.
- Leading Edge Coated Media is optional.

2. Media Water Distribution System

The water distribution plumbing and interconnections are schedule 40 PVC or copper tubing with solid brass inlet fittings where applicable. Water distribution over the media sections is through 100% polyester cloth fiber hose with at least ten (10) water outlet perforations per foot and includes a half round PVC spray distribution cover over the entire media length. The water distribution system is easily accessible from outside of the unit.

3. Wet Media Housing

Media housing is 6.375" deep and custom constructed from 3/16" thick, industrial grade, high impact, and corrosion proof UV resistant extruded ABS polymer. All exterior surfaces are painted with a UV resistant acrylic coating to increase protection from the sun. The housing has a removable top section for front media removal. The bottom media supports suspended the media above any standing water. All media cases include a drain fitting, located as defined by application or installed by the end user.

4. Water Control Systems

a. Operating Instructions For The Microprocessor Regulated Water Supply System (MPR)

POWER ON

1. Red power light is on for about 3 seconds
2. The System Water Supply Solenoid Valve will open and the red power light blinks on and off at 1 second rate
3. The System Water Supply Solenoid Valve will stay on for a period of time depending on S M or L configuration setting.
4. The System Water Supply Solenoid Valve will turn off and the power light will be on blinking at 1 second time

The power light will be on for about 5 seconds then returns to normal operation of blinking on and off.

CALIBRATION

1. Press the calibration button and hold it on for 2 seconds; the power light will blink rapidly.
2. Press the button once more and the System Water Supply Solenoid Valve will open, and the power light will blink off, then on for 1 second.

3. Press the button once more and the System Water Supply Solenoid Valve will close and normal cycle will begin.

NOTE: Pressing and releasing the button again will turn off (close) the valve (starting a normal off cycle) and store the time between button presses for all future on (valve open) cycles.

The calibrated time is stored in non-volatile memory so that it will be remembered even if power is removed from the unit.

NOTE: Consult the IOM manual for the MPR for more detailed information.

**b. Recirculating Systems (Sump system)
Consists of the following components:**

Sump - reservoir holds the water that will be recirculated over the media.

Submersible Pump - will recirculate the water that is contained in the sump over the media.

Water Balancing Valve - will regulate the amount of water that flows over the media.

Bleed Valve - will regulate the amount of water that is bled off to keep the system water from becoming contaminated. The amount of bleed water is typically 6% of the evaporation rate unless the water quality is extremely poor.

**c. Recirculating System (Central Sump)
Consists of the follow components:**

A Central Sump system will not have reservoirs on each unit, but will have a large reservoir at a central location and all water supply plumbing and drain plumbing will be connected to it. This system is utilized when there are numerous precoolers in close proximity. The Central Sump will have a pump large enough to provide an adequate supply of water to each precooler that is attached.

5. Transitions

a. OPTIONAL (Supplied by *ENERGY SAVER*)

Transitions are required when the CFM of the condenser fan(s) will yield a net pad velocity in excess of 500 FPM if the precooler is made the same size as the condenser air opening. The transition is constructed of, at a minimum, 18 Ga. G90-galvanized steel or equivalent. All welds are protected by a zinc rich coating.

b. Transitions (when field fabricated)

Field fabricated transitions must be of adequate strength to hold the precooler, with wet media, in a level and rigid position during operation. When the precooler is of much greater size than the condenser opening, the transition length must be great enough to ensure a reduction angle of 30 degrees or less. (See figure 1).

