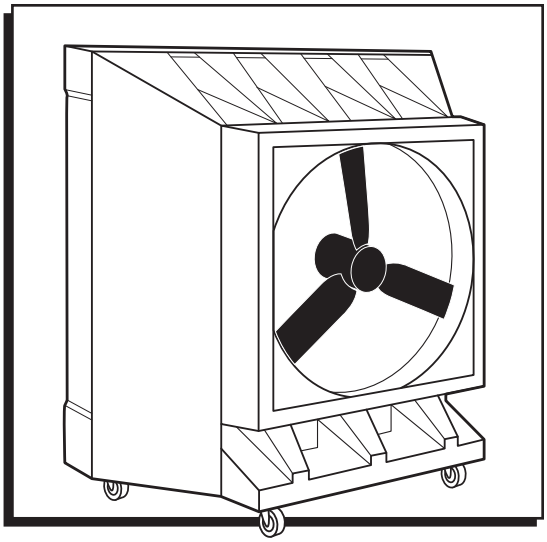
ULINE H-3030, H-3784
EVAPORATIVE COOLER

1-800-295-5510
uline.com



INTRODUCTION

WHAT IS EVAPORATIVE COOLING?

When trying to understand evaporative cooling, it may be best to think of air as being like a sponge, meaning that air has an ability to absorb moisture that it comes in contact with. The amount of moisture that the air will absorb depends on the state of the air, or specifically, how much moisture the air already contains and the temperature of the air. If the air is warm and contains only a small amount of moisture, it will more readily absorb moisture. As air cools, its volume decreases, and with it, its ability to absorb moisture decreases.

The term "relative humidity" describes the quantity of water in the air in relation to its total capacity. Any volume of air at any given temperature has an ability to hold a certain quantity of moisture. If the air contains 20% of its total capacity to hold moisture, the relative humidity is said to be 20%. Whereas, a humidity of 100% indicates that the air at this temperature and pressure is holding all the moisture it can. If the air has less that 100% relative humidity when entering the unit, then it has the ability to hold more moisture, and will thus evaporate more water and cool more effectively.

When describing the amount of moisture in the air, the term relative humidity is used because the absorption capacity of air changes relative to air temperature. The warmer the air, the more absorbent it becomes, and can consequently hold more water. That is to say that air that has a 100% relative humidity can hold no more water vapor. However, if the air is heated, it expands, and, as a result, the relative humidity decreases even though the total amount of water vapor in the air has not changed. As a result, we must describe the level of humidity relative to its maximum capacity. Is it a 50˚F sponge or an 80˚F sponge? An 80˚F sponge will hold more water at 50% humidity than a 50˚F sponge.

How is cooling produced? In order to evaporate water, heat (energy) is required. In fact, the evaporation of one gallon of water requires almost 8,700 BTU's. Where does this heat come from? The heat comes from whatever the water is in contact with as it evaporates. This could be a hot sidewalk, your body, a tree, or from the air itself. As the heat is removed from an object, the temperature of that object is decreased. In the case of the unit, heat is removed from the air, reducing the temperature of the air.

It is important to realize that the temperature of the water does not have a great effect upon the cooling produced by the evaporation. If you were to place a gallon of 50˚F water on a warm sidewalk, it would consume 9,000 BTU's during its evaporation, thus making the sidewalk 9,000 BTU's cooler. A gallon of 90˚F water would produce 8,700 BTU's of cooling, only a 3% difference in the total result. This translates into a difference of less than 1˚F in the performance of the unit.

The following table demonstrates the BTU's removed from the air based on a given amount of water evaporated in an hour by the unit.

U.S. GALLON/HOUR	TOTAL BTU'S REMOVED
10 (37.8 liters or 8.3 Imperial Gallons)	87,000
12 (45.4 liters or 10.0 Imperial Gallons)	104,400
14 (53.0 liters or 11.7 Imperial Gallons)	121,800

In simple terms, evaporative cooling is nature's way of cooling. The unit utilizes the same phenomenon, but in an extremely efficient manner.

INTRODUCTION CONTINUED

HUMIDITY AND EVAPORATIVE COOLING

A given volume of air at a certain temperature and pressure has the ability to absorb and hold a certain amount of water vapor. If that volume of air contains 50% of the amount of moisture that it is capable of holding, it said to be at 50% relative humidity.
The higher the temperature of the air, the higher the amount of moisture it is capable of holding.
Any change in the temperature without a corresponding change in the pressure results in an increase or decrease in the amount of water vapor the air can hold.

