

THE BAG FILTER MYTH

Many customers are pulled into the myth that a bag filter is a good option for filtration of cooling tower open loop water systems. The primary reason for selecting bag filters over a high efficiency sand filter is the perceived cost. Before one can make the decision to choose a filtration technology, one must complete a Particle Distribution test to understand the real (TSS) total suspended loading in their cooling water system, understand filtration technology limitations, understand that filtration efficiency will have a direct impact on chemical cost, what is the best solution to reduce total operational cost long term and how best to protect the work environment for working staff members.

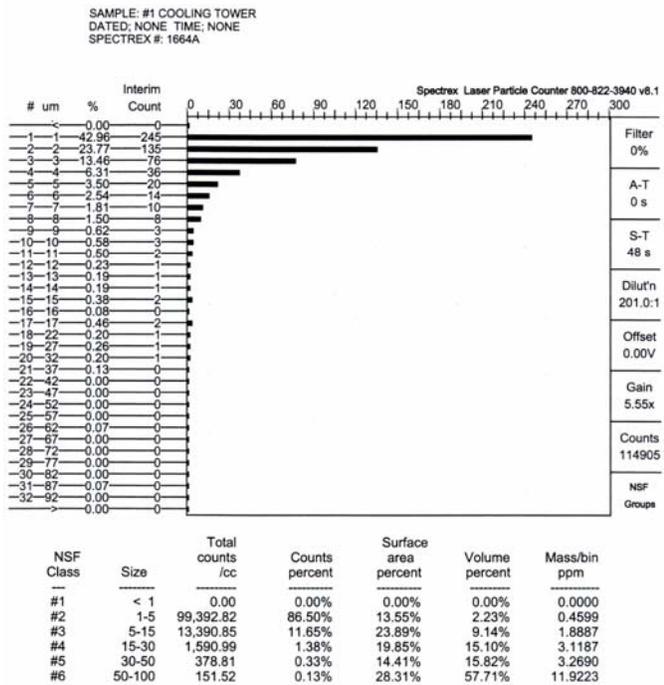
Bag Filter Efficiency

Typical bag filter selection for cooling tower water filtration starts out at (100) hundred to (50) fifty micron in size. The particle distribution lab analysis, Sample #1 Cooling Tower, is a real result from a high-rise in downtown Chicago. If a (50) fifty micron bag were selected for this account, only about 13% of the TSS, total suspended solids, would be removed. Note that 98% of the total partials are less than (15) fifteen micron and 86.5% are less than (5) five micron in size. Typically 85% of TSS in a cooling tower is less than (5) five micron in size. The efficiency of particle removal with a (10) ten or (20) twenty micron bag would be less than 10%.

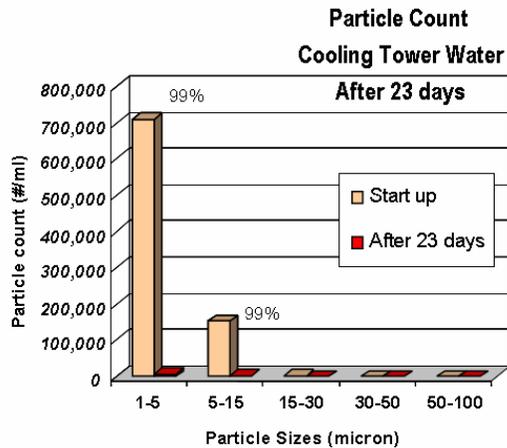
The high cost of labor and bag replacement for filtering down to (1) one micron is not practical, so therefore, the TSS load on a condenser heat exchanger, typical a chiller, never is able to reach 95 to 99% efficiency removal of all particles in the cooling water.



Corrosion by-products, calcium based scale, dissolved iron, dissolved manganese, oil & grease, general organics, mud, clay, silt and bio fouling challenges the operational efficiency of cooling water systems. Unless these solids are removed, the operational efficiency declines, tower maintenance cost increase, chemical cost escalates and maintenance personal can be exposed to higher risk. Typically, 85-90% of the particles found in the recirculation water are smaller than (5) five micron in size. Despite their larger number, these very



fine particles usually make up less than 30 – 40% of the total weight of solids found in the cooling water system. It has been proven that fouling, on cooling tower condenser are due to the very fine particles that can plate on the surface due to the low laminar flow and velocity. Small bacteria, which reject a polysaccharide product (binding agent) start building up, creating slimy condition that trap and retains other suspended particles.

