YWCT
Custom Cooling Towers

Cooling tower filtration systems

General

The cooling tower's purpose is to remove excess heat from the water used to cool various industrial systems. The removal of the heat is carried out by the flow of the water counter (or across) to an air flow. The cooled water flows to the various users, which are responsible for transferring the heat between the industrial systems and the tower water. (heat exchangers)

To reduce the likelihood of mechanical malfunctions of the various parts of the cooling system, and to enable efficient working over the long haul, the water's quality must be ensured. Water treatment is carried out by a dedicated system (chemical injection or other solutions), as well as by mechanical filtration, whose function is to filter out suspended solids (particles) from the cooling water.

Cooling water contamination may be caused from a few possible sources:

- Low-quality make-up water such as treated wastewater or river water
- Contaminants whose source is the air entering the tower (dust, insects, industrial exhaust)
- Contaminants whose source is a breach or leak from the industrial process (releasing contaminants) into the cooling water
- Contaminants in the cooling water itself, such as salts, organic contaminants, and corrosion

Apart from protecting the system components, mechanical filtration lowers operating costs by:

- **Saving on chemicals –** Anti-corrosives and anti-scaling compounds attach themselves to suspended particles in the cooling water instead of to system parts; removal of the particles therefore reduces the quantities of chemicals needed.
- **Saves work –** The suspended particles in the cooling water constitute "condensation nuclei" for buildup of minerals and biological contaminants that later settle in the tower pool or in areas where water flow is slow (heat exchangers); these must then be removed manually.
- **Saves energy –**Blockage and coating of the heat exchange surfaces (heat exchanger, tower fill) reduces the cooling system's efficiency and hence increase the power consumption.
- **Saves part replacements –** Preventing settling and buildup of organic matter and minerals on the system components reduces or prevents having to replace them due to blockages.

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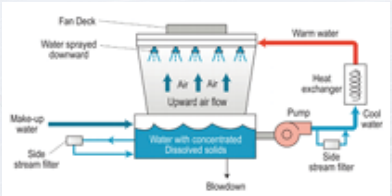
- **Saves make-up water –** Enables operation in a larger number of cycles.

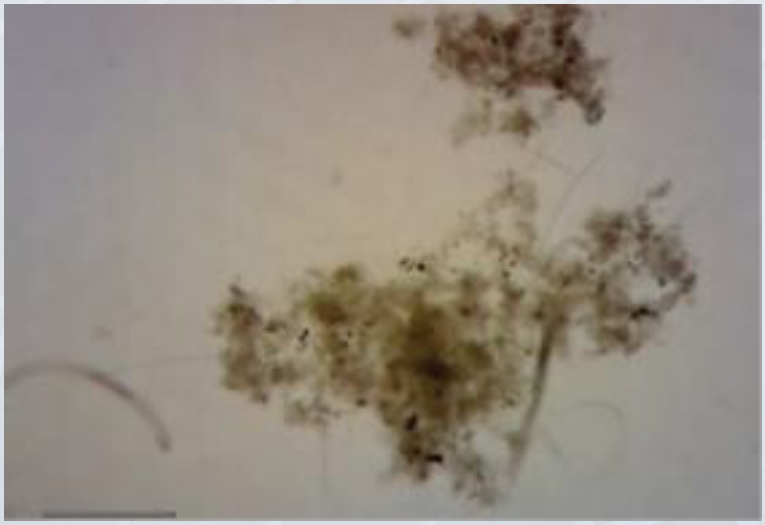
Possible filtration processes in the cooling tower

- **Make up water filtration –** In cases wherein a large quantity of suspended solids in the make-up water is known or suspected, installing a 30-50-micron filter is recommended, to prevent contamination of the cooling water.
- **Full stream filtration –** filtration all of the cooling water. Mostly used in small cooling systems serving equipment that is sensitive to water quality. The advantage of full stream filtration is that it fully protects the system parts from various extreme scenarios; the drawback is that it is costly.
- **Side stream filtration –** This is the most common filtration method in cooling towers. In this method 5%-10% of the overall system flow is filtrated hence statically we one can assume that the entire quantity of the water in the system undergoes filtration every X hours. The assumption is that the rate of particle removal therein will be higher than the rate of addition of contaminants in the water, and thus the proper level of water quality ensured. The drawback: Side stream filtration is not a solution in extreme cases such as sandstorms or a bad leak or breach into the cooling water.



Contaminants in cooling tower water

Contaminant	*Size in microns*
Sea sand	100-1000
Fine dust	10-100
Mold spores	10-30
Hair	30-120
Coal dust	30-60
Nematodes	150
Thread algae	50 <
Clay	1-10



Enlarged image of biological flukes

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Filtration technologies used in cooling towers

Filtration type	Filtration level in microns	Foot print	Cost	Filtration method	Rinsing technologies	Remarks
Hydrocyclone	- 1,500 70	Low	Low	The water flows in a circular flow pattern, so that the heavy particles are ejected toward the sides of the vessel and collect in a lower collection tank.	Parodically drainage of the collection tank	• Suitable for particles over 1.6 specific weight • Not suitable for organic matter • Simple maintenance
Disk filter	20 - 800	medium	Low	The water passes through a cylinder of grooved plastic disks, and the contaminants collect on the external walls and between the disks	By means of reverse flow and releasing of the tension on the filtration element (disks)	• Most are made of plastic, a big advantage for seawater • Depth filtration • Especially suited to organic matter
Screen	10 - 500	Low	Medium	The water passes through a filtration cylinder made of woven thread (screen) or a perforated surface. The contaminants collect on the inside of the cylinder.	Uses a suction scanning mechanism or brushes to clean the screen	• Suited to heavy industry • Minimal rinse pressure • Especially suited to hard mineral particulate (sand, dust)
Media filter (sand)	10 - 100	High	High	The water flows through a multi-layered filtration media, where the particles are trapped mechanically and by electric and chemical attraction forces.	By means of reverse flow (back wash and releasing of the filtration media. In some cases, auxiliary pumps are used.	• In use for decades • High filtration quality • Many types of filtration media • Affected by filtration speed • When misused - Liable to become a contaminants source • Lack of filtration uniformity Uses a high quantity of backwash water

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