

# Filter Element Beta Ratios

## Filter Beta Ratios

The Beta Ratio equals the ratio of the number of particles of a minimum given size upstream of the filter to the number of particles of the same size and larger found downstream. Simply put, the higher the Beta Ratio the higher the Capture Efficiency of the filter.

## Filtration Ratings Defined

Filter ratings are an often misunderstood area of contamination control. The most commonly used rating is the Beta Ratio, which is defined as the ratio of the number of particles upstream of the test filter versus the number downstream, greater than a given size.

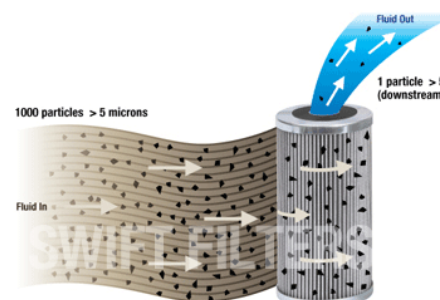
Using the Beta Ratio, a 5-micron filter with a Beta 1000 Rating will have on average 1000 particles larger than 5 micron upstream of the filter for every one 5 micron or greater particle downstream.

The efficiency of the filter can be calculated directly from the Beta Ratio since the % efficiency is simply  $(\text{beta}-1)/\text{beta} \times 100$ . A Beta 1000, 5-micron filter is thus said to be 99.99% efficient at removing 5 micron and larger particles.

Caution must be exercised when using Beta Ratios since they do not take into account field operating conditions such as pressure surges and changes in temperature, which can affect real life performance.

A filter's Beta Ratio also does not give any indication of its dirt holding capacity, the total amount of material that can be trapped by the filter throughout its life, nor does it account for how the capture efficiency changes over time. Nevertheless, Beta Ratios are an effective way of gauging the expected performance of a filter.

The ISO standard for Multi-pass filter testing (ISO 16889) has changed to require filter manufacturers to determine the average particle sizes which yield Beta Ratios equal to 2, 10, 75, 100, 200, and 1000, again using the multi-pass test stand approach. The new standard gives a better interpretation of a filter's overall performance.



Beta Ratios	Capture Efficiency
1.01	1.0%
1.1	9%
1.5	33.3%
2.0	50%
5.0	80%
10.0	90%
20.0	95%
75.0	98.7%
100	99.0%
200	99.5%
1000	99.9%



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Of course, regular monitoring of fluid cleanliness using ISO particle counting should be used to determine the efficiency of the filter in actual field conditions.

The chart below provides a particle size comparison of the more recent ISO 16889 standard with the old ISO 4572 standard.

Bx(c)=1000 (ISO 16889)	2.5	5	7	12	22
Bx=200 (ISO 4572)	< 1	3	6	12	25