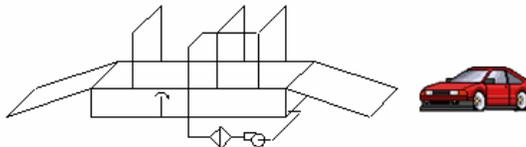


Removal below even (1) one micron is possible and practical, but not with the use of a bag filter. The following test results demonstrate the ability to remove 99% of all TSS even down below (1) one micron. The following particle test was performed on a Vortisand side stream filter in an assembly plant in Dundee, Michigan. In less than (30) thirty days of operation, this large cooling tower system was able to realize a 99% removal of all TSS. Typically as shown in this real customer results, most suspended solids are smaller than (5) five microns.

Improvement in Chemical Effectiveness

In this case a large North American Auto Assembly Plant had made the decision to design a water system using bag filters as the primary filtration method. The water seal booth had limited TSS loading and (100) hundred micron bags were selected. Biological problems developed and the effectiveness of the bags became suspect. The decision to lower the micron bag to (10) ten micron was made and still TSS were not reduced and the biocide program remained ineffective. The bio count remained above 10^5 and the assembly plant was not able gain control of the microbiological problem. The decision was made to eliminate the use of the bag filtration for the following reasons: (1) The TSS solids were contributing to the bio activity, (2) Lowering the micron of the filter bags to (10) ten micron was ineffective, (3) The added cost for plant labor to maintain service of the filter bags become excessive, (4) Labor and filter bag cost were exceeding the budgeted cost, (5) The increase in biocide use, in attempt to control bio growth, not only added unplanned cost and (6) No one realized how important the need to remove smaller particles were.

Automotive Assembly Plant - Water Seal Car Wash Application



Problem with Assembly Water Seal Booth

- Filtration started at 100 micron and then lowered to 10 micron
- Question on filter bag effectiveness
- Labor issue with servicing filter bags
- Not meeting bio counts

Before the Vortisand was installed, the bio count was exceeding 10^5 and we were not able to meet our goal.
Quality Manager, General Assembly Engineering,

Total Suspended Solids challenge chemical effectiveness due to (1) solids increase the total surface area, which will increase chemical demand, (2) increasing deposits require an increase in dispersant usage, (3) large particles collect in the tower fill and reduce even water distribution, which reduce biocide contact with microorganisms throughout the cooling tower, (4) the increase in fine particles settling on condenser tubes require additional biocide and dispersant usage and (5) the increase in solids provide microorganisms an protected environment and possible nutrients for growth. Proper control of dissolved solids and

minimization of organic material in the water is critical for biological control and may reduce the risk of harmful organisms found in cooling water systems, which may put those who come in contact with a water system, at personal health risk.

Why Bag Filters Fail

All filtration technologies have applications where their use is ideal and are recommended most water treatment professionals. In the case of both open and closed water loops, most water treatment professionals do not recommend the use of bag filters for the following reasons:

- 1) The requirement for filtration below (10) ten micron is required in open cooling loops where most of the suspended particles have been proven to be less than (5) five micron in size.
- 2) The requirement for filtration below (5) five micron is required in closed cooling loops where most of the suspended iron particles have been proven to be less than (3) three micron in size.
- 3) The true surface area on a bag is limited and this surface often blinds over with TSS and bio material, before the bag can provide adequate processing time. Often filter bags in these applications are changed out prematurely due to fouling.
- 4) Filtration application, which require a (1) micron rating, may prove to increase the cost of filter bag replacement, often higher than originally expected. The original cost estimates for filter bag replacement may have been based on the use of (50) fifty micron bags and the required cost of replacement bags, at (1) one micron rating, may exceed original cost estimates.
- 5) The benefit of a cleaner system is often outweighed by the operational requirements to maintain replacement of bags, typical every (8) eight hours. Typically over time, less bags are replaced and the bag filter may never meet their intended purpose of improving system efficiency.
- 6) Few chemical water treatment professionals request Particle Distribution Analysis and the operating engineer may not realize how fine the particles are in a cooling water system.
- 7) It is critical to remove 95 to 99% of all TSS in order to reduce the protected environment and reduce the possible nutrients that microorganisms require for growth. A bag filter will not practically meet this requirement.
- 8) Finally, what is the risk of operational staff handling filter bags, which may contain a high percentage of bio material?

When selecting a cooling tower filter technology, Sonitec recommends that each individual understands the TSS load, confirm the effectiveness of the technology, confirm that the filter technology selected can meet the TSS demand and receive a guarantee, from the filter vendor, that the recommended technology will reduce TSS in a cooling water system by 95 to 99%, even down to (1) one micron.