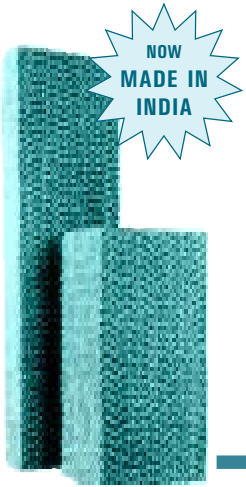


# W A T E R F A C T S\*

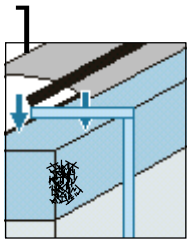
\* Facts you need to know  
to optimise effectiveness of your  
Evaporative Cooling Pads



For cost-effective, efficient cooling

## 'Mis'management of water

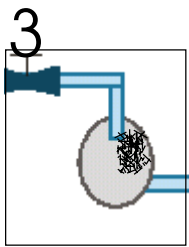
Majority of problems reported by users of evaporative cooling pad based systems are basically due to improper treatment of water or 'mis'use / management of water. The problems can be categorised as :



Scale formation



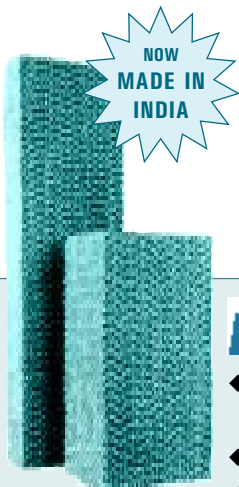
Microbiological infestation



Corrosion of support frame work, sump, pumps, etc.

Problems arising from mismanagement of water can be handled effectively by :

- Identifying type of water
- Water treatment



### **ECCCOOL™** EVAPORATIVE COOLING PAD (ECP)

- ◆ Made of cellulose paper, engineered from cross-sectional, specially treated flute media capable of absorbing and retaining water to provide the maximum cooling efficiencies.
- ◆ Treated with stiffening and wetting agents to provide efficient cooling.
- ◆ Considerable effective life span.

## Types of water

Natural water contains many soluble minerals and salts in different proportion. Based on the proportion of salt and mineral content, water can be classified as :



Hard water, normally, contains a higher concentration of mineral and salt.

When water evaporates, it leaves behind a concentration of mineral and salt in form of a precipitate, which manifests itself as scale on the cooling pads.

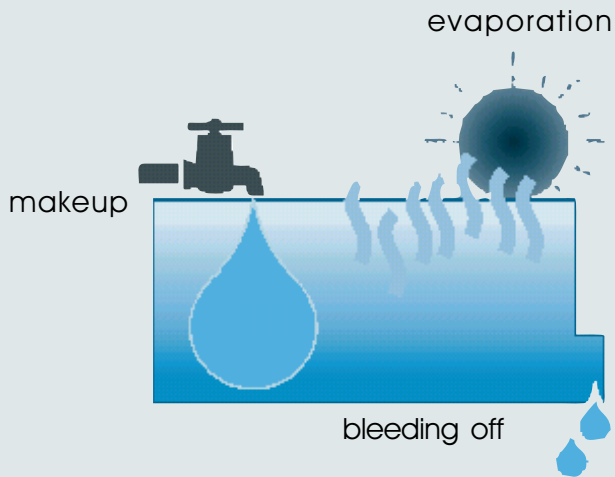
## PROBLEMS DUE TO 'MIS'MANAGEMENT OF WATER

Continuous build-up of these minerals, in form of scale, on the media surface restricts airflow and reduces the cooling efficiency. Additional

fresh water is needed to dilute the high concentration of salts in the sump water if build-up is occurring.

As opposed to hard water, soft water is capable of leaching out the rigidifying agents and causing the pads to collapse.

