

NOTE! READ AND SAVE THIS MANUAL — IMPORTANT SAFETY INSTRUCTIONS

USE AND CARE INFORMATION FOR CEL-AIR EVAPORATIVE COOLERS

The selection of evaporative cooling as a method of cooling your building will provide maximum cooling at minimum operating expense. Your evaporative cooler unit is designed and built to provide many years of dependable operation. The following information includes sections on installation, start-up and regular maintenance.

INSTALLATION AND START-UP SAFETY

- An evaporative cooler should only be installed by a qualified and experienced installer in which all work should be in compliance to all local and national electrical codes.
- Before installation it is important to be certain the mounting surface will bear the operating weight of the unit. For proper unit operation it is also important that it be operated in a completely level position.
- Electrical wiring must be installed a safe distance away from any sharp or moving parts (blower wheels, pulleys, sheaves, belts, etc.).
- Either an open drip proof or totally enclosed fan cooled motor may be used. Check the electrical supply to see that it matches the requirements shown on the motor name plate.
- Guards should be installed when blower is within seven feet (7') of working level or when deemed advisable for safety.
- Evaporative media should be wetted-out, dried and reservoir drained, then repeat process one more time before running for normal operation.
- A bleed-off is required to prevent scale from formation on the evaporative media.
- All safety devices and panels of unit must be reinstalled and remounted as previously mounted before start-up, servicing or cleaning.

PRE-START CHECK LIST

- For adequate water supply attach a minimum 3/8" water line to float valve. Min. 50 p.s.i. required.
- Fill water reservoir to a level of 2" to 2½" or as necessary.
- Check for leaks.
- Check to see that cooler is level.
- Check all piping connections for a tight fitting.
- Check water distribution system for an even flow.
- Check belt tension.



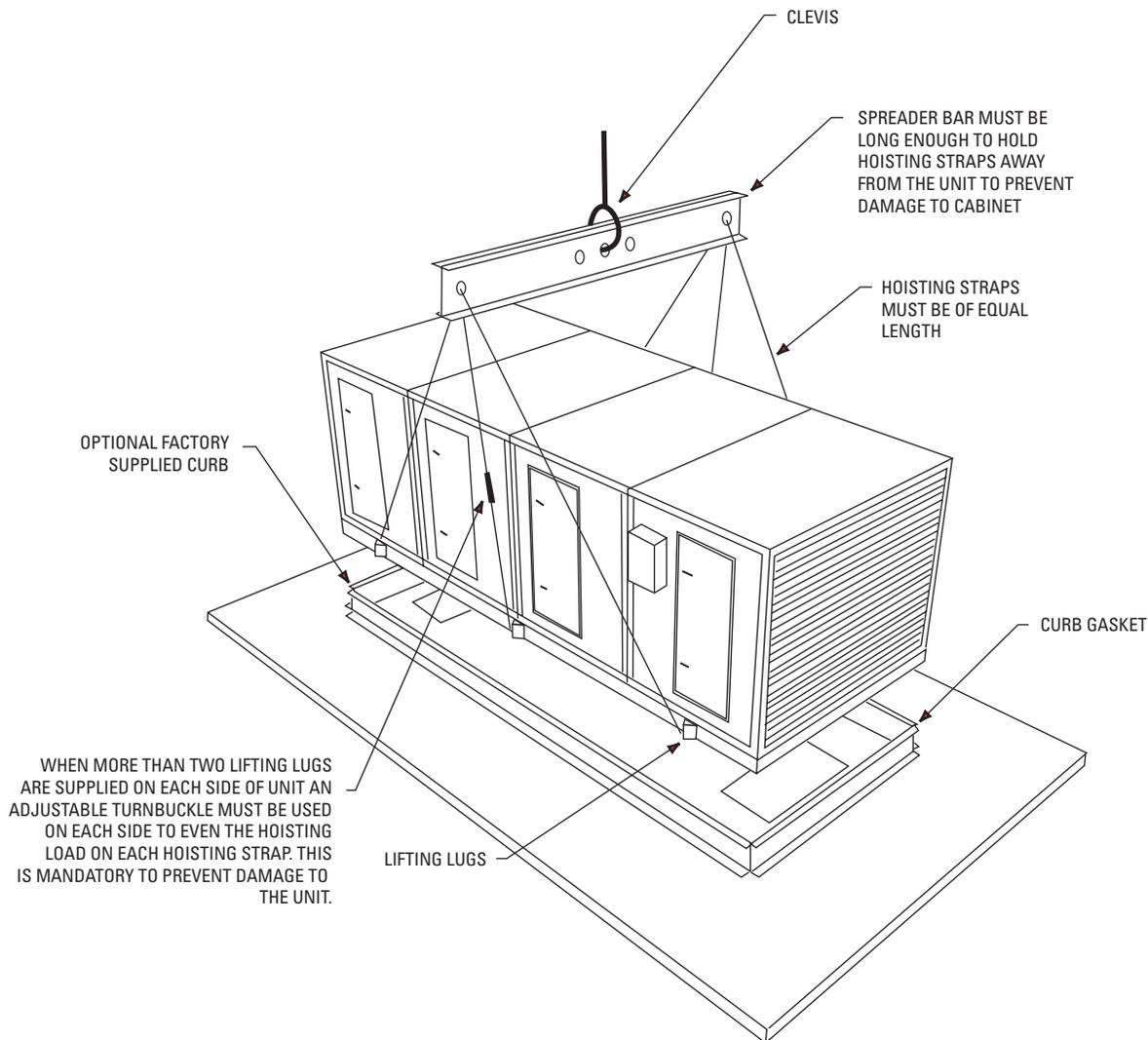
SAFETY

Caution: DISCONNECT ALL ELECTRICAL POWER TO THE UNIT BEFORE ATTEMPTING TO INSTALL, OPEN, OR SERVICE YOUR UNIT. IF THE UNIT IS THERMOSTATICALLY CONTROLLED, THE THERMOSTAT IS NOT TO BE USED AS A DISCONNECT AS IT MAY RESET AND START THE UNIT UNEXPECTEDLY.

For future reference, record Model and Serial Numbers of your evaporative cooler here:
(Numbers are located on the outside of the unit.)

Model No. _____ Serial No. _____

RIGGING INSTRUCTIONS



1. Avoid unnecessary jarring or rough handling.
2. Spreader bars must be used to prevent damage to the unit casing.
3. Care must be taken to keep the unit in the upright position during rigging.
4. Units will have lifting lugs welded and/or bolted to the base when specified.
5. Care must be taken to not damage the watertight seams in the unit casing.
6. Avoid damage to the curb and curb gasket when rigging onto a curb.
7. Only used trained professional riggers when moving equipment.

RIGGING

Proper handling of the equipment is mandatory during unloading and setting it into position.

NOTE: If equipment is not set in its permanent position and is stored on the ground or other unlevel area, proper provisions must be taken for supporting and protecting the equipment. See Long-Term Storage section on the other side.

It is mandatory that the proper spreader bars and hoisting straps be used when rigging. It is also mandatory that an experienced and reliable rigger be selected to handle unloading and final placement of the equipment. Your rigger must be advised that the unit contains delicate components and that it be handled in an upright position. Care must be exercised to avoid twisting the structure.

