The Easy Way to Increase Cooling Efficiency on Crossflow Cooling Towers

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Metaphorically speaking, the Fill Pack and Heat Exchanger in a cooling tower system is what the lungs and heart are to the human body; when either fail or, aren't working fully, it effects other parts of the body and one's health suffers. Similarly, when a cooling tower Fill Pack and Heat Exchanger isn't kept clean, the heat exchange process doesn't work efficiently, and the health of the cooling system and its supported systems (environmental/process) suffers due to reduced heat transfer.

Cooling systems that rely on cooling towers to dissipate heat in a process or environmental application accomplish this by drawing in massive volumes of air and water into the cooling tower — as the water in the loop travels through the Fill Pack on its way back to the water basin, air is simultaneously pulled through the fill pack causing some of the water to evaporate — it is through this evaporation that heat is released.

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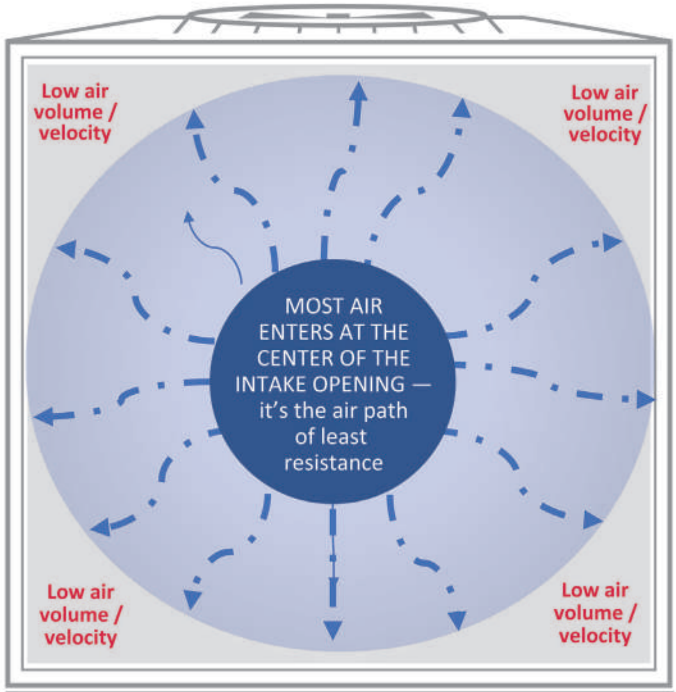
Important Note:
The greater the Fill-to-Air exposure, the faster and more efficient the evaporation and the lower the temperature of the returned water at the basin. *(Interestingly, Cooling towers perform the mechanical equivalent of the human body cooling system; when one sweats, the air passing over the skin causes the perspiration to evaporate, thus pulling the heat away from the body resulting in cooling — when goosebumps naturally form on the skin, it's the body's way of increasing surface-to-air contact which speeds evaporation and cooling.)*

Fig #1

Towers *Without* Intake Filtration Have Less Fill Utilization



The further away you get from the center of the tower, the lower the air volume and velocity entering the cooling tower fill; upper and lower corners have the lowest air volume and velocity entering the fill.

The laws of physics tell us that air always moves by taking the path of least resistance — hence, the air draft created by the giant fans on top, pull air into the tower, through the fill and out the fan in a roughly tubular formation. The path of least resistance is typically the center of the intake opening/Fill Pack and where the highest air-volume/velocity will be found. As you move further from the center, air volume and velocity decreases, resulting in reduced Fill efficiency and evaporation around the edges and corners of the Fill. (See Fig #1 above)

Selecting the Correct Filtration Method.

When cooling towers are certified for designed cooling performance, hey are certified based on how they will be delivered from the factory without filtration. Increasing capacity and efficiency beyond its design usually requires a design change commonly requiring resizing the fans/water supply and/or adding more modular cells.

One thing is certain, the cleaner the Fill/Strainers and Heat Exchangers are kept, the better and more efficient the cooling will be — this of course means that on-going maintenance is critical for optimal cooling tower performance no matter its designed capacity.

Because cooling towers are gigantic air scrubbers that captures airborne debris floating past the draft zone — the debris can circulate and clog the fill, plug strainers, heat exchangers and blow-down valves, restricting water-flow and causing significant loss in cooling capability.

It's important to realize that optimizing the ecology and operational efficiency of a cooling tower is best accomplished by combining good physical maintenance with a chemical water treatment regimen and some form of filtration. Chemical treatment specifically targets organic matter, suspended solids/bacteria/water PH and conductivity, while filtration systems are designed to capture larger debris that can impact cooling performance.

There are two general technologies used for filtration: **Side Stream Water Filtration** and Air Intake Filtration Systems (also called Cottonwood Filter Screens). Engineers designing NEW cooling systems or retrofitting existing systems, should understand that in most towers, over 90% of fouling is a direct result of airborne debris being pulled into the cooling tower. If you are considering a cooling system which includes Side Stream Water Filtration, it's important to realize that it won't protect the Fill Pack, nor fully protect Strainers and Heat Exchangers — it is there to help manage airborne and waterborne debris only AFTER it gets into the tower.