If the temperature increases without an increase in the pressure, the result is a decrease in the relative humidity, and thus an increase in its ability to hold moisture. That is to say that in the morning the humidity may be high, but as the day passes and the temperature increases the relative humidity will naturally decrease. The extent to which relative humidity decreases through the day can be affected by local weather systems and proximity to large bodies of water. If an increase in temperature accompanied by a weather system containing moisture moves in, then the drop in humidity will not be as great. Nevertheless, the fact remains that relative humidity does drop as air temperature increases. In fact, for every 20˚F rise in temperature, the moisture-holding ability of air doubles. For instance, if the temperature of the air was 70˚F and the relative humidity was 100% at 5 a.m., and the temperature increased to 90˚F at noon, the moisture holding ability of the air would double.

As a result, the air would now be holding only half of the moisture it is capable of holding, and the relative humidity of the air would drop to 50%. The hotter the day, the drier the air becomes, and the more cooling that can take place through the evaporation of water. This means that when the day gets hot enough to require cooling, the relative humidity will be much lower than in the morning and will allow an evaporative cooling device to work more effectively.

Since any evaporative cooling device must evaporate water to achieve cooling, more water vapor is put into the air. As the ambient relative humidity increases, it becomes more difficult to put moisture into the air. The efficiency of any evaporative cooling device is directly related to its ability to evaporate water (cooling the air) at a given relative humidity. A unit with low efficiency will cool only at low relative humidity levels, while a unit with high efficiency can achieve effective cooling at much higher humidity levels.

EVAPORATIVE COOLING AND THE UNIT

The effectiveness of the unit is best appreciated when it is above 85˚F and below 75% relative humidity. By the time the outside temperature reaches 85˚F, the humidity is almost always below 75%. Generally, as one goes up, the other goes down.

SETUP

UNPACKING

The unit is shipped completely assembled and sitting on a plastic pallet with a large cover box strapped over the unit. It is a simple matter to cut the straps and remove the box by lifting it over the unit.

CONNECTING THE WATER AND ELECTRICITY

WATER CONNECTION **(Applies only to H-3030)**

NOTE: Unit must be in upright and level position.

After the unit has been thoroughly tested at the factory, a special 2-sided brass hose adapter is attached to the water inlet on the side of the unit, which is below the spray bar adjustment and drain valves.
A standard garden hose is attached to this brass hose adapter and cinched down to preclude leaks.
Visually verify that the hose washer is in position and in good condition.

NOTE: Water supply inlet pressure should be limited to 50 psi maximum.

Once the hose connection is made, water may be turned on to the unit. Water should now be entering through the float valve to fill the sump tank. To verify that your connections are secure, visually inspect connections for leaks. Remove the cooling pads.*
Once the sump tank is filled, the water flow should stop and the inlet connections may now be visually checked for leaks. Pay particular attention to the hose connection into the float valve and the connections into the brass inlet fitting.

All of these inspections have been performed at the factory but shipping may have caused connections to loosen.

The cooling pads may now be replaced.*

*See page 7 for details.

SETUP CONTINUED

ELECTRICAL CONNECTION

NOTE: Unit must be in upright position with cooling pads installed!

This unit utilizes a single power cord and control switches. Before connecting the plug to an outlet, ensure that there is no standing water where the cord may lie or the operator is standing. The use of separate multiple outlet devices are not recommended.

When making electrical connections ensure that local and national codes are adhered to. Use only with GFCI Protected Receptacles.

Please refer to the barcode product label on the side of the unit for specific electrical requirements.

OPERATION

PLACEMENT OF THE UNIT

There are three primary considerations when deciding where to place this unit:

1. Fresh Air Supply - The inlet side of the unit (pad side) must be placed so as to ensure that a smooth, uninterrupted supply of fresh air is available.
2. Air Pattern - The cool air discharged from (fan side) the unit should have a clear area in which to circulate, being as free of obstructions as possible.
3. Ventilation (Exhaust) - There should be a defined place in which the air from unit can be exhausted from the area being cooled. This is to prevent the unit from recirculating air that has already been through the cooling process.

A primary consideration when actually deciding where to place the unit is the direction of the airflow. The unit creates a fan-shaped air pattern that circulates air over a large area. This pattern may be disturbed or broken up by obstacles such as shelves, workbenches, etc. It is important to insure that a clean, unbroken path for the air from the unit is provided to the maximum extent possible.

You may want to raise the unit above any low obstructions in order to increase the overall coverage. When raising the height, insure that the platform constructed for holding the unit is stable, well constructed, and will not allow the unit to tip over. The unit must be level and in the upright position. When supporting with a platform allow for the full weight of a functioning unit by including the weight of the water both in the sump tank and the added weight of the water saturated cooling pads. The total weight could be in excess of 500 lbs. (227 kg.).

When the unit is placed near a wall or other obstruction, it is recommended that a distance of at least 3 feet from any wall or obstruction to the face of the cooling pads.

