

# Hydraulic filter elements

## 1. The original

Filter elements are the important component for efficient hydraulic filtration. Exclusively produced in our plant in Öhringen, the Sm-N2 and Sm-X filter elements ensure a great oil purity in hydraulic and lubrication systems also with difficult applications.

**MAHLE** hydraulic filter elements are important in the recent hydraulic filtration and exceed all national and international standards. **MAHLE** hydraulic filter elements are produced for **MAHLE** standard and DIN-filter housings, also available for other filter suppliers' dimensions or for customized versions.

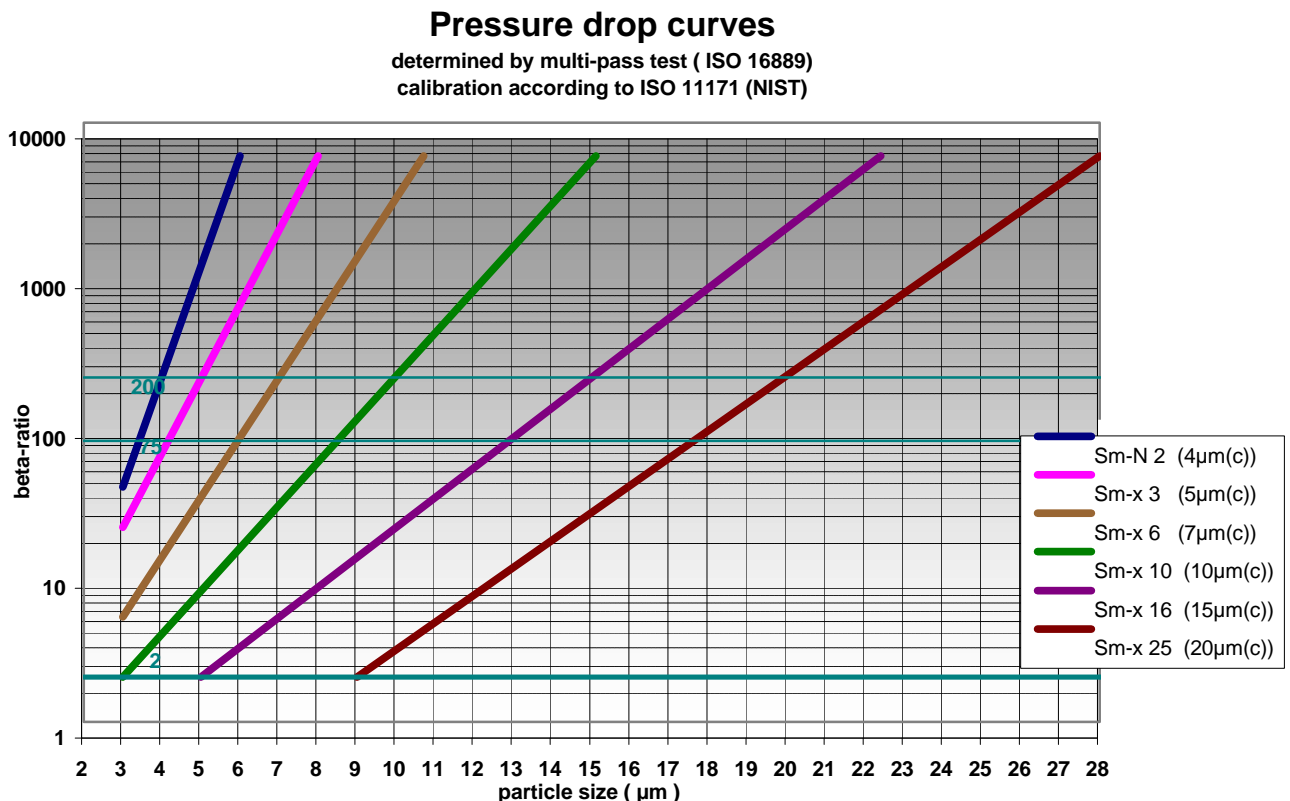
## 2.Retention rate

The retention rate of a filter element is determined according to multi-pass test. As the test dust ACFTD has been replaced by ISO-MTD, all particle sizes were newly defined and the previous multi-pass test according to ISO 4572 were replaced by ISO 16889. In the following chart, the retention rate of MAHLE hydraulic filter elements are stated according to the new standard as well as to the obsolete.

