



## Technical Bulletin 5 MICRON RATING

### MICRON RATING OF FLUID FILTERS

Many times you see on a filter a micron rating which is supposed to be a way of telling how fine the filtration of the filter is. What is really a micron rating though?

The word micron means  $1\mu\text{m}$  (micrometer). A micrometer is a distance measurement unit, used in the metric system which equals to 0.001mm or 1 millionth of a meter. To better understand the size of a micron below are some comparative sizes:

- Diameter of human hair: 70 microns
- Lower limit of human visibility (with naked eye): 40 microns
- White blood cells: 25 microns
- Red blood cells: 8 microns
- Bacteria: 2 microns
- Tobacco smoke: 0.5microns

What does the word micron mean in the filter rating though? A micron rating is a general way to indicate the ability of the filter to capture some particles of that size. The micron rating by itself though means nothing! If you see for example a filter that says the micron rating is 10 micron, then this is misleading as the manufacturer isn't telling you all you need to know.

There are various ways of rating the filtering media. The three most popular ways of rating are the following:

- **NOMINAL MICRON RATING:** This is the ability of the media to retain particles of a specific size. This rating is given by the particle size followed by the percentage. For example a nominal rating of 50% at 10micron, means that the media retains 50% of the particles which are sized as 10 micron.
- **ABSOLUTE MICRON RATING:** This rating is obtained using a single pass test. A single pass test is performed by passing a contaminated liquid through the filter media. Any particles that pass through the media are captured and measured. This rating gives you a retention percentage of 98.7%

- MULTIPASS BETA RATIO TESTING: This rating is the most accurate and the most accepted method of rating filters. It has been standardised by most organisations: SAE (SAE J1858), ISO (ISO 4548-12, lube oil and ISO16889, hydraulic or fuel), ANSI (American National Standards Institute) and NFPA (National Fluid Power Association). Multipass testing uses a contaminant which has a known particle distribution and it is added regularly in measured quantities to the fluid. Samples of the fluid are measured at timed intervals both from the upstream & downstream sides of the filter. From these two measurements you can calculate the beta ratio which is calculated as below:

$$\beta_{\chi} = \frac{\text{Number\_Of\_Particles\_Upstream}}{\text{Number\_Of\_Particles\_Downstream}}$$

$\beta_{\chi}$  = The beta ratio for the particles of  $\chi$  size

If we take as example the particles of 10micron and we measure 1000 particles upstream and 500 particles downstream then we will have:

$$\beta_{10} = 1000/500, \text{ so } \beta_{10} = 2$$

To beta ratio by itself doesn't give you much information, so to translate the beta ratio to a more useful information, you have to subtract 1 from the original ratio and then divide by the original ratio. So in this case you subtract 1 from 2 and divide by 2, so you get  $(2-1)/2 = 50\%$ .

So in this case it means that the media retains 50% of the 10micron particles.

To avoid doing the math every time, you can use the chart below to convert beta ratios to efficiency %

Beta Ratio	Efficiency %
2	50
10	90
20	95
75	98.7
100	99
200	99.5
1000	99.9
10000	99.99
100000	99.999

You can also find the beta ratio stated with more than one number, for example:

$\beta_{5/10/20} = 2/20/75$ . In this example, the media tested removed 50% of 5-micrometer or micron size particles, 95% of 10-micrometer or micron size particles and 98.7% of 20-micrometer or micron size particles presented to it.

Multipass testing is the most accepted way today to present the rating of a fluid filter.

Micron rating is used only in liquid filtration. Engine air filters are rated using lifetime. For more information please read the Air Filter Efficiency Technical Bulletin.