START-UP PROCEDURE

RECEIVING

Inspect the complete unit for shipping damage. If damage is present, you have the right to either accept or reject the shipment. If the receiving contractor or the receiving agent for the contractor elects to receive the equipment in a damage condition, it then becomes the contractor's responsibility to note the extent of the damage on the delivering freight bill of lading in the presence of the delivering agent (driver) of the delivering freight carrier in accordance with the ICC regulations. It also then becomes the responsibility of the receiving contractor to work with the delivering carrier to have the equipment repaired to the satisfaction of United Metal Products, Inc., so the warranty may remain valid. United Metal Products must also be notified of shipping damage immediately. Be sure to read warranty for further information. United Metal Products will in no way be responsible for any unauthorized back charges due to events or circumstances out of their control which may cause shipping delays.

INSPECTION OF EQUIPMENT—VISUAL

The equipment type and arrangement should be verified as ordered at once when it arrives at the jobsite. When a discrepancy is found, the local United Metal Products Sales Representative must be notified immediately so that corrective action may be investigated, also verify electrical conformance to specifications. Unauthorized alterations and unauthorized back charges will not be recognized by United Metal Products, Inc.

LONG-TERM STORAGE

There is a time limit of one year from date of shipment that any unit may be kept in long-term storage. At the end of the one year period, the unit must be in operation. Rotate the wheel by hand every two weeks to redistribute grease on internal bearing parts.

NOTE: Failure to perform the long-term storage requirements past 60 days from shipment and properly log these required procedures will void the warranty.

CURB INSTALLATION

NOTE: If the unit is installed on grillage, this section will not apply.

The curb will be shipped unassembled. It necessary to assemble it on the job-site. Each part of the curb is identified with the proper tags and/or markings. It is important the curb be installed level and square.

NOTE: See section under receiving instructions when receiving curbs and inspecting for freight damage and filing of freight damage claims. Any freight damage is the responsibility of the receiving contractor and/or his authorized receiving agent and the delivering carrier.

When installing the curb, obtain a copy of the approved submittal, as each unit and actual curb installation may not be identical.

INSTALLATION AND START-UP SAFETY

- Before installation it is important to be certain the mounting surface will bear the operating weight of the unit. For proper unit operation, it is also important that it be operated in a completely level position.
- Electrical wiring must be installed a safe distance away from any sharp or moving parts (blower wheels, pulleys, sheaves, belts, etc.).
- All guards and/or interlocks, mechanical or electrical, provided by manufacturer must always remain in place to provide needed protection against moving parts.
- Guards must be installed when fan or discharge is within personnel or within seven (7) feet of working level or when deemed advisable for safety.
- All safety devices, panels, and doors of the unit must be installed and remounted as previously mounted before start-up, servicing, or cleaning. NOTE: A 5/16" allen key is needed for fan cabinet access.
- Check for leaks.
- Check belt tension.
- Remove shipping blocks.



TO VALIDATE WARRANTY FOR UNITS SHIPPED, THIS FORM MUST BE FILLED OUT FOR EACH UNIT AND RETURNED TO UNITED METAL PRODUCTS, INC. by fax #: (480) 968-9555 or mail, Attn: Ron Dase.

PRE-START CHECKLIST

(Responsibility of Installing Contractor)

NOTE: Please complete & return fax to United Metal Products within 30 days of start-up for warranty validation.
Fax: 480-968-9555

INSTALLER _____ COMPANY _____ DATE _____
MODEL NUMBER _____ SERIAL NUMBER _____ TAG NUMBER _____

- BLOWER(S)**
1. bearing blocks tight and aligned
 2. bearing concentrics tight
 3. driven pulley and hub tight
 4. remove shipping blocks under isolator and adjust for deflection
 5. set screws in blower hub tight and secure (NOTE: after two weeks of operation - retighten)
- MOTOR(S)**
6. mounting bolts tight
 7. electrical connections and cover tight
 8. pulley and hub tight
- BELTS**
9. guard in place and secure
 10. belts tight and aligned
- WET SECTION**
11. media clean & in place
 12. pump flow rate adjusted
 13. pump cooling circuit adjusted
 14. flush/bleed tubing secure in overflow
 15. float valve adjusted properly
 16. media with 60° to air entering side
 17. fill and drain actuators operating properly
 18. flush and drain media and sump a minimum of twice before oper. (prevents water carry-over)
- FILTER BANK**
19. rack secure, filters fit properly, clips in place
- FURNACE (ONLY WHEN APPLICABLE)**
20. check gas piping for leaks (refer to starting instructions provided w/furnace)

- ACTUATED DAMPERS**
21. adjust and secure
 22. operate freely
 23. shipping blocks removed
- COILS**
24. secure and sealed tight to wall frame
 25. tighten all coil connections and check for leaks
 26. fins are combed straight after shipping
 27. internal piping and connections insulated
- ELECTRICAL CONNECTIONS**
28. all electrical connections tight
 29. prove out all door safety switches
- CABINET**
30. check caulked seams & seals
 31. check door latches for a tight seal and fan access doors secured with provided allen head (5/16") latch
 32. remove isolator tie downs if provided
 33. tighten any bolts or screws that may be loose
 34. all safety devices, panels and doors of unit must be installed and remounted as previously mounted before start-up, servicing or cleaning
- OPERATION**
35. amps
 36. fan noise
 37. rotation correct
 38. air capacity
 39. vibration
 40. door safety locks closed
 41. all safety devices installed and secure
 42. thermal overloads set properly

