Evaporative Cooling
Water Treatment
And Maintenance

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System Design
Considerations Which Reduce Maintenance Problems

- Good water distribution
- No water leakage
- Easy access to water distribution for maintenance
- Proper bleed-off
- A trough which can easily be drained and cleaned
Evaporation of Water

- When water evaporates, only pure water is released.
- Dirt and harmful chemicals are left behind on the pads, in the water and in the sump.
- Eventually, the water becomes so contaminated that it is harmful to the pad and gutters.
Chemicals Are Not Recommended for Daily Pad Maintenance

- Chemicals dry out on the media each time the water is turned off, causing the chemicals to lose their effectiveness.
- Some chemicals are corrosive and will harm pads and gutters.
- Some chemicals contribute to microbial growth.
- Many chemicals cause environmental problems.
- Those who use chemicals often feel they can neglect other maintenance requirements.
Plumbing and Water Distribution

Having a well designed and maintained water distribution system is the single most important way of prolonging pad life.

Water distribution systems should be neat, clean and easy to access.
A Good Bad Example
Areas "starved" for water will be the first to clog or soften.
Check for Clogged Holes in the Distribution Pipe
Poor Distribution

Eventually, the pads become clogged and fall out of the supports because they are so heavy.
Clean Filters Regularly

A dirty filter will reduce water flow by more than 50%.
Check the Pressure in the Distribution Pipe
Hole Size and Spacing

To provide even water distribution to corrugated and fiber pads, use 1/8" diameter holes drilled on 3" or 4" centers.

**Height of Jet for Different Pads**

<table>
<thead>
<tr>
<th>Pad Depth</th>
<th>3” Spacing</th>
<th>4” Spacing</th>
<th>Flow Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2”</td>
<td>n/a</td>
<td>3”</td>
<td>0.3 gpm/ft</td>
</tr>
<tr>
<td>4”</td>
<td>4”</td>
<td>11”</td>
<td>0.5 gpm/ft</td>
</tr>
<tr>
<td>6”</td>
<td>11”</td>
<td>20”</td>
<td>0.75 gpm/ft</td>
</tr>
</tbody>
</table>

Never locate the holes along the bottom of the distributor pipe. If so, they are will clog with silt from the bottom of the pipe.
Basic Requirements for Pad System

- Water is distributed evenly across the top of the pad.
- Holes are on the top of the pipe.
- All flashing directs the water into the pad without splashing.
- Pad is supported above water even during shut down.
- 50% support area under the pad.
Poorly Designed System

- Loose flashing allows water to escape from the distribution section
- Not enough support area under the pad
- Pad sets in water after shut down
Correct Orientation of Corrugated Pads

The unequal angles direct more air to the inlet where it is the hottest, driest, and dirtiest.
Incorrect Orientation of Corrugated Pads

Air Flow

15°  45°
Equal Angle Pads

Air Flow
Good for Evaporation and Pad Life
Poor Water Distribution
Algae Must Have Three Essential Elements to Survive

• LIGHT
• MOISTURE
• NUTRIENTS
Shade the Water Distribution System

Do not use clear or translucent hoses, tanks, or water distributors.
Make certain the sump is shaded.
**Nutrients from the Air**

- Nearby farm fields and roads contribute dust and fertilizer which can be drawn into the pads.
- Do not allow exhaust air from other processes to blow into the media. Contaminants from adjacent buildings as well as incinerators, and feed silos, can be absorbed into the recirculating water.
Hot Dry Air
- Dust
- Pollen
- Nutrients
- Building Contaminants
- Soluble Gasses

Cool Humid Air

Flow Meter
Flow Control Valve
Cooling Media

Shade Cloth
Dry the Pads Completely Every 24 Hours

• Regular drying of the pads for several hours at a time will retard or stop the growth of most microorganisms. Set automatic controllers so the water to the pads turns off before the fans turn off. The extra air will help to dry the pads.