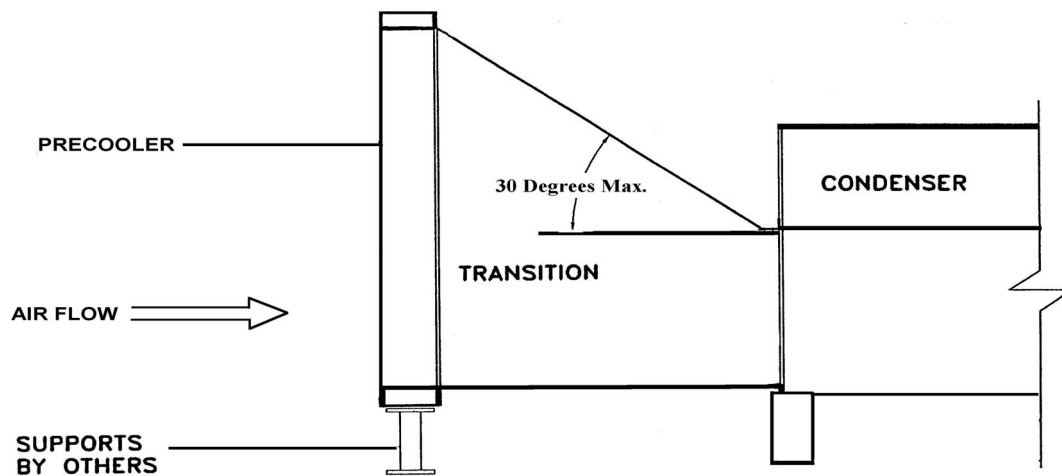


Figure 1.

II - RECEIVING AND UNPACKING

The Evaporative Precooler is shipped assembled. When two or more precoolers are being installed on the same air conditioner condenser or condensing unit, generally only one MPR is required. However, on certain individually controlled compressor units, additional MPR water control systems are provided.

On precoolers with the recirculating water control systems, an install kit is enclosed containing drain fittings, compression fittings, screws, washers, and installation instructions.

CAUTION: When unpacking the unit, ensure that no parts are accidentally discarded or lost!

Visually inspect the unit for obvious defects or damage. All units are thoroughly inspected prior to leaving the ENERGY SAVER manufacturing facility. Should any defect be noted, claims for damages should be filed with the carrier and notification sent to ENERGY SAVER.

III - INSTALLATION

A. Mounting Instructions

NOTE: Extreme care must be taken to ensure that any and all mounting screws are kept away from all condenser tubes. Mounting screws could penetrate a condenser tube causing refrigerant leakage. Vibration could also cause an eventual penetration if the mounting screw is left near a condenser tube.

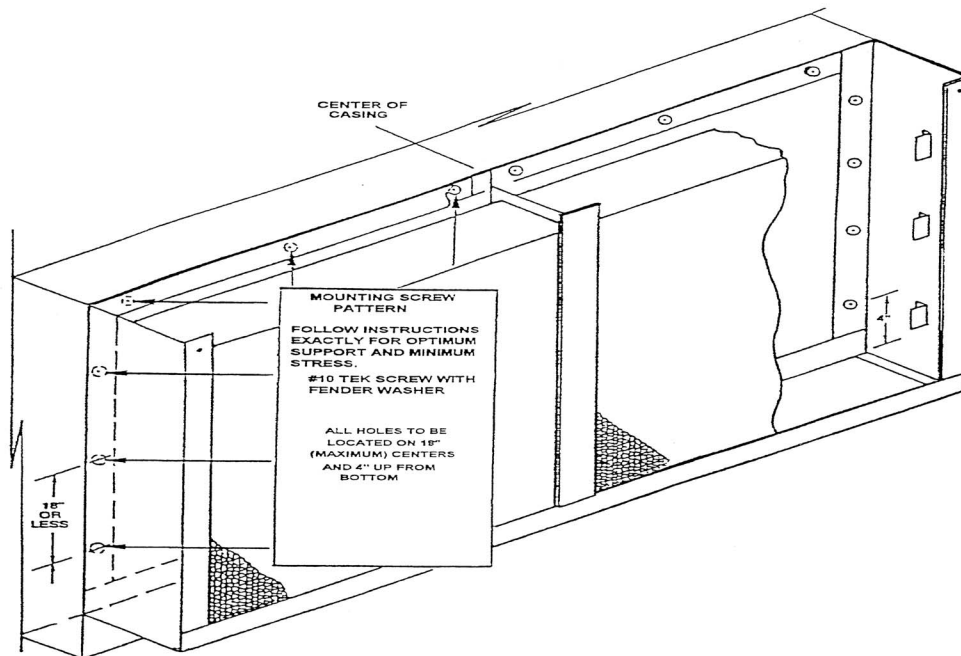
NOTE: Any obstacles in the way such as electrical disconnect boxes or electrical lines need to be relocated or sheet metal adapters may need to be fabricated in order to obtain proper installation.