This allows the unrestricted flow of warm air to the cooling pad side of the unit. If multiple units are used near each other, be sure to aim the unit so that the air flows compliment each other. Opposition will negate the airflow and allow an area of dead air to accumulate between units.

FILLING WITH WATER

Once the unit is connected to a water supply, turn on the supply valve that fills the sump tank with water. Once the sump tank is full, the float valve will shut off the supply flow. (50 psi max. inlet water pressure.)

STARTING THE PUMP AND ADJUSTING THE WATER FLOW

CAUTION! Do not run pump when sump is dry.

1. Once the sump tank is full, move the pump switch to the ON position to turn on the pump.

   When first turning on the pump, the level in the sump will drop suddenly and restart the flow of supply water. This is a normal condition, as the cooling pads require a large amount of water for proper wetting.

   When the unit is new, the new pads will require an initial 'breaking-in' period. This period is required for the pads to begin readily absorbing water. It may require up to a week to achieve maximum efficiency.

2. It is important that the spray bar is properly adjusted when first starting the water flow in the unit. To increase the flow use the spray bar adjustment valve on the side of the unit.

OPERATION CONTINUED

STARTING THE FAN

NOTE: Cooling pads must be installed and caster brakes must be engaged.

Start the fan by turning the fan switch to one of the available speeds. Adjust the speeds slowly allowing, the fan to obtain its full speed at the LOW speed before going to MEDIUM and before going to HIGH.

Pads should appear wet; however, cascading amounts of water can actually reduce cooling efficiency. Proper adjustment will prevent problems and increase cooling capacity.

When turning the fan off at the end of the day or week, the pump should be turned off about 15 minutes before the fan to allow the cooling pads to dry. This will increase the life of the pads.

MAINTENANCE AND STORAGE

Very little maintenance is actually required on the unit. The primary topic that accounts for most of the maintenance is cleanliness. Keeping the unit clean will do more than any other single item to maintain your unit in peak operating condition. The rugged, corrosion-resistant construction of the unit and industrial grade components make for the low maintenance characteristics. In exceedingly dusty or dirty environments, optional filters are available from your distributor.

DAILY MAINTENANCE

Daily the pump should be turned off approximately 15 minutes before the fan is turned off. This will allow the cooling pads to dry out and help extend their life, minimizing the growth of mildew, mold, bacteria and other odor-causing elements.

WEEKLY MAINTENANCE

At the end of the week or at a scheduled time, the unit should be shut down and the sump tank should be drained. Close the spray bar adjustment valve and open the drain valve. A hose may be attached to the drain valve to drain the water to a remote disposal area. Once the drain valve is open, starting the pump will drain the unit. When the pump has removed most of the water a small amount will be left in some areas.

Once the sump is drained and the power disconnected, the pads may be removed for inspection of the sump tank. Assuming that the unit is in a dusty environment, dust may collect in the sump tank over time.

Vacuum out dirt and any remaining water using a wet/dry shop vacuum and wipe clean with a cloth. Inspect and clean the Inlet Strainer located on the bottom of the pump. Replace pads in correct airflow direction, referring to label on the pads.

STORAGE

1. Drain all water from the sump tank and clean as above, ensuring that the pads and sump are completely dry.
2. Roll up power cord and secure it so that it is not rolled over, tripped over or caught in equipment.
3. Cover the unit completely to prevent dust build up and store in a dry area.

CAUTION! Disconnect power before removing cooling pads from the unit!

This also helps prevent damage to the pads. Optional dust covers are available from your distributor.

NOTE: Power cord may be replaced only by the manufacturer or qualified agent!

TROUBLESHOOTING

The most common problems encountered with unit are operational problems. The unit consists of three systems. It is important to determine which system of the unit the problem is associated with. Certain problems may be associated with more than one system.

When determining which system that the problem is associated with you must first define the problem, i.e., the pump is not running. Although this might seem a bit over-simplified, several things may cause a particular problem. So while defining the problem, a careful check of all systems should be made to fully understand the extent of the problem.

If you have a complete understanding of all the systems of the unit and how they depend on each other, it becomes much simpler to define and solve any problems.

Although the unit is designed to be simple to maintain, it will be necessary to have some basic hand tools (screwdrivers, pliers, adjustable wrenches, etc.) as well a volt/ohm meter for troubleshooting the electrical system.

FAN SYSTEM

CAUTION! Please use caution when troubleshooting or repairing all electrical components. Be certain that all power is disconnected from the unit before the cooling pads are removed to gain access to the fan.