## Basic theory of water evaporation



$$\text{MAKE - UP QUANTITY} = \text{EVAPORATION} + \text{BLEEDING OFF}$$

## Evaporation rate

ALCULATE THE RATE OF EVAPORATION  
IN THE AIR COOLER

$$\text{Evaporation rate (lpm)} = \frac{\text{cfm} \times (t1 - t2)}{550}$$

t1 = dry bulb temperature of entering air (°F)

t2 = dry bulb temperature of leaving air (°F)

## Dry bulb temperature

DRY BULB TEMPERATURE (°F) OF  
LEAVING AIR CAN BE CALCULATED AS BELOW :

$$t2 = t1 - hs (t1 - w1)$$

t1 = dry bulb temperature of entering air (°F)

t2 = dry bulb temperature of leaving air (°F)

hs = saturation efficiency of the selected media

w1 = wet bulb temperature of entering air (°F)

## Guideline

- ❑ Ensure pH range of 7.3 to 8. Water with extreme pH value is not suitable for cooling pads.
- ❑ Adjust the bleed off rate to ensure pH value does not cross the prescribed limit.

*Bleed off is referred to the rate at which the water is being removed from the sump to maintain the water quality.*

- ❑ Normally, bleed off rate is 20% of the evaporated water.
- ❑ Maintain the water quality. Both very hard and very soft water is harmful and can adversely affect the life span and performance of cooling pads.

- ◆ Treated with anti-rot and rigidifying resins to extend its life span.
- ◆ Cross-corrugated to maximize the mixing of air and water and eliminate water carryover.
- ◆ Saturation effectiveness ranging from 50 to 98%, can be achieved depending upon air velocity and depth of the cooling pad.

## Water management guidelines

Recommended water management for Evaporative Cooling Pad based systems incorporating Eco-Cool Cooling Pads.

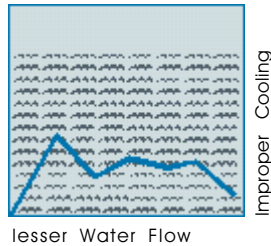
A. Rate (s)

B. Chemistry

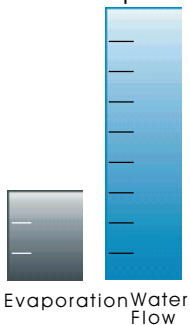
C. Treatment

## Recirculation rate of water

It is important to control the quantity of water in circulation through the media. Water, if flowing at a lesser rate than recommended, results in uneven wetting of the media, which causes improper cooling. Cooling depends on evaporation rate.



The water provided should be sufficient to keep the entire media wet and flushed, therefore, limiting scale deposition over the media surface.



Severe deposition could result in air flow restriction and also localized very high pH levels at joints of the media leading to the leaching of the stiffening resins causing early failure of the media.

Please ensure water flowing through the pad is maximum 3 times the rate of evaporation or 1.5 gpm per sq. ft. of top surface.

## Bleed-off rate

Water evaporates leaving behind all soluble salt and mineral present in it.

This results in a high concentration of minerals in the sump water. Further, the evaporation of this water causes precipitation of these salts and minerals in the form of scales, which deposits itself on the media surface.



TO AVOID BUILD UP OF SCALES, SOME OF THE RE-CIRCULATED WATER MUST BE REPLACED WITH FRESH WATER. THE FRESH WATER DILUTES THE CONCENTRATED SUMP WATER, THEREBY, MAINTAINING THE DESIRED WATER QUANTITY.

The water, which is replaced, by fresh water is referred as bleed-off water.

Bleeding off some of the water is the most practical means of minimizing scale accumulation. Bleed-off prevents excessive concentration of minerals in the re-circulated water.

The bleed off rate should be 5% to 100% of the evaporation rate depending upon water hardness and air - borne contamination level.

Bleed-off rate for general applications should be set at 20% of maximum evaporation rate in extreme conditions.

A flush out cycle should be used that runs fresh water through the pad every 24 hours when the fan is switched off. This water should run for 3 minutes for every foot of media height.

Regular inspection, to ensure that the bleed rate is adequate and is maintained, is a must.