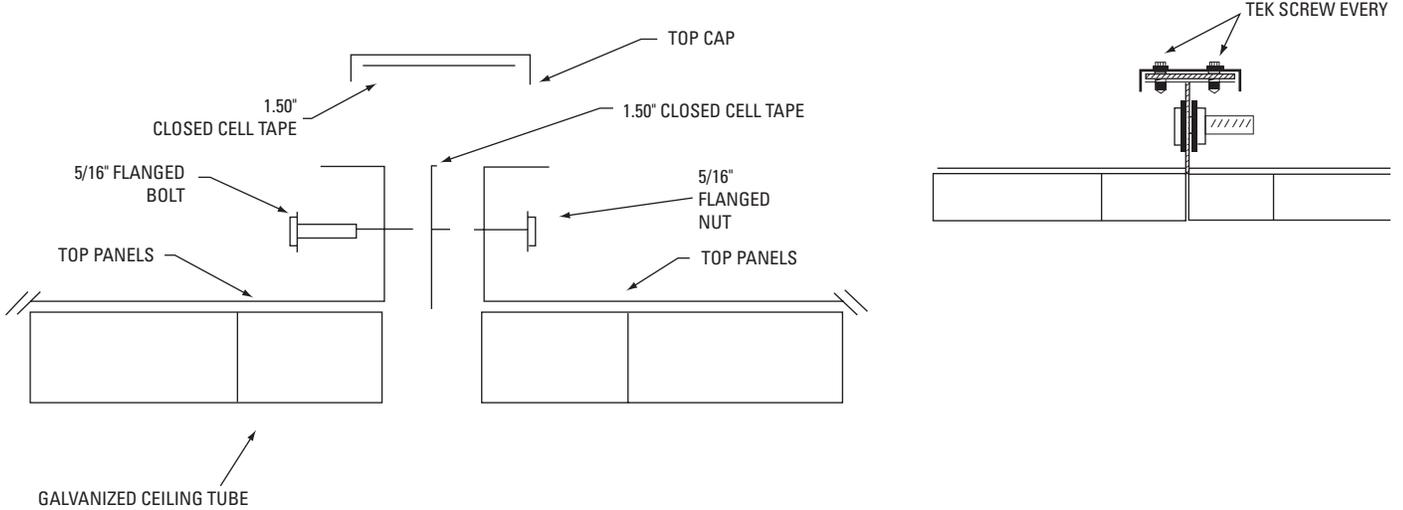
COMMISSIONING RECORD

<u>SUPPLY FAN</u>	AMPS		VOLTS
A. L1 _____ L2 _____ L3 _____			L1 - L2 _____ L1 - L3 _____ L3 - L2 _____
B. L1 _____ L2 _____ L3 _____			L1 - L2 _____ L1 - L3 _____ L3 - L2 _____
Final Overload Setting _____			
Nameplate: Model # _____ Volts _____ Amps _____			HP _____
<u>RETURN FAN</u>			
A. L1 _____ L2 _____ L3 _____			L1 - L2 _____ L1 - L3 _____ L3 - L2 _____
B. L1 _____ L2 _____ L3 _____			L1 - L2 _____ L1 - L3 _____ L3 - L2 _____
Final Overload Setting _____			
Nameplate: Model # _____ Volts _____ Amps _____			HP _____
<u>OTHER FAN</u>			
A. L1 _____ L2 _____ L3 _____			L1 - L2 _____ L1 - L3 _____ L3 - L2 _____
B. L1 _____ L2 _____ L3 _____			L1 - L2 _____ L1 - L3 _____ L3 - L2 _____
Final Overload Setting _____			
Nameplate: Model # _____ Volts _____ Amps _____			HP _____
<u>PUMPS</u>			
A. L1 _____ L2 _____ L3 _____			L1 - L2 _____ L1 - L3 _____ L3 - L2 _____
B. L1 _____ L2 _____ L3 _____			L1 - L2 _____ L1 - L3 _____ L3 - L2 _____
Final Overload Setting _____			
Nameplate: Model # _____ Volts _____ Amps _____			HP _____

Verify all Amp and Volt readings meet nameplate data
 Installer's Acceptance Signature X _____ Date _____

NOTES: _____

DIVIDED MOUNT UNIT ASSEMBLY DETAIL

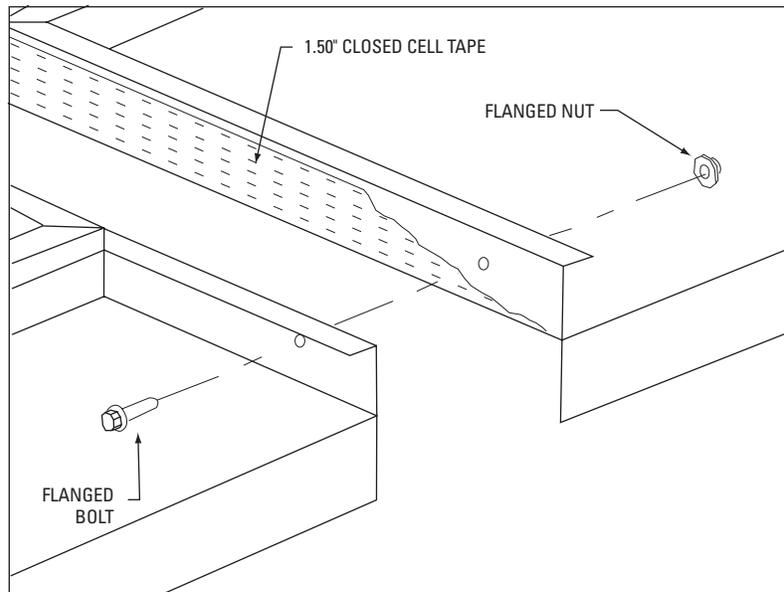


NOTES:

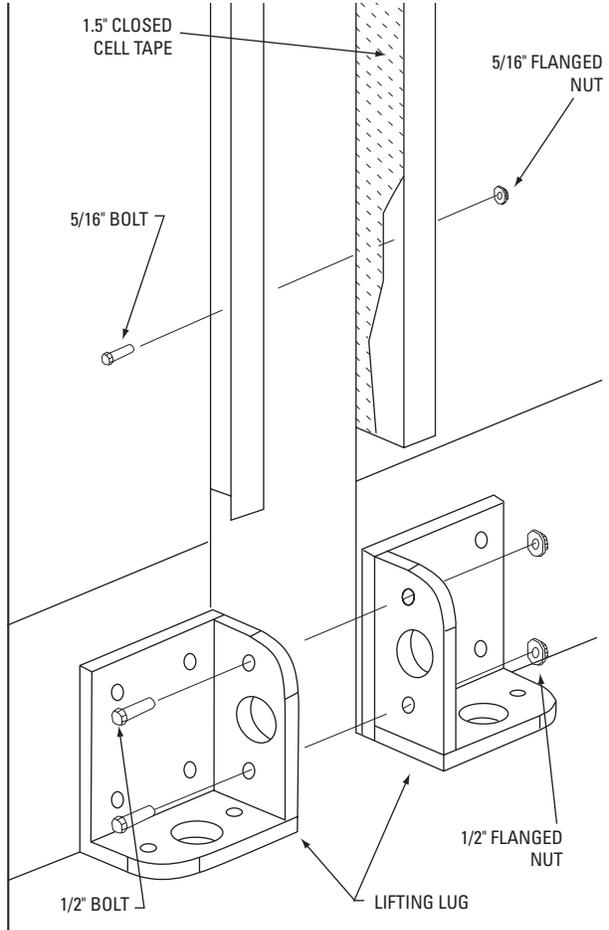
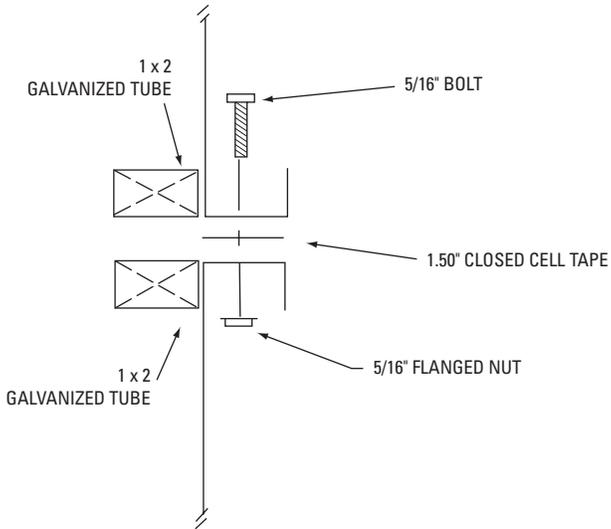
1. 1.50" closed cell tape (supplied by UMP) **MUST** be used between the units to insure a watertight seal.
2. 1.50" closed cell tape (supplied by UMP) **MUST** be used under the top cap(s) to insure a watertight seal.
3. Before applying tape, make sure surface is clean, dry, and

free of loose debris (metal filings, paint chips, etc.).

4. Make sure ALL bolts are as tight as possible and that tape is compressed along entire seam.
5. Caulk and seal all remaining holes and gaps.