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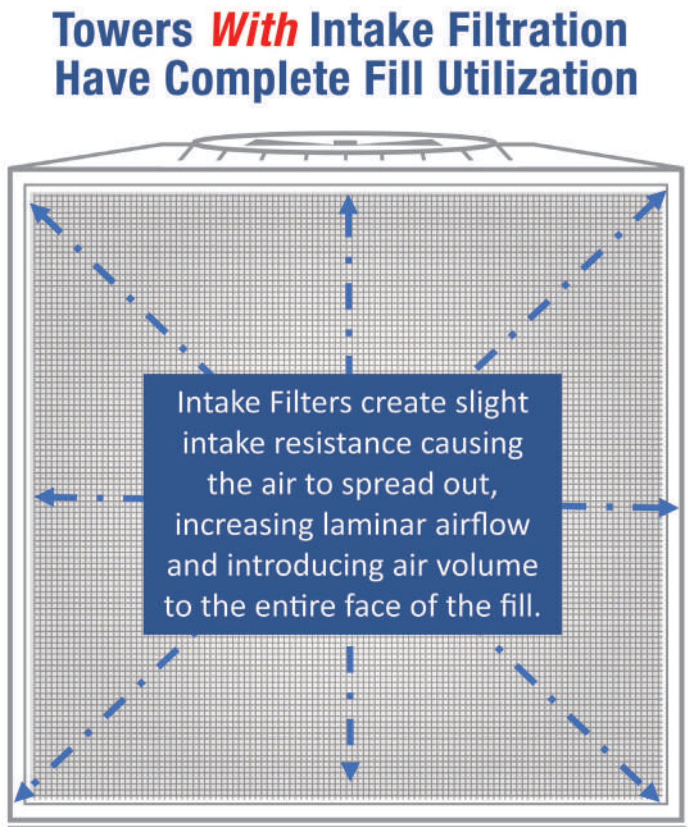
In contrast, **Air Intake Filter Screens** are an effective, low cost approach that mounts over the intake opening stopping debris at its point of entry, keeping it out of the system in the first place and helping to reduce maintenance and water treatment chemical cost.

Fig #2



Intake filter screens create minor air resistance at entry, increasing laminar airflow which forces the air to spread out over the entire face of the intake opening — resulting in increased fill utilization and lower water temperature at the basin.

In addition to stopping airborne debris at it's point of entry, Cottonwood Filter Screens by design, slightly increases airflow resistance causing the air to spread out over the entire intake opening resulting in an increase in "Laminar Airflow." In other words, it creates a 'wall of air' that fully covers the intake opening thus exposing the entire fill pack to more air volume and velocity versus not using screens and having lower Fill Pack utilization.

(See Fig #2 above)

Increasing laminar airflow using Cottonwood Filter Screens is very significant because it naturally increases the efficiency of the Fill Pack in two ways. First, it provides greater Air-to-Fill exposure over the entire Fill Pack thus increasing the evaporative capacity of the Fill and Second, it stops airborne debris from infiltrating the Fill, Basin, and Heat Exchanger for optimal performance all season long.

Cottonwood filter screens help **reduce water temperature at the basin by as much as 1-2 degrees F** beyond the design temperature.

So, what's the big upside of this? Cottonwood Filter Screens increase the evaporative capacity of the Fill, reducing water temperature at the basin by 1 to 2 degrees Fahrenheit beyond its original design temperature. This translates into a significant reduction/elimination in downtime, lost productivity and energy savings.

When considering filtration options, the following questions should be asked.

- What filter systems *(air vs. water)* provides the greatest overall benefit given the operating environment?
- Which system provides the greatest filtration surface area *(this can directly impact frequency of cleaning — the smaller the filter, the more frequently it needs cleaning)*.
- Specifically what parts of the cooling system does each filtration method protect vs. the other?
- What is the cost associated with downtime due to heat exchanger or cooling tower fouling or clogging? *(Knowing this will help you justify filtration system cost)*
- Can filtration be installed without shutting down the cooling tower? *(If the cooling tower must be shut down for installation, you need to factor lost productivity into the cost of your filtration system if it's not being installed during shutdown periods).*
- What is the cost associated with both the filter and installation?
- How easy is the system to install and maintain — Air vs. Water Filtration?

Answering the above questions will help you to fully understand your options and to make the best choice.

If one isn't currently using filtration as part of the cooling system, then any filtration is better than nothing, however, selecting a solution best suited to the operation should be the goal and that requires knowing what kind of debris is the problem and where it is getting into the system. As previously stated, **"Over 90% of debris entering a cooling tower is Airborne not Waterborne."** As a rule of thumb: **"Don't select an air intake filter to solve a waterborne problem."** And, conversely, **"Don't select water filtration to solve an airborne debris problem."**

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