AFS LEARNING CENTER
AMERICAN FILTRATION & SEPARATIONS SOCIETY

Filters and their Efficiency and Life Ratings

Filters are commonly rated on their efficiency (their ability to remove particles) so that their users can anticipate how much volume of effluent can be expected to be filtered to a certain cleanliness or contamination level released to the downstream side of the filter.

This can be measured in particle retention in the filter or penetration through the filter, and is usually expressed in one of two ways, both of which are usually qualified by the upstream particle challenge concentration, the particle size range being captured, and the volumetric flow and/or velocity during testing:

1) Filters are most commonly rated by efficiency, typically between fifty and 100 percent. A 0.3 um air filter with a 99.5% rating will on average remove 99.5% of the 0.3 um and larger particles from the feed stream under some set conditions defined by the test method used, usually specified by contamination levels of particles upstream, and velocity at the upstream side of the filter, or volumetric flow through the filter.

Individual filter performance will vary and while individual filters will be more or less efficient than the nominal rating, on average they must meet the stated efficiency at a given particle size to suit the application specifications. Variations in flow rate and contamination type, particle dimension and shape, and distribution of those dimensions through their range can change the average efficiency.

In gas-phase or air applications, this measurement is commonly referred to as Fractional Efficiency, expressed in percentage of the particle counts of the upstream particle challenge, say 99.5 %, which would mean that 0.5% of the particles continued downstream penetrating the filter.

For filtration of liquids this can be expressed in the same weight-percent captured fraction, but where multi-pass or recirculation applications are targeted, the efficiency is sometimes expressed as count of particles of a given dimension penetrating per unit captured, or the "Beta-Ratio." For example, a 99.5% efficient multi-pass element would be called Beta 200, because one particle in 200 was allowed to penetrate to the downstream side of the filter at a given particle size. Other detailed classifications of filters are common, depending on which kind of application is involved, gas phase, or liquid phase, and these are detailed in AFS short courses at spring and fall conferences.

2) Filter “life” is generally determined by the amount of contamination that a filter can hold in its media surfaces and within its structure before it reaches it terminal pressure or service life in time. Exceeding the guidelines of the manufacturer’s specification can cause irreversible fouling, mechanical failure or unloading of solids downstream. The life of a filter is sometimes expressed as “dirtholding” or “dustholding” capacity. “Dirt(Dust)-Holding Capacity” (DHC) is sometimes quoted as a weight or an expression of particle count retention statistics under stated flow and contamination conditions per unit surface area of the filter medium. Again, more details are available by application in AFS short courses and tutorials.

<u>Summary</u>

Combining Filter Efficiency with Filter Life, a filter user can estimate how much contamination removal benefit to expect from a filter over time in application. The more the filter-user and filter-designer know

about the upstream contamination and flow conditions, the more likely there will be a satisfactory experience with the particular filter design being considered.

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