DIVIDED MOUNT UNIT ASSEMBLY DETAIL



NOTES:

1. 1.50" closed cell tape (supplied by UMP) MUST be used between the units to insure a watertight seal.
2. Before applying tape, make sure surface is clean, dry, and free of loose debris (metal filings, paint chips, etc.).

3. Make sure ALL bolts are as tight as possible and that closed cell tape is compressed along entire seam.
4. Caulk floor water tight after unit is assembled. Tape is compressed along entire seam.

REGULAR MAINTENANCE AND ANNUAL START-UP

The commercial/industrial evaporative cooling unit you selected may be either horizontal discharge, down discharge or up discharge. The down discharge unit is designed for either flat or pitched roofs. The side discharge unit is designed for either the side of a building or on a flat or pitched roof. The up discharge unit is primarily designed for ground mount application. In all applications, care must be taken that the fan or blower is facing an unoccupied space only. Guards must be installed when operating within seven feet (7') of personnel or when deemed advisable for safety.



SAFETY

Caution: DISCONNECT ALL ELECTRICAL POWER TO THE UNIT BEFORE ATTEMPTING TO INSTALL, OPEN, OR SERVICE YOUR UNIT. IF THE UNIT IS THERMOSTATICALLY CONTROLLED, THE THERMOSTAT IS NOT TO BE USED AS A DISCONNECT AS IT MAY RESET AND START THE UNIT UNEXPECTEDLY.

For efficient operation it is crucial that your evaporative cooler be properly maintained each year. The cooling capability of any cooler will be severely limited if regular maintenance is neglected for even one year. Therefore, the following maintenance information must be applied at the recommended intervals in order to receive maximum benefit from the cooler.

1. CHECK EVAPORATIVE MEDIA

Evaporative media should be checked for salt build-up at beginning and end of season. Scale build-up can occur when heavy salt-laden water is not diluted correctly. If evaporative media scales and plugs up, it should be hosed down to clean away dirt and salt particles. (FIGURE 1)



FIGURE 1

When replacing media, be sure 60 degree angled flutes are slanted downward toward the entering air stream.

2. BLEED-OFF SYSTEM

A water bleed-off tee is recommended in order to fight scale build-up. This will help prevent excessive salts and corrosion build-up and will prolong the life of the unit.

3. CHECK BELT TENSION

With each cooler inspection be sure to check for proper belt tension. Proper belt tension is approximately ½" movement of the belt when pressed at mid-span under normal thumb pressure. Do not overtighten belt. However, a new belt should be tighter than a used belt. (FIGURE 2)



FIGURE 2

4. LUBRICATION

Motor and fan blower shaft bearings on the CF units will require relubrication with a #2 consistency Lithium Base grease. (EXAMPLES: Shell Alvania #2, Mobil Mobilux #2, Texaco Multifax #2.) NOTE: Do not overgrease. The major cause for bearing failure is overgreasing. (FIGURE 3)



FIGURE 3

DO NOT USE MACHINE OIL AND DO NOT OVERGREASE BEARINGS. PUMPS SHOULD BE CHECKED AND OILED AS NEEDED.

5. CLEAN WATER PUMP AND RESERVOIR

ALWAYS DISCONNECT POWER BEFORE SERVICING PUMP. Snap the plastic grid off the bottom of the submersible pump and clean. Remove old debris from reservoir and coat with high quality sub sealer. A removable media frame has been provided for thorough cleaning of sump. (FIGURE 4)



FIGURE 4

6. DISTRIBUTOR CLEAN-OUT

If distribution pipe becomes clogged, a removable plug has been provided for cleaning. (FIGURE 5)



FIGURE 5



FIGURE 6

ANNUAL SHUT-DOWN

At the end of the cooling season it will be necessary to turn off the water supply to the cooler. Unscrew and remove stand-pipe to allow the water to drain down. Do not leave water standing in unit for prolonged periods of time while unit is not in use.

NOTE: NEVER OPERATE THE WATER PUMP WITHOUT HAVING THE RESERVOIR FILLED WITH WATER.

ACCESSORIES

FURNACE

Refer to furnace maintenance installation and start-up information and comply with all requirements.

FILTERS

If your unit has been provided with a filter sections, remove and replace dirty filters as shown in FIGURE 7.

To remove the filter, turn the filter clips to the side and pull it out of the frame. To install a new filter place the filter in its frame and and rotate the filter clips back into position.

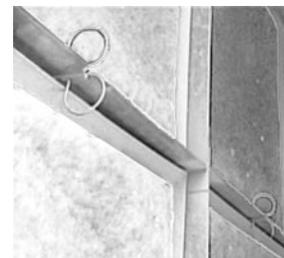
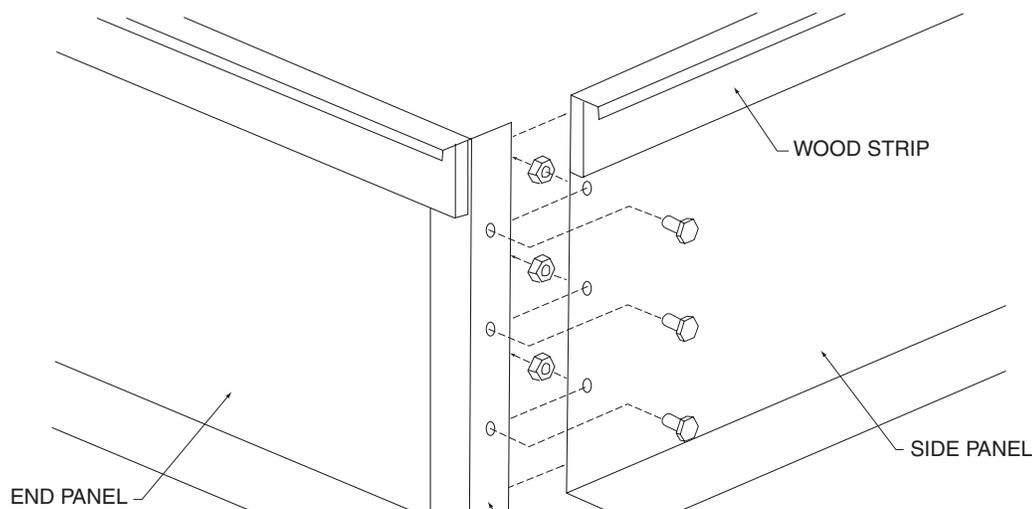
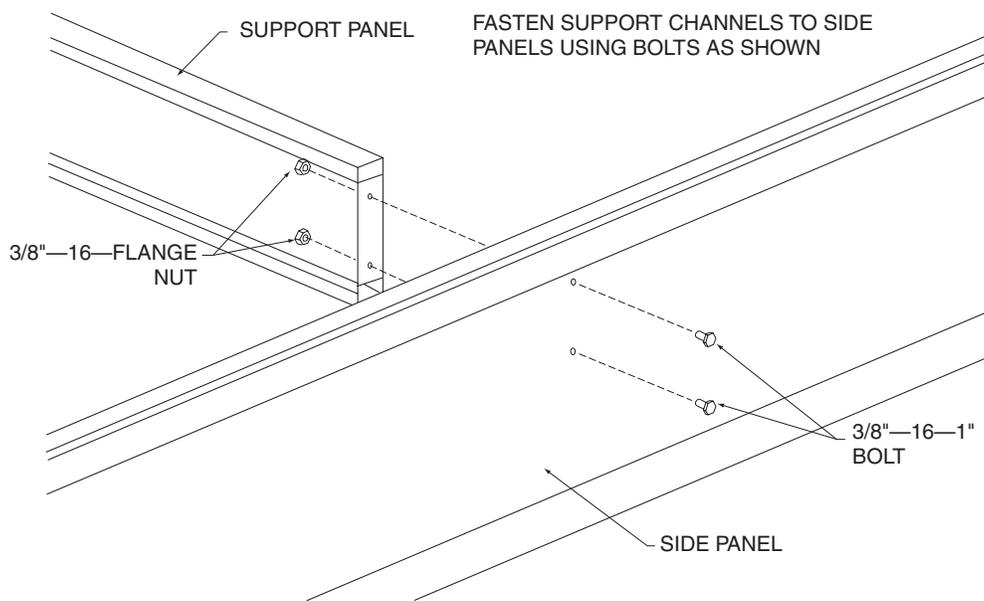
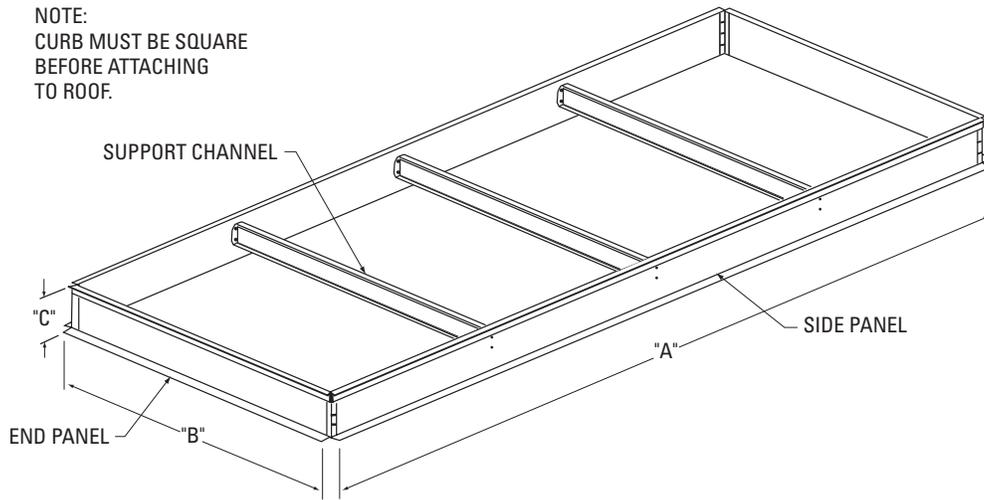