OPERATING ISSUE	CHECK	SOLUTION
Fan motor won't run and makes no sound.	Power cord, switches, circuit breaker, etc., cord, reset breaker.	Check switch connection. Reconnect power.
Fan motor won't run and makes a humming sound.	Blade in contact with shroud. Motor stalled (will not turn by hand).	Check mounting bolts. Replace motor.
Breaker trips or fuse blows when fan is started.	Motor stall (as above). Other items on circuit.	Replace motor. Remove other items.
Motor overheating, shutting off and restarting several minutes later.	Inlet air obstructed or too close to wall.	Provide minimum 36" inlet clearance.
Fan motor won't run and switch makes soft clicking sound.	Faulty motor. Switch making good contact.	Replace motor. Replace switch.
Fan motor won't run and has a burning smell.	Start capacitor leaking from cover. Motor stall (as above).	Replace capacitor. Replace motor.

WATER SYSTEM

The water system consists of three primary elements:

1. Water delivery system
2. Spray bar assembly
3. Pump

The water delivery system consists of two assemblies:

1. The water inlet assembly
2. The plumbing assembly

The water inlet assembly is made up of three components:

1. The bulkhead fitting
2. The float valve connection hose
3. The float valve

The plumbing assembly consists of three elements:

1. Riser (PVC components)
2. Drain valve
3. Spray bar adjustment valve

TROUBLESHOOTING CONTINUED

WATER INLET SYSTEM

PROBLEM	CHECK	SOLUTION
Floor near the unit is wet. Water flow is too heavy.	Water inlet hose is loose at supply hose or inlet hose is loose at bulkhead fitting.	Adjust water flow. Tighten connections and/or replace hose washers.
The unit overflows from sump tank or is spitting water through fan.	Float valve is loose at bulkhead fitting or at float valve. Water pressure is too high to allow float valve to shutoff. (50 psi max.) Float valve is not seating properly. Spray bar valve adjustment.	Tighten connections and/or replace hose washer. Reduce water pressure by checking in-line reducer. Check for particles in valve. Replace valve. Close down adjustment valve to reduce excess water flow.

PLUMBING ASSEMBLY

PROBLEM	CHECK	SOLUTION
Water spitting from the unit.	Cracked riser assembly. Spray bar adjustment valve.	Replace riser assembly.
Water leaking from drain valve.	Washer worn. Stem worn.	Replace washer. Replace drain valve.
Water leaking from spray bar valve.	Washer worn. Stem worn.	Replace washer. Replace spray bar valve.

SPRAY BAR ASSEMBLY

PROBLEM	CHECK	SOLUTION
Too many dry streaks in the pads.	Holes in spray bar blocked by foreign material.	Remove and clean spray bar. Clean individual holes.
Water spitting from the unit.	Hose connection loose.	Tighten hose. Replace hose and washer. Reseat spray bar end caps.
Excess water in air coming from the fan.	Pad installation.	Pads must be installed according to air flow direction label on the pad.

SUBMERSIBLE PUMPS PROBLEM CHECK SOLUTION

PROBLEM	CHECK	SOLUTION
Pump will not run when switch is turned on.	Power cord, switches, circuit breaker, switch box, connection, etc. Air lock in hose.	Reconnect power, reset breaker or reconnect in switch box. Disconnect hose at base of pump, run pump to release air, then reconnect.
Pump hums when switch is turned on but does not pump water.	Inlet filter clogged. Pump motor locked. Other items on circuit.	Clean filter. Replace pump. Remove other items.
Breaker trips or fuse blows when switch is turned on.	Wiring short in line between pump and switch box.	Check and/or replace wiring.
Pump cycling on and off periodically.	Sump tank is empty. Spray bar valve is closed.	Fill with water. Open valve.
Pump will not run and power is available and pump is functional.	Switch making closure contact.	Check continuity/replace switch.

PAD REPLACEMENT

Ensure that all water is removed from the unit and all power is disconnected. Remove all impediments to access the component you are checking or replacing.

REPLACING THE COOLING MEDIA (PADS)

The flap must be removed to allow access to the cooling pads. Start with the center pad which should be tilted out from the top and lifted out of the drain trough.

The two pads to either side of the center pad may then be removed in the same manner. To remove the two outside pads, first pull them sideways toward the center of the unit until they clear the side retainer. They may then be removed in the same manner as the other pads.

1. Locate the set screw in the rear of the unit on the upper right side. (See Figure 1)
2. Remove set screw and lower front flap to vertical position.
3. Once the front flap is moved, grasp the right pad and tilt out at a 90° angle. (See Figure 2)
4. Pull the pad up to remove from unit. Repeat for other pads. (See Figure 3)

Figure 1

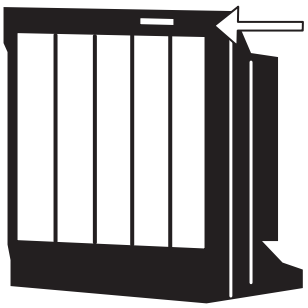


Figure 2

Figure 3