Prepare the opening, when possible, by removing any louvered panels or wire screens in front of the condenser. Remove any other unnecessary (non-structural) sheet metal screws around the outside of the condenser opening so the precoolers will fit flush against the unit.

Remove media from the casing before attempting to mount the cell. Mounting the cell in any fashion other than that described in this manual may void the warranty. Notice the red dye mark on the top of the leaving airside of the media. Be sure to reinstall the media in the same position. Failure to do so will result in water carry-over into the air conditioning unit and may affect the air conditioner warranty.

1. Cell Mounting

NOTE: It is important that the top of the Evaporative Precooler be level when installed to ensure distribution of water over the media.



NOTE: Extreme care must be taken to ensure that any and all mounting screws are kept away from all condenser tubes. Mounting screws could penetrate a condenser tube causing refrigerant leakage. Vibration could also cause an eventual penetration if the mounting screw is left near a condenser tube.

1. Hold the cell in position over the coil opening to observe any interference. On multiple cell units place all units in position to verify that the proper cell is in the proper position.

If the Evaporative Precooler does not completely cover the coil section of the condenser, any openings should be blocked off to prevent air from bypassing the Precooler. The block-off must not restrict airflow through the condenser coil.

In addition to the mounting screws along the casing, it is necessary to support large Evaporative Precoolers by placing supports (customer supplied) beneath them. This includes precoolers with large single pads over 48 inches long, and those with two or three media pads in the same cell.

The spacing of supports beneath the Evaporative Precooler varies with the length of the unit. A 12" wide support should be centered beneath a single-pad cell. When installing cells with two pads, space three supports. Two pads units will need 12" wide supports. On units more than 120" long, 20" wide supports are required. In addition to sheet metal, supports may also be constructed of materials such as wood or angle iron.

2. Just before mounting each individual cell, apply liberal amounts of silicone or equal caulking / construction compound to the mounting surface of the cell. Take care to note, which is the mounting surface. It is the opposite surface from the media access surface.
3. Place the case against the condenser section.
4. Center the cell over the condenser coil opening.
 - a. Locate the center (or 2" from center brace on doublewide cells) of the top flange of the cell.
 - b. Fasten the casing at this point to the condenser section using a supplied Tek screw and a fender washer.
 - c. Ensure that the cell is level.
 - d. Run a Tek screw in at about 4" up from the bottom of each side.
 - e. There are now three screws.
 - f. Continue mounting the cell with screws no more than 18" apart around the side and top flanges.
 - g. **DO NOT** run screws through the bottom flange.