FIGURE 7

CURBS: KNOCK DOWN CURB ASSEMBLY

NOTE:
CURB MUST BE SQUARE
BEFORE ATTACHING
TO ROOF.



NOTE:
USE 3/8"—16—1" BOLTS
USE 3/8"—16—FLANGE NUTS

PLACE THIS LIP FROM END PANELS BETWEEN THE OUTER FACE OF SIDE PANELS AND INNER FACE OF WOOD STRIPS, THEN SNUG TOGETHER AND CLAMP. PLACE BOLTS AS SHOWN

TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
EXCESSIVE NOISE AND/OR VIBRATION	<ol style="list-style-type: none"> 1. Defective bearing. 2. Locking collar loose on shaft. 3. Foreign material inside sealed bearing. 4. Sheave not tightened on shaft: (motor or blower). 5. Loose blower. 6. Loose belt. 7. Belts are worn, oily, or dirty. 8. Improper drive selection. 9. Misaligned sheaves. 10. Blower out of balance. 11. Motor or motor base not securely anchored. 12. Bent blower shaft. 13. Bearings dry. 14. Wheel rubbing blower housing. 	<ol style="list-style-type: none"> 1. Replace. 2. Tighten set screw. 3. Replace. 4. Tighten set screw and check alignment. 5. Tighten set screws. 6. Adjust tension. 7. Clean or replace. 8. See individual Model Name Plate for correct drive selection. 9. Realign. 10. Straighten or replace. 11. Secure properly. 12. Replace. 13. Lubricate blower bearings. 14. Inspect blower shaft collars, belt, pulley alignment, and motor mounting.
BLOWER INOPERATIVE	<ol style="list-style-type: none"> 1. Blown fuse or open circuit breaker. 2. Broken belt. 3. Loose sheaves. 4. Electricity turned off. 5. Defective motor. 	<ol style="list-style-type: none"> 1. Replace fuse or reset circuit breaker. 2. Replace. 3. Tighten and check alignment. 4. Contact local power company. 5. Repair or replace.
INSUFFICIENT AIR FLOW	<ol style="list-style-type: none"> 1. Lack of sufficient air exhaust. 2. Blower speed too slow. 3. Belt slippage. 4. Media plugged. 5. Inlet louver or filter plugged. 	<ol style="list-style-type: none"> 1. Open window or doors to increase ventilation. 2. Check for proper drive combination. 3. Tighten and check alignment. 4. Rinse or replace media. 5. Clean louver or replace filter.
INADEQUATE COOLING	<ol style="list-style-type: none"> 1. Insufficient water flow to media, i.e. media is dry. 2. Media plugged with scale. 3. Dry media. 4. Pump not working. 5. Evaporative media in backward. 6. Distributor plugged. 7. Water level too low in reservoir. 8. No water supply. 9. Low water pressure. 	<ol style="list-style-type: none"> 1. Check water distribution system. 2. Rinse or replace media. 3. Open restrictor clamp hose to allow more flow. 4. Unplug pump. Clean impeller housing. 5. Position so the pad side with dark stripes faces exterior or unit. 6. Clear holes or replace distributor system. 7. Adjust water level to between 2" and 2 1/2". 8. Turn on water level. 9. Increase to minimum of 50 p.s.i.
MOTOR CYCLES ON AND OFF	<ol style="list-style-type: none"> 1. Excessive belt tension. 2. Blower shaft tight or frozen. 3. Motor overloaded. 4. Improper pulley sizing on fan unit. 	<ol style="list-style-type: none"> 1. Adjust belt tension. 2. Lubricate blower bearings. 3. Adjust motor to name plate amps. 4. Refer to Individual Name Plate for proper sizes.
WATER DRIPPING FROM OVERFLOW STANDPIPE OF CORNER OF UNIT	<ol style="list-style-type: none"> 1. Float arm improperly adjusted. 2. Float valve leaking. 3. Unlevel mounting. 	<ol style="list-style-type: none"> 1. Adjust float. 2. Replace float valve. 3. Level the unit on the stand or roof curb.
DISAGREEABLE ODOR	<ol style="list-style-type: none"> 1. Evaporative media not completely saturated. 2. Stagnant or stale water in reservoir. 3. Evaporative media mildewed or clogged. 	<ol style="list-style-type: none"> 1. Saturate evaporative media before starting unit. 2. Drain, flush, and clean reservoir. 3. Check bleed-off setting. Replace evaporative media.