| Filter element | Retention rate         |                       |
|----------------|------------------------|-----------------------|
|                | according to ISO 16889 | according to ISO 4572 |
| Sm-N2          | $\beta_{4(c)} = 200$   | $\beta_2 = 75$        |
| Sm-x3          | $\beta_{5(c)} = 200$   | $\beta_3 = 75$        |
| Sm-x6          | $\beta_{7(c)} = 200$   | $\beta_6 = 75$        |
| Sm-x10         | $\beta_{10(c)} = 200$  | $\beta_{10} = 75$     |
| Sm-x16         | $\beta_{15(c)} = 200$  | $\beta_{16} = 75$     |
| Sm-x25         | $\beta_{20(c)} = 200$  | $\beta_{25} = 75$     |

## 3.Pressure drop curves

Hydraulic filters have to deposit particles in a wide spectrum. The retention's efficiency referring to the particle size for different filter materials is presented graphically in the pressure drop curves.



## 4.Results

In a hydraulic or lubrication system, the duty of the filter is to achieve a particle contamination to the level required and keep the level constantly during a long period. For identification of the solids in industrial hydraulic, the coding of numbers of particles according to ISO 4406 is common. With the new definition of test dust and number of particles, the standard ISO 4406 has been revised in 1987. This standard has been newly published as ISO 4406 in 1999. The new edition now uses a 3-digit code for particles  $> 4\mu\text{m}$  ( c ),  $> 6\mu\text{m}$  ( c ) and  $> 14\mu\text{m}$  ( c ). The particle sizes  $> 6\mu\text{m}$  ( c ) and  $> 14\mu\text{m}$  ( c ) correspond to approx.  $0.9\mu\text{m}$  referring to the obsolete. In the following, the achieved cleanliness classes with **MAHLE** hydraulic filter elements for all standardized ranges are stated. These values are based on long-term experiences with filter sizing and are considered as an approximate value.

|        | Cleaness classes<br>according to ISO 4406(1999)<br>>4 $\mu\text{m}$ (c) / >6 $\mu\text{m}$ (c) / >14 $\mu\text{m}$ (c) |
|--------|--|
| Sm-N2  | 13/11/08   |
| Sm-x3  | 14/12/09   |
| Sm-x6  | 16/13/10   |
| Sm-x10 | 17/15/11   |
| Sm-x16 | 20/17/12   |
| Sm-x25 | 23/19/13   |

## 5.Test regulations

**MAHLE** filter elements are manufactured respectively, tested in accordance with the following international standards:

|              |   |
|--------------|---|
| DIN ISO 2941 | Hydraulic fluid power - filter elements - verification of collapse / burst resistance                                       |
| DIN ISO 2942 | Hydraulic fluid power - filter elements - verification of fabrication integrity and determination of the first bubble point |
| DIN ISO 2943 | Hydraulic fluid power - filter elements - verification of material compatibility with fluids                                |
| DIN ISO 3723 | Hydraulic fluid power - filter elements - method for end load test  |
| DIN ISO 3724 | Hydraulic fluid power - filters - evaluation of pressure drop versus flow characteristic                                    |
| ISO 10771.1  | Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications.                                     |
| ISO 16889    | Hydraulic Fluidpower filters-Multi-pass method for evaluation filtration performance of a filter element                    |

As an independent industrial filter section within a technologically oriented, world-wide operating group, the **MAHLE** industrial filters are available for all scientific possibilities of the **MAHLE** group.

## 6.References

For further information on **MAHLE** hydraulic filters, we recommend our "filter guide". For information on replacement of the test dust and replacement of different ISO-standards, the article "**New test dust, new calibration, new filter testing methods - effects in practice**" was published in the magazine "**O + P - Oil hydraulic and pneumatics (2002) no.1**". This article is available on request at **MAHLE**!

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