2. Transition Mounting

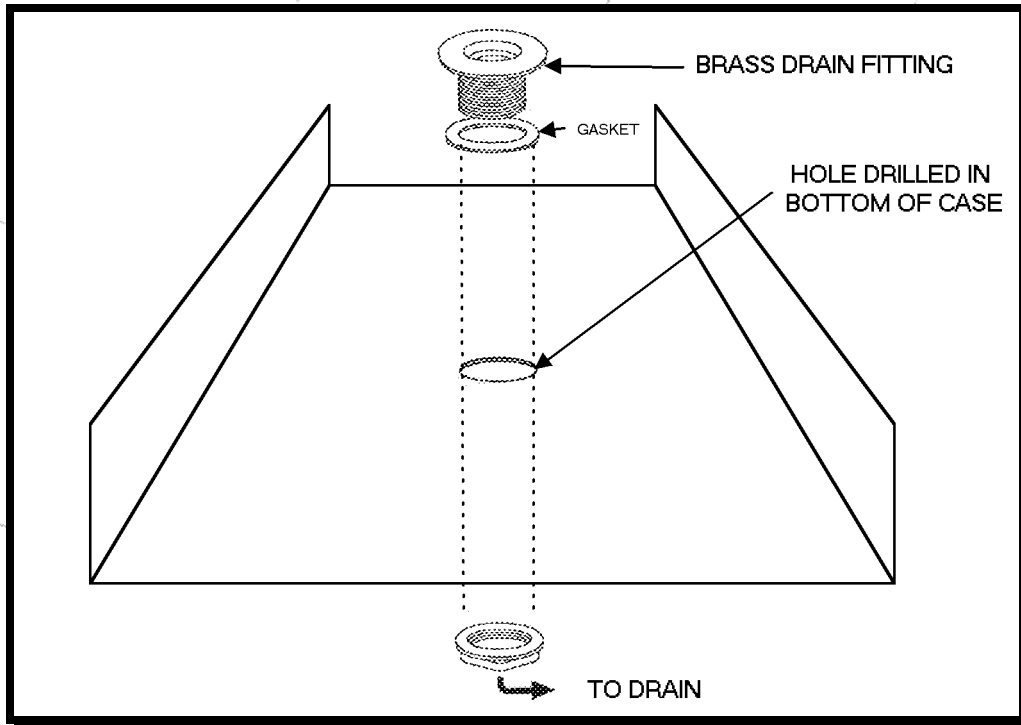
Optional transitions may be supplied with the pre-cooler system. Transitions and ducting are of sheet metal and have flanges like the pre-cooler cells. The mounting of the transition should proceed exactly as described in III A 1 above for the cell mounting. The cell then mounts to the transition as described above.

B. Install Drain Fittings

If the case is not predrilled, drill a hole in the bottom of the case, at the lowest point for attaching the brass drain fitting. Figure 3 shows installation of the drain fittings provided.

Run a drain line from the unit to dispose of wastewater, piping it into the ground, sewer, condensate return from the evaporator section, or some other disposal location. On a central sump system, the drain will be return to the central sump.

The bleed off and overflow drain from recirculating unit should be installed in the same manner.



NOTE: When installing multiple cells to a common drain line, a minimum 1-1/2 inch drain is required.

C. Water Connections

NOTE: Unless unit is a recirculating type see separate instruction manual for MPR before proceeding.

The Evaporative Precooler operates on supply line water pressure and requires approximately 1/3 gallon of water per running hour per ton of refrigeration when the compressor is running. MPR type water supply systems are recommended for use with the precooler. If water pressure is over 60 PSI, a pressure regulator must be installed to reduce the pressure of 60 PSI.

Attach the MPR water control housing to the case using the screws provided. Install a water line of copper tubing* from the domestic water supply to the solenoid valve provided (refer to the unit specifications for the specific tubing size required for your unit). Connect the water control housing to the bulkhead fitting(s) with copper tubing. Refer to the MPR Installation Operation Manual for wiring program.

NOTE: *This copper tubing is to be supplied by the customer and should meet local plumbing codes.

Water distribution tees that are brazed or soldered should be tested for plugged branches before further assembly. Customers with units ground water should provide strainers.

The bulkhead fitting is connected to the water flow control valve and the polyester soaker hose. This internal plastic tubing must not protrude into the air stream of the Evaporative Precooler. Cold supply water can cause water vapor to condense on the tube, and these droplets could be picked up by the air stream and carried into the condenser.

Adjust the water flow control valve to minimize waster water while ensuring that the entire media pad becomes wet during each ON period. Water flow should be adjusted at maximum airflow and wet bulb depression to assure complete wetting of the media at all operating conditions. This is described in detail in the separate INSTALLATION and OPERATION MANUAL for the MPR.