MAINTENANCE TIMETABLE

Function	Annual Start-up	During Season	Annual Shut-down
WASH EVAPORATIVE MEDIA		X	X
CLEAN WATER PUMP	X	X	
CHECK BELT TENSION	X	X	
LUBRICATION	X	X	
CLEAN RESERVOIR	X	X	
ADJUST WATER CLAMP	X	X	
DRAIN RESERVOIR			X
ADJUST BLEED-OFF	X		

LIMITED WARRANTY

UNITED METAL PRODUCTS, INCORPORATED extends this limited warranty to the original buyer and warrants that products manufactured by United Metal Products shall be free from original defects in workmanship and materials for one year from start-up or 18 months from date of shipment (whichever is sooner), provided same have been properly stored, installed, serviced, maintained and operated with bleed-off system properly installed. This warranty shall not apply to products which have been altered or repaired without United Metal Product's express authorization, or altered or repaired in any way so as, in United Metal Product's judgment, to affect its performance or reliability, nor which have been improperly installed or subjected to misuse, negligence, or accident, or incorrectly used in combination with other substances. Warranties on purchased parts, such as electric motors, pumps and pads, are limited to the terms of warranty extended by our supplier (usually one year duration).

LIMITATION OF REMEDY AND DAMAGES: All claims under this warranty must be made in writing and delivered to United Metal Products, Inc., 1920 East Encanto Drive, Tempe, Arizona 85281, within 15 days after the date of shipment by United Metal Products of the product claimed defective, and Buyer shall be barred from any remedy if Buyer fails to make such claim within such period.

Within 30 days after receipt of a timely claim, United Metal Products shall have the option either to inspect the product while in Buyer's possession or to request Buyer to return the product to United Metal Products at Buyer's expense for inspection by United Metal Products. United Metal Products shall replace, or at its option repair, free of charge, any product it determines to be defective, and it shall ship the repaired or replacement product to Buyer FOB. point of shipment; provided, however, if circumstances are such as in United Metal Products judgment to prohibit repair or replacement to remedy the warranted defects, the Buyer's sole and exclusive remedy shall be a refund to the Buyer of any part of the invoice

price, paid to United Metal Products, for the defective product or part.

United Metal Products is not responsible for the cost of removal of the defective product or part, damages due to removal, or any expenses incurred in shipping the product or part to or from United Metal Products plant, or the installation of the repaired or replaced product or part.

Implied warranties, when applicable, shall commence upon the same date as the express warranty provided above, and shall, except for warranties of title, extend only for the duration of the express warranty. Some States do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. The only remedy provided to you under an applicable implied warranty and the express warranty shall be the remedy provided under the express warranty, subject to the terms and conditions contained therein, United Metal Products shall not be liable for incidental and consequential losses and damages under the express warranty, any applicable implied warranty, or claims for negligence, except to the extent that this limitation is found to be unenforceable under applicable state law. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from State to state.

No employee, agent, dealer, or other person is authorized to give any warranties on behalf of United Metal Products or to assume for United Metal Products any other liability in connection with any of its products except in writing and signed by an officer of United Metal Products. Liability shall in no case exceed the unit price of the defect product or part.

TECHNICAL ADVICE AND RECOMMENDATIONS, DISCLAIMER: Notwithstanding any past practice or dealings or any custom of the trade, sales shall not include the furnishing of technical advice or assistance or system design. Any such assistance shall be at United Metal Products' sole option.

WARNING

Our products are designed and manufactured to provide performance, but they are not guaranteed to be 100% free of defects. Even reliable products will experience occasional failure, and this possibility should be recognized by the User. If these products are used in a life support ventilation system where failure could result in loss or injury, the use should provide adequate back-up ventilation, supplementary natural ventilation or failure alarm system, or acknowledge willingness to accept the risk of such loss or injury.

DO NOT USE IN HAZARDOUS ENVIRONMENTS where fan's electrical system could provide ignition to combustible or flammable materials.

NOTE

If any assistance from the factory is needed to check, test, or start-up any UMP equipment, a prevalent rate per day, per

person plus travel, lodging, food, etc., will be paid by the buyer/contractor.

CAUTION

Guards must be installed when fan is within reach of personnel or within seven (7) feet of working level or when deemed advisable for safety.

DISCLAIMER

United Metal Products, Inc. had made a diligent effort to illustrate and describe the products in this literature accurately; however, such illustrations and descriptions are for the sole purpose of identification, and do not express or imply a warranty that the products are merchantable, or fit for a particular purpose, or that the products will necessarily conform to the illustrations or descriptions or dimension.

All information in this literature is subject to change without notice.

LIMITS FOR MAKE-UP WATER ANALYSIS FOR EVAPORATIVE COOLING UNITS FOR HVAC SYSTEMS

The following water quality is established for evaporative cooler water make-up. This water can then be cycled up 2 to 6 cycles to obtain the following stability indices.

Langelier Index = 0.5 ± 0.25

Ryznar Index = 6.0 ± 0.5

Puckorius Index = 6.5 ± 0.5

CONSTITUENT	ALLOWABLE mg/l
Calcium Hardness (as CaCO ₃)	50 - 150 mg/l
Total Alkalinity (as CaCO ₃)	50 - 150 mg/l
Chlorides (as Cl)	<50 mg/l
Silica (as SiO ₂)	<25 mg/l
Iron (as Fe)	<0.2 mg/l
Conductivity	<750 μ mhos
Suspended Solids	<5 mg/l
pH	7.0 to 8.5

Source of Water:

Deep wells or municipal water supplies are recommended.

Lake and river water should be filtered and chemically treated for microbial growth.

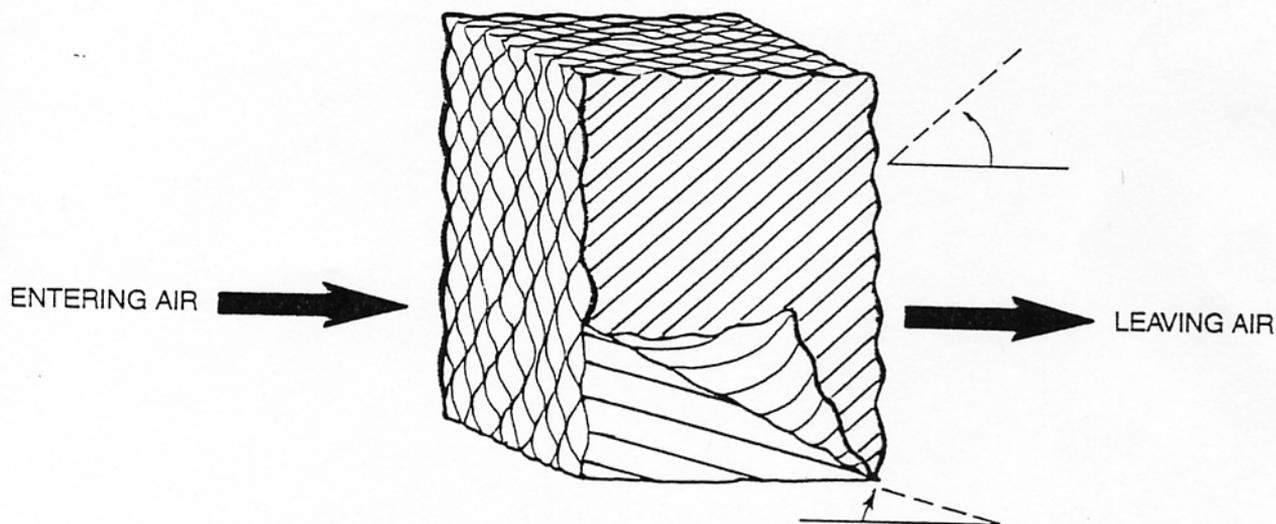
Seawater, brackish water and reclaimed water are not recommended.