RECOMMENDATIONS TO ENSURE LONG LIFE OF PADS

MAKE UP WATER = WATER EVAPORATED + BLEED OFF

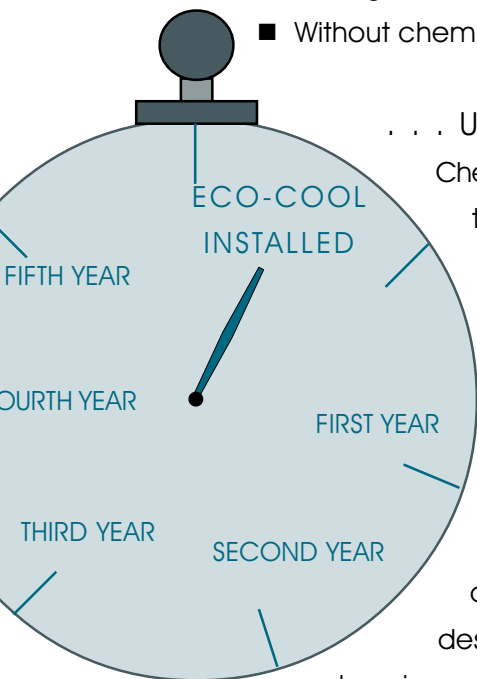
## Micro-biological growth control

Water provides an ideal medium for growth of various type microbiological organisms mainly algae, mold, fungus, bacteria, etc.

Any of these organisms can damage the media and may result in undesirable odor in the air stream.

Growth of these organisms can be controlled effectively

- By using chemicals.
- Without chemicals.



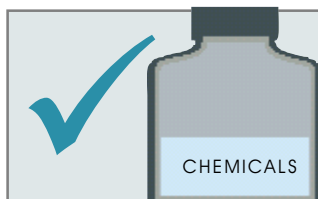
### . . . USING CHEMICALS

Chemicals used in treating the water can be broadly classified as oxidizing and non-oxidizing. As the name suggests, the oxidizing chemical is chemical that is oxidizing in nature. They destroy micro-organisms and also destroy the nutrition used by micro-organisms to grow.

Chlorine and bromine are two most commonly used chemicals to control organism growth. These chemicals should be handled with great care, as they are potentially dangerous.

AN OVER DOSE OF THESE CHEMICALS MAY ALSO DAMAGE THE COOLING MEDIA. THESE CHEMICALS SHOULD NOT BE USED ON A CONTINUOUS BASIS.

It is important to maintain a 7.3 to 8 pH level after the treatment.



There are some non-oxidizing chemicals, which are not oxidizing in nature, that are toxic to micro-organisms. Unlike oxidizing chemicals, they remain active and effective in the water for a longer period and are effective over a broad pH range. These chemicals are also effective on broad spectrum of micro-organisms like bacteria, fungus, mold, algae etc.

Please consult your Water Treatment Consultant before using any chemicals.

### . . . WITHOUT CHEMICALS

Mostly growth of micro-organisms is the result of improper and inconsistent maintenance of water reservoir and other surrounding area.

Micro-organisms need water, sunlight and nutrients to breed and grow. The cooling pads must be above the water level of the sump especially when the pump is switched off. The pads should be dried out so that organisms present in the media become dry. It is recommended to flush the media prior to the next start up and operate the pump for sometime prior to start the fan.

Organism grows faster in the sunlight. By shading the media and avoiding light falling on the pads, the growth of these organisms can be retarded to a great extent. Also micro-organisms cannot exist without nutrients. An effective removal of nutrients from the sump water can control the growth of these organisms. Normally, the air passing through the media brings nutrients. Typical nutrients present in the air are farm field dust, pollen, organic dust and organic emissions from near by stacks.

Proper cleaning and maintenance is always better than the chemicals treatment.

## Corrosion control

### LEGIONNAIRE'S DISEASE CONTROL

Legionnaire's Disease is a respiratory disease, contracted by inhaling aerosol laden with sufficient Legionella pneumophila bacteria (1 to 5 mm in diameter) into the low respiratory system.