CAUTION: Do not continuously flood media with water, as this will cause premature breakdown.

An even flow from top to bottom of the media pad with the least amount of water is all that is needed to assure maximum efficiency and life span.

D. MPR Electrical Connections

NOTE: Installation and Maintenance instructions for operating the MPR can be found in a separate more detailed IOM.

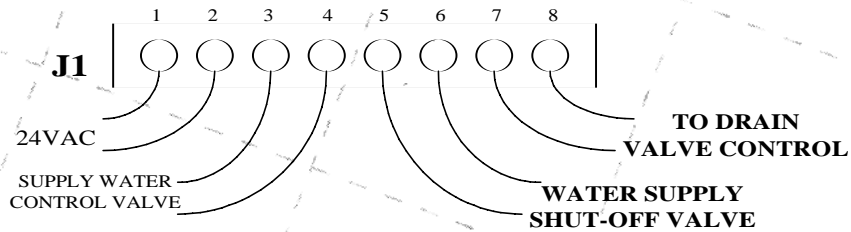


Figure 4

The transformer should be wired in existing electrical control panel as follows:

- STANDARD** In parallel with the load side of the #1 or main contactor.
- OPTION A** Units with more than one compressor or with compressor unloading may choose to wire in parallel from the full load compressor contactor or from the unloaded circuit, only when the unit is under full load.
- OPTION B** Units that have staged condenser fans may use these relays to operate the transformer.

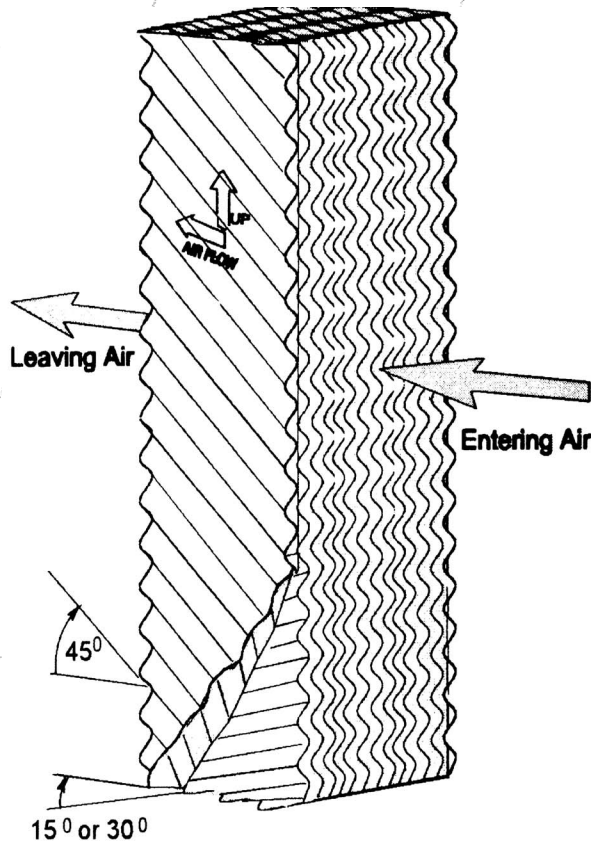
After the wiring method, which best suits the application has been chosen, connect transformer low voltage (24 Volt) wires to the MPR.

IV - MAINTENANCE

A. Media Maintenance

In order to get the best performance from your cooling media pads, they must be installed properly. If you have purchased a pad with two equal angles, then it can be installed in either direction.

Depending on the application, pads are manufactured with special angle combinations. Those having combinations of $15^\circ \times 45^\circ$ or $30^\circ \times 45^\circ$ are made to direct more water toward the air entering side of the pads. If installed backwards, the pads may not work properly.



Pads must always be installed with the steeper flute angle sloping down toward the air entering side. The reasoning is simple. The steeper angle puts more water on the entering side of the pad where the air is hot, dry and dusty and extra water is needed most. The unequal angles also counteract the tendency of the air to push the water toward the air leaving side of the pads.