Any deviation outside of these suggested limits should be discussed with Munters Corporation.

Important!

In order to get the best performance from your cooling pads, they must be installed properly. If you have purchased a pad with two equal angles, these instructions can be disregarded.

Depending upon the application, pads are manufactured with the following angle combinations: 15°/45°; 30°/45°; 30°/60°; 45°/60°.



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 hot, dry, dirty side of the pad where it is needed most. It also counteracts the tendency of the air to push the water toward the back of the pad.

COOLING PAD CHECKLIST

- ✱ Reduce the number of on-off cycles.
- ✱ Shade the pads and sump.
- ✱ Dry the pads out completely once every 24 hours.
- ✱ Maintain a suitable water bleed off.
- ✱ Drain and disinfect the entire water distribution system quarterly.
- ✱ Avoid harmful contaminants, including dust, fumes, harsh cleaners, and water treatment chemicals.
- ✱ Run the recommended quantity of water over the pad.
- ✱ Avoid dry areas on the pad.
- ✱ Stop annoying leaks in the water distribution system.
- ✱ Clean the water filters regularly.

IMPORTANT FORMULA

Evaporative Cooling

$$\text{Efficiency} = 100\% \frac{\text{LDBT} - \text{WBT}}{\text{EDBT} - \text{WBT}}$$

$$\text{LDBT} = \text{EDBT} - \frac{\text{E}\% \times (\text{EDBT} - \text{WBT})}{100\%}$$

Water Evaporative and Bleed-off

$$\text{Gallons per Hour Evaporated} = \frac{1.2 \times \text{CFM} \times \text{EDBT} - \text{LDBT}}{10,000}$$

$$\text{Cycles of Concentration} = \frac{\text{Evaporation} + \text{Bleed off}}{\text{Bleed off}}$$

$$\text{Bleed off} = \frac{\text{Evaporation}}{\text{Cycles} - 1}$$

$$\text{Make up} = \text{Evaporation} + \text{Bleed off}$$

Air Flow

$$\text{Velocity} = \text{Feet per minute} \frac{\text{CFM}}{\text{L} \times \text{H}}$$

Abbreviations

E% = Evaporative cooling effectiveness

EDBT = Entering dry bulb temperature (before cooling pad)

LDBT = Leaving dry bulb temperature (after cooling pad)

WBT = Wet bulb temperature (same before and after the pad)

CFM = Cubic feet per minute of air

L = Length of pad wall in feet

H = Height of pad wall in feet

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Evaporative Cooling Division

ENGINEERING BULLETIN

MB-SCP-205

CONTROLLING SCALE AND DIRT IN EVAPORATIVE PADS

WATER DISTRIBUTION

Proper water distribution is the single most important way of prolonging pad life. The water will flush away dirt and contaminants which may be harmful to the pad. Areas "starved" for water will be the first to clog or soften.

- Check the pressure in the distribution pipe. Most distribution systems consist of a perforated plastic pipe with holes directed at a splash plate. If the pressure is low, the water will not break up at the splash plate. Streaking and dry areas will occur.
- Check for adequate water flow. Adjust the flow until there are no dry streaks. When the pads are operating properly, they will be thoroughly wetted with a visible flow of water trickling down the flutes. Most of the water will pass over the pad and return to the sump. If there is little water running out the bottom of the pad, the dirt and minerals are not being flushed.
- The distributor pipe must be level. If more than one pad wall is fed by the same pump they must be carefully balanced with valves. The distributor pipe operates at a relatively low pressure. When the cover is removed to expose the pipe, notice that the water jets only a few inches into the air. If one end of the pipe is lifted, the flow at the high end decreases.
- Check for clogged holes in the distributor pipe. The simplest way to clean the holes is to install a ball valve or threaded end cap at the end of each distributor pipe. While the pump is running, open the valve and allow the water to flush the dirt and debris from the pipe. Usually the first signs of blockage will be at the end of the pipe farthest from the pump.
- Never locate the holes on the bottom of the distributor pipe. If so, they are guaranteed to clog with silt from the bottom of the pipe.
- Clean the water filter often. A dirty filter will substantially restrict the flow of water. Install a ball valve on the clean-out for the filter. This way the filter can be flushed without tools and without shutting off the pump.

- Make sure the pump is large enough. The pump should be sized to supply a certain amount of water at a specified pressure. Besides lifting the water from the sump to the top of the pad, there are other pressure losses in the system. Friction losses in the pipes, elbows and valves can consume between 3 and 5 psi, (6.9 to 11.5 feet of pumping head). A clean, in-line filter will use another 5 to 10 psi the pump's pressure, (11.5 to 23 feet of pumping head).

- Required water flow for various pads:

4" corrugated pads	0.50 GPM per linear foot
6" corrugated pads	0.75 GPM per linear foot

ON-OFF CYCLING OF THE PADS

Many people have reported better control of temperature and humidity from evaporative cooling pads when the water is cycled on and off with a timer. Typically, a ten minute timer is used with the 'on' time set between three and seven minutes. **These timers should not be used.**

With these timers, the pad is forced to wet and dry six times per hour and up to 144 times per day! Like any other piece of equipment, every cycle shortens its life. Why? Because the minerals and chemicals in the water dry on the surface of the pad when the water evaporates. It is the most concentrated when the pad is almost dry. It is important to keep the concentration of these chemicals as low as possible by maintaining an adequate flow of water over the pads.

Each type of pad has a recommended quantity of water for best operation. This water flow will provide a protective coating on the surface of the pad. Only a small portion of this water will actually evaporate. The remainder of the water will continually flush the pad.

The pads should, however, be allowed to dry out every 24 hours while the fans are running to help curb algae growth.

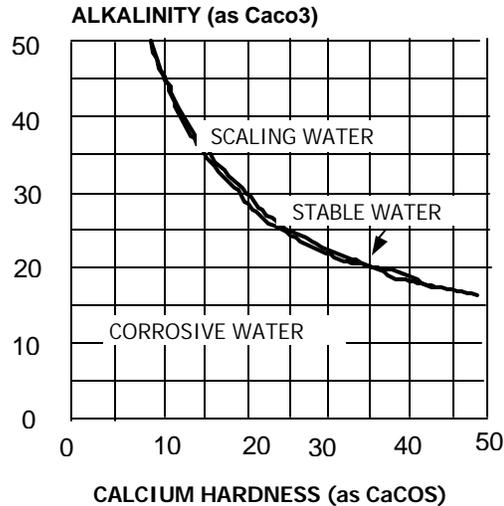
COMMON SCALE FORMING MINERALS

Calcium Carbonate
 Calcium Sulfate
 Calcium Phosphate
 Iron Oxide
 Silica (SiO₂)

In most systems, calcium carbonate and silica are the most troublesome scale formers. The silica is the most straight forward. It must be kept at a concentration less than 150 PPM. Calcium carbonate scaling is more dependent on alkalinity (an indication of pH). Its solubility can be simplified to a curve of calcium carbonate concentration versus alkalinity.

On the chart, notice that stable water is represented by the narrow line. Water quality to the right of the line forms scale. Water to the left of the line is scale dissolving or corrosive. It is difficult to keep water perfectly balanced. Instead, try to keep the water reasonably close to the line so that it fluctuates between scale forming and scale dissolving.