Evaporative coolers do not provide suitable growth conditions as the water used for evaporation is cool and does not encourage growth of these bacteria. This bacteria grows when water temperature is between 70°F to 115°F.

We can further reduce the possibility of the bacteria growth by following precautions:



**1.** Run fans after switching off water circulation pump to allow pads to get dry.

**2.** Thoroughly clean and flush the entire cooling water loop regularly (minimum annually), including disinfecting before and after cleaning.

**3.** Maintain system bleed off consistent with makeup water quantity.

**4.** Avoid dead end piping, low spots and other areas in the water distribution system where water may stagnate during shutdown.

**5.** The inlet of the evaporative cooler should not be located near to any cooling tower.

**6.** Maintain system cleanliness. Deposits from calcium carbonate, minerals and nutrients may contribute to the growth of these bacteria and other micro-organisms.

Corrosion is destruction of a metal by chemical or electrochemical reaction with its environment. During evaporative cooling, water circulating in the system is exposed to varying conditions and its composition changes, which increases its corrosive characteristics.

Corrosion can occur in pipelines, water sump, water pump and water distribution channel causing damage, or destruction of, the equipment, or excessive rapid wear of moving parts such as pumps. Corrosion can reduce cooling efficiencies and create water flow blockages.

Corrosion related damages can be minimized by the following:

- Using corrosion resistant construction materials.
- Providing protective coatings to separate the water from the metal surfaces of the equipment.
- Adding corrosion inhibitors and pH control chemicals to water or removing oxygen from the water.

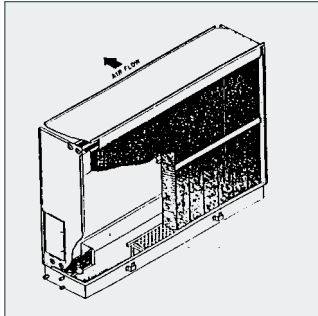
*pH is defined as logarithm of the reciprocal of the hydrogen ion concentration of a solution. If pH value is less than 7, the water is considered as acidic and if pH value is more than 7, water is considered as alkaline.*

- Use of dissimilar metals should be minimized and if possible, avoided. Organic coating or gasket must be used between two dissimilar metals to avoid galvanic corrosion.

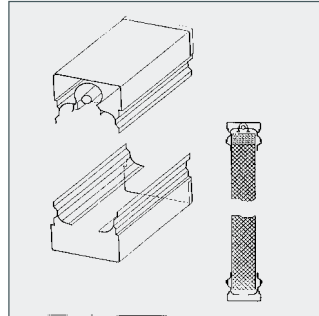


Corrosion treatment of cooling water is done through use of chemicals like blends of phosphate, phosphonate, molybdate, zinc, silicate, and various polymers for corrosion control.

# Typical water distribution circuit, frame work, construction



A Typical rigid media in standard frame



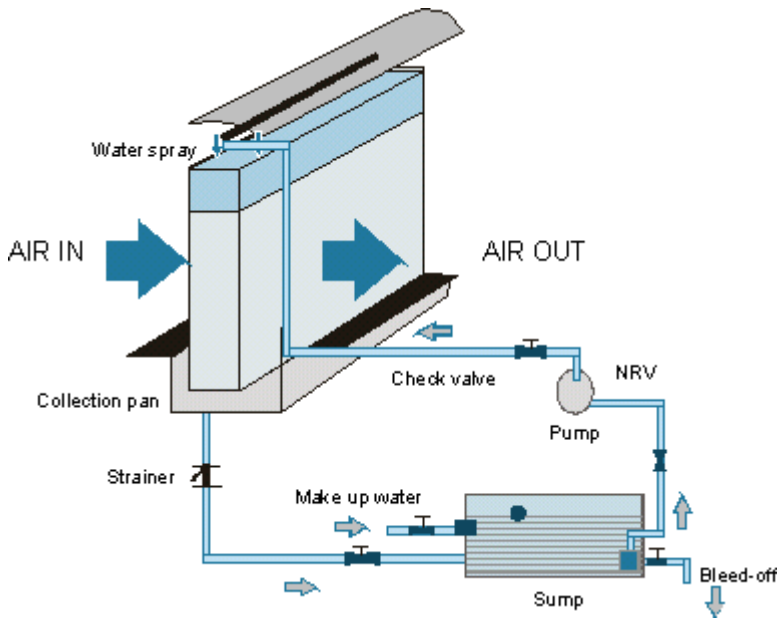
A Typical water distribution system.