CAUTION: Do not expose evaporative media cooling pads to sparks, open flame, welding spatter, temperatures in excess of 350 F. or other sources which may ignite the paper. The new GLASdek® media (a porous fibreglass) will not readily ignite, unless exposed to a direct flame or extremely high temperatures for an extended period of time.

If excessive deposits begin to build up on the media, there may be several problems.

1. If the build up occurs when using MPR water supply system there is not enough water flow on the media pad. Adjust timer for more time ON. In general, complete pad wetting prevents the pad from drying out and prevent build up of mineral deposits.
2. If the build up occurs when using a recirculating pump or central sump water distribution system, increase the bleed off rate.

3. If the water is extremely hard, more frequent pad replacement may be necessary.

The pad can be cleaned while water is flowing by brushing it with a soft bristled brush in an up and down direction.

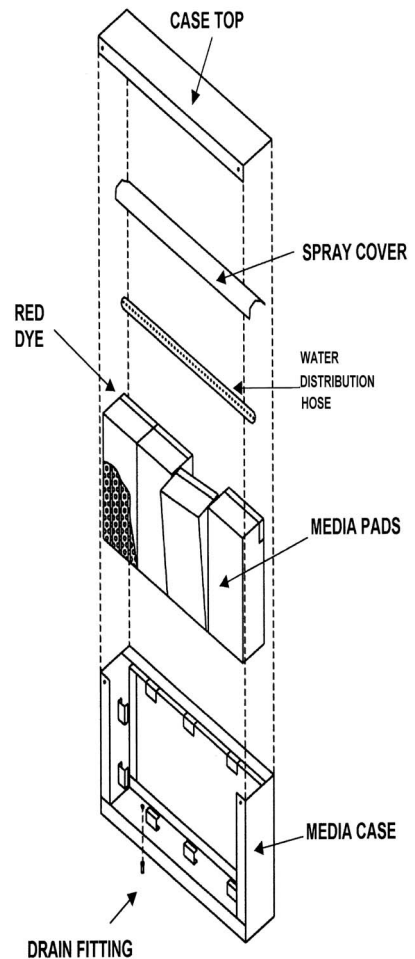
If the media becomes clogged with contaminants or mineral deposits which cannot be removed by cleaning, or if the media loses its structural integrity such that it is restricting the airflow, the media should be replaced.

B. MEDIA PAD REMOVAL

1. Remove case top
2. Remove spray cover (Anti-Spray Half Tube).
3. Unhook water distributor (Nylon Soaker Hose).
4. Lift pad(s) out of the case.

C. MEDIA PAD INSTALLATION

1. Place media pad into case noting that the red dye on pad is at the leaving air top of case.
2. Reinstall water distributor (Nylon Soaker Hose).
3. Install spray cover (Anti-Spray Half Tube).
4. Slide case top cover into position and secure with screws.



CAUTION: Do not use an acid base cleaner as this may cause damage to the media.

D. MEDIA CASE and MPR SOLENOID VALVE MAINTENANCE

The ABS media case requires very little to no annual maintenance. At the end of the cooling season, when preparations are being made to winterise the pre-cooler, a simple flush and cleaning of the debris that has collected in the bottom of the unit should be adequate.

If the MPR solenoid should become plugged, back flush it with the existing water line.

G. ANNUAL SHUTDOWN

Visually inspect water distribution hose for any restrictions. Wash down the media with fresh water to flush out any accumulated particulate matter.

F. WINTERIZATION - Without Optional Auto-Freeze Protection

Shut off water to system when operating temperature drops below 50° F. Drain water system to protect the pipes from freezing. Disconnect both pipe connections to the MPR to drain all water remaining in the pipes.

Media must be removed if ice or snowstorms are anticipated to prevent damage to the media caused by freezing and thawing.

G. PRECOOLER PRODUCT WARRANTY