

Understanding Liquid Filter Efficiency

This information is provided as an aid to understanding filter efficiency terminology based on current ISO, ANSI and NFPA test standards.

What Is a Beta Ratio?

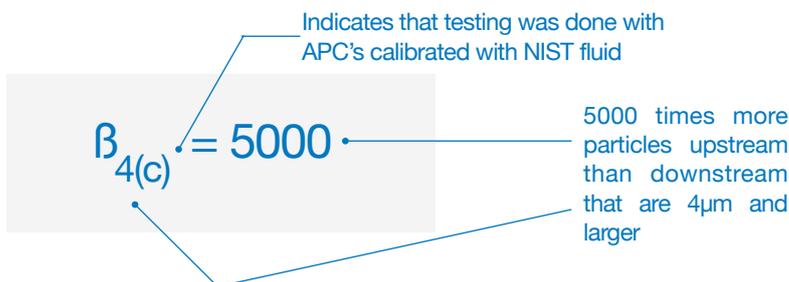
Beta ratio (symbolized by β) is a formula used to calculate the filtration efficiency of a particular fluid filter using base data obtained from multi-pass testing.

In a multi-pass test, fluid is continuously injected with a uniform amount of contaminant (i.e., ISO medium test dust) then pumped through the filter unit being tested. Filter efficiency is determined by monitoring fluid contamination levels upstream and downstream of the test filter at specific times. An automatic particle counter is used to determine the contamination level. Through this process an upstream to downstream particle count ratio is developed, known as the beta ratio.

The formula used to calculate the beta ratio is:

$$\text{Beta ratio}_{(x)} = \frac{\text{particle count in upstream fluid}}{\text{particle count in downstream fluid}}$$

where (x) is a given particle size



What is Efficiency?

The beta ratio is commonly used to calculate the filtration efficiency of a filter and can be converted into a percentage of efficiency at a given particle size.

The formula used to calculate efficiency is:

$$\text{Efficiency}_{(x)} = \frac{\beta - 1}{\beta}$$

where (x) is a given particle size

$$\beta_{4(c)} = 5000 \text{ is same as } 99.98\% @ 4\mu\text{m}$$

$\beta 5000$ is 99.98% for particles $4\mu\text{m}$ and greater

How Big is a Micron?

Compare a micron size to these familiar particles.

Grain of table salt	100 μm
Human hair	80 μm
Lower limit of visibility	40 μm
White blood cell	25 μm
Talcum powder	10 μm
Red blood cell	8 μm
Bacteria	2 μm
Silt	<5 μm

Beta Ratio (at given particle size)	Efficiency (at the same particle size)
1.01	1.00%
1.1	9.10%
1.5	33.30%
2 (Nominal)	50.00%
5	80.00%
10	90.00%
20	95.00%
75 (Absolute)	98.70%
100	99.00%
200	99.50%
1000	99.90%
2000	99.95%
5000	99.98%

- Without Beta Ratio / Efficiency information, Micron rating alone is meaningless.
- Focus must be on Beta Ratio, rather than just Efficiency %, as we can see above, 98.70% & 99.98% might not sound too big of a difference but in Filtration World, that's a huge difference.