## TYPICAL DATA FOR DISTRIBUTION SYSTEM

	4" - 8" DEPTH	10 - 12" DEPTH
PIPE DIA	3/4" - 1 1/2"	1" - 1 1/2"
HOLE DIA	1/8"	5/32"
SPACING	2 1/2" - 3 1/2"	3"
MAX PIPE LENGTH	16ft	16ft

## PRECAUTIONS

- ▶ Header pipe should be located at the top of the media towards the front enabling the water to flow towards the front of the media from where air is entering in to the system.
- ▶ Header size should be selected as per the total quantity of water circulating through the media.
- ▶ Please ensure a circulation water quantity of 1 1/2 to 2 GPM per sqft. of the top surface area or 3 times the evaporation rate, which so ever is higher in order to keep the media wet and to achieve the rated performance.



## A Typical Evaporative Cooling Installation

It is recommended to always use a distribution pad for better effectiveness, more so when the media thickness is greater than 8".

## MATERIALS OF CONSTRUCTION

( Suggested material shown will help to provide a long, relatively trouble-free service life )

1. Main Header - PVC
2. Collection Pan - FRP / GI WITH FRP LINING
3. Side Plates - FRP / MSHDG
4. Gutter - FRP / PVC / GI
5. Sump - MASONRY / GI WITH FRP LINING / SS

Performance of



based systems  
in major cities in India

City	Outside Design Conditions (Summer)				Condition of air leaving the media at 80% (3) saturating efficiency		Makeup water flow
	DBT°F	WBT°F	RH%	Wet Bulb Depression  (1)	DBT°F  (2)	WBT°F	(lpm) per 1000 cfm (4)
Agra	108	75	21	33	81.6	75	3.985
Ahmedabad	110	78	24	32	84.4	78	3.979
Ambala	110	75	20	35	82	75	3.997
Aurangabad	104	76	24	28	81.6	76	3.955
Bangalore	96	78	45	18	81.6	78	3.894
Bhopal	106	73	20	33	79.6	73	3.985
Calcutta	100	78	26	22	82.4	78	3.918
Chennai	103	82	41	21	86.2	82	3.912
Coimbatore	98	76	37	22	80.4	76	3.918
Dehradun	105	75	25	30	81	75	3.967
Delhi	110	75	20	35	82	75	3.997
Hyderabad	106	78	28	28	83.6	78	3.955
Indore	106	77	28	29	82.8	77	3.961
Jaipur	110	75	20	35	82	75	3.997
Jodhpur	110	77	23	33	83.6	77	3.985
Kathmandu	85	75	63	10	77	75	3.846
Lucknow	109	79	26	30	85	79	3.967
Mumbai	95	83	60	12	85.4	83	3.858
Nagpur	112	76	28	36	83.2	76	4.003
Pune	104	76	28	28	81.6	76	3.955

- Notes : 1) Wet Bulb Depression = Outside Dry Bulb Temp. in °F – Outside Wet Bulb Temp. in °F.  
 2) Condition of air leaving media = ODBT – S.E. (ODBT – OWBT)  
 3) 80% evaporative cooling efficiency (saturation efficiency) is achieved only with a minimum of 8" (200mm) thick pad.  
 4) Make up water flow = water evaporation + bleed off. (Based on 2'x1'x8" pad).  
 5) Total recirculated water flow should be 3 times of rate of water evaporation or 1.89 LPM per linear foot of 4" thick pad.  
 6) Due to constant product refinement, the performance data may change in future.

Manufactured by :  
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