QUICK REFERENCE CHART



CLEANING THE SUMP AND DISTRIBUTION SYSTEM

When water evaporates, only pure water is released. The dirt and harmful chemicals are left behind with the water on the pads and in the sump. Eventually, the water becomes so contaminated that it is harmful to the pads and gutters.

Quarterly cleaning and flushing of the pads will increase their service life.

- Completely empty the sump of water and silt.
- Refill with clean water.
- If possible, turn off fans.
- Manually turn on the pumps to run fresh water over the pads for about 30 minutes. Use as much water as possible.

- Open the ends of the water distribution pipes to flush out debris which could clog the holes.
- Replace the covers when done. When using silt collection, remove plug and drain the system.
- Gently hose stubborn deposits from the face of the pads.
- Completely empty the sump to remove the old algae and dirt which was just rinsed off the pads.
- Disinfect the system by adding the proper amount of approved chemical.
- Check to make sure the bleed off is still functioning properly.
- Refill with clean water.

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Evaporative Cooling Division

ENGINEERING BULLETIN

MB-ACP-205

PREVENTING ALGAE IN EVAPORATIVE COOLING PADS

Algae needs three essential elements to survive, **light, moisture and nutrients.**

SHADE THE PAD AND SUMP

Algae only needs sunlight for a few hours each day. If sunlight can be minimized, the growth period will also be shortened. Remember to cover the sump. Algae may be growing there, too.

Locate pads inside the pad house away from direct sunlight. If there is no pad house, erecting a barrier of shade cloth or awnings will inhibit algae growth.

Cover the sump to keep out dirt and light.

Do not use clear or translucent hoses, tanks, or water distributors.

If inlet louvers or curtains are used, a dark color will reduce the sunlight.

ALLOW THE PADS TO DRY COMPLETELY ONCE EVERY 24 HOURS

Algae cannot live when it is bone dry. Regular drying of the pads for several hours at a time will stop algae growth. Minimize the number of drying cycles, though. Too many will weather the pad. During the cooling season, they should cycle once each day.

Set automatic controllers so the water to the pads turns off before the fans turn off. Pad pumps should be turned on last and turned off first.

Do not allow the bottom of the pads to set down in the water when the system is not running. Adjust the float valve and overflow after the system shuts down and all of the water returns to the trough.

MINIMIZE NUTRIENT CONTAMINATION

Algae feeds off the nutrients in the water and air, not from a "good" cooling pad. Look for sources of nutrients and try to eliminate them.

Nearby farm fields and roads contribute dust and fertilizer which can be drawn into the pads.

Injectable fertilizers find their way into the pad via sprinkler systems. Do not allow sprinklers to spray into the pad or sump.

Feed hoppers should not be located near the pad wall.

When cleaning pads, remove from the pad wall. Old algae growth should be cleaned and removed from the system. When the pads are cleaned, algae and dirt are usually flushed into the gutter and go back to the sump. If it is not removed, it will serve as a nutrient for the next crop of algae.

Remove spent, rotted media pads as they may decompose to form nutrients.

Do not use phosphate type scale control agents or detergents in the pads. They degrade to form phosphate type nutrients.

Use water from deep wells or municipal supplies. Surface water from lakes and shallow wells may be high in nutrients.

Do not allow exhaust air from other processes to blow into the media. Volatile organic compounds from kitchens, paint shops, and furnaces can be absorbed into the recirculating water.

Since it is impossible to keep all nutrients out of the evaporative cooler, flush the pads, gutter and sump

COMMON ALGAE TREATMENT CHEMICALS

Continuous use of algae treatment chemicals is not recommended. Besides being potentially harmful, they will not control algae without periodic cleaning and flushing of the system. Housekeeping and preventative tips are outlined in Engineering Bulletin MB-ACB-205, ***PREVENTING ALGAE IN EVAPORATIVE COOLING PADS***.

After cleaning and flushing the evaporative cooling system, according to Engineering Bulletin MB-SCP-201, ***CONTROLLING SCALE AND DIRT IN EVAPORATIVE PADS***, it can be treated with certain algae control chemicals. There are many control chemicals commercially available. Most contain one, or a combination of, certain active ingredients. Read the label to determine the nature of these ingredients. Never use any chemical which is not labeled for use in evaporative coolers or do not list the ingredients. Remember, there are no miracle chemicals.

The three most common chemical groups are quaternary amines, oxidizing biocides and copper compounds.

Examples of the **quaternary amines** are:

- Octyl Decyl diMethyl **Ammonium Chloride**
- Alkyl diMethyl Benzyl **Ammonium Chloride**
- n-Alkyl diMethyl Ethyl Benzyl **Ammonium Chloride**

Combinations of these chemicals are found in many swimming pool chemicals and commercial disinfectants. If used in evaporative coolers, dosage should be maintained between **30** and **50 PPM**.

Examples of the **oxidizing type biocides** are:

- sodium **hypochlorite** (Clorox)
- solid calcium **hypochlorite** (HTH Pool Tablets)
- diMethyl **Hydantoin** (AgraBrom)
- Ethyl Methyl **Hydantoin** (DantaBrom)
- Hydrogen **Peroxide** (Baqua Shock, Pool Treatment)
- Potassium **peroxymonosulfate** (Oxy-Bright)

These products when used continuously or in too high of concentrations, can destroy wood, cellulose and metals. The concentration must be maintained between **1 and 2 PPM**. For bleach, HTH and other forms of hypochlorite, the water pH must be maintained less than 7.5 or it will have no effect on the algae.

Copper compounds:

- Copper is effective for killing algae. However, it is not usually sold as a general disinfectant because it is not effective against bacteria. Copper is also extremely **corrosive**, and therefore should not be used in systems containing stainless steel, galvanized steel or

CALCULATING DISINFECTANT DOSAGES

Whenever disinfectants or algaecides are used to clean evaporative cooling pads, it is very important to use the correct dosage. Too much of any chemical, (especially oxidizing biocides) may burn the pads as well as corrode the pumps and gutters.

Correct dosage can be estimated as follows:

$$\text{Dose Size (Fluid Ounces)} = \frac{\text{Desired PPM} \times \text{Sump Capacity (Gallons)}}{\text{Percent Active Ingredient} \times 78}$$

For instance, when treating a 250 gallon sump with chlorine bleach (5.25% active)* to a concentration of 2 PPM use the following dose:

$$\text{Dose Size} = \frac{2 \text{ PPM} \times 250 \text{ Gallons}}{5.25\% \times 78} = 1.22 \text{ Fluid Ounces}$$

Conversely, if the entire gallon of chlorine bleach was poured into the sump, the concentration would be:

$$\frac{5.25\% \times 78 \times 128 \text{ Fluid Ounces}}{250 \text{ Gallons}} = 210 \text{ PPM}$$

This is way too much chlorine! So, be careful when disinfecting pads and reservoirs, because overdosing is easy.

*Commercially available chlorine laundry bleaches have an active chlorine concentration of 5.25%.

MAXIMUM RECOMMENDED DOSAGES	
Quaternary Amines	30-50 PPM
Oxidizing Biocides	1-2 PPM
Coppers (Not Recommended)	
<i>If the chemical manufacturer recommends a different dosage, use the lesser amount.</i>	