• Install a separate timer to the pumps which will turn the water off all night. There is little cooling effect from the pads between midnight and sun up.

• Minimize the number of drying cycles, though. Too many will weather the pad.
Check the Pads After the System Shuts Down

- Adjust the float valve and overflow after the system shuts down and all of the water returns to the trough.

- Do not allow the bottom of the pads to set down in the water when the system is not running.

- This pad has 18” of moss growing along the bottom.
Nutrients from the Water

- Do not use phosphate type scale control agents or detergents on 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.
Reducing Nutrient in the Pad System

- 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.
- Remove spent, rotted media pads as they may decompose to form nutrients.
Chemicals Which Will Harm Cooling Pads

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

The concentration can be maintained between 1 and 2 PPM in make-up water. 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.
Effect of Chlorine or Bromine

When used continuously or in too high a concentration, oxidizing biocides can destroy wood, cellulose and metals.
Algae Resistant Edge Coatings

Consider using a pad with a rubberized edge coating

- Retards growth
- Algae and dirt will not stick to the coating
- Resistant to weathering
- Scrubbable
Removing Stubborn Deposits

- Gentle Brushing in the direction of the corrugations will remove Algae and some minerals
- Pad must be bone dry or the deposits will just smear around
Reducing Scale Formation

Scale and mineral deposits form on the face of the cooling pad when the mineral content in the water is too high.

- Increase the flow of water over the face of the pad.
- Make certain the flow of water is even from one end of the distributor pipe to the other.
- Clean and flush the distributor pipe regularly, especially if dry streaks appear on the face of the pad.
- Use plenty of bleed-off.
- Bleed off is also important for algae control
What is in Your Water?

- Dissolved Gasses
- Silica
- Sodium
- Chlorides
- Metal Ions
- Feathers
- Calcium
- Carbonate
- Biocides
- Microbial Growth
- Nutrients
- Sediment
- Dirt
Flow Meter

Flow Control

Valve

Cooling

Media

Hot Dry Air

- Dust
- Pollen
- Nutrients
- Building Contaminants
- Soluble Gasses

Cool Humid Air

Contaminants From the Water

- Minerals
- Nutrients
- Suspended Solids
- Water Treatment Chemicals
- Microorganisms

Bleed Off Line

Cooling Media

Flow Control Valve

Flow Meter
Flow Meter
Flow Control Valve
Cooling Media
Cool Humid Air
Flushing the Sump
Hot Dry Air
Dump Systems

Dump systems will keep the cooling system the cleanest as they discharge sediment, sludge as well as concentrated water.
“Unintentional” Bleed-off

Un intentional bleed-off due to leaks and undersized tanks is probably the most common method.

Plugging leaks in the system may result in clogging of the pads with dirt and minerals.
Poor Bleed Location

- Bleed line is at the end of header pipe where it can clog.
- The user has directed the water back into the gutter.
Final Checklist

- Shade the pads and sump
- Dry the pads out completely each night
- Bleed off a quantity of water regularly
- Flush and disinfect the entire water distribution system at least quarterly
- Avoid harmful contaminants including dust, fumes, harsh cleaners, and water treatment chemicals
- Run the recommended quantity of water over the pads
NEW PAD 6" DEPTH .75 GPM/FT
ON/OFF CYCLING  5-ON/5-OFF

TIME ELAPSED, MINUTES

EFFICIENCY

PRESSURE DROP, "WG

Efficiency

Pressure Drop

0% 20% 30% 40% 50% 60% 70% 80% 90% 100%
4 YR OLD PAD 6" DEPTH
ON/OFF CYCLING 5-ON/5-OFF

TIME ELAPSED, MINUTES

EFFICIENCY

PRESSURE DROP, " WG

0.4"
0.3"
0.2"
0.1"
0"

20% 30% 40% 50% 60% 70% 80% 90% 100%

0.1" 0.2" 0.3" 0.4"