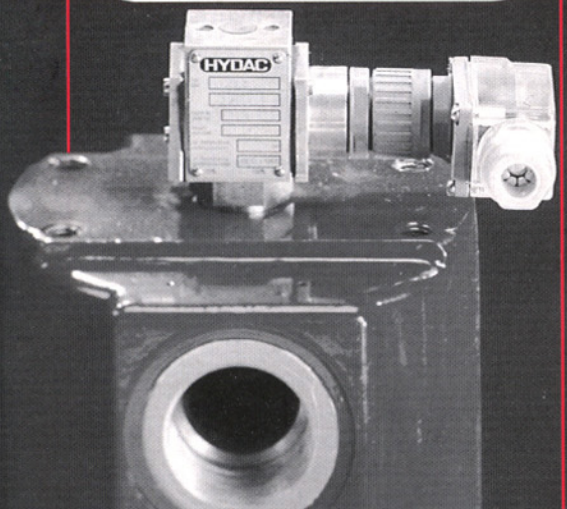
HYDAC INTERNATIONAL

# Pressure Filters
## DF / MDF / LF




**The DF, MDF and LF series of HYDAC pressure filters is designed for inline mounting in hydraulic systems and for process engineering applications for filtering contaminants out of fluids used in these systems.**

# 1. DESCRIPTION

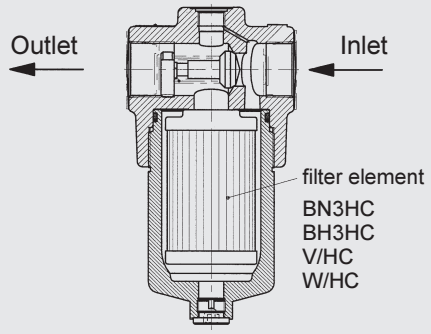
1.1. FILTER HOUSING

1.1.1 **Basic design**

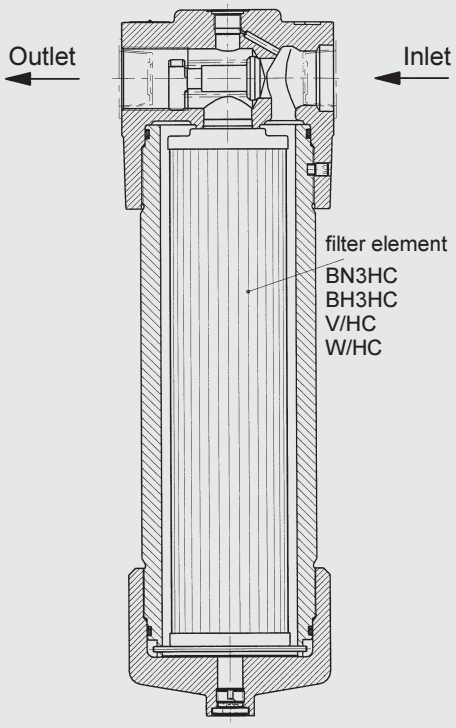
Filters of the DF, MDF and LF series consist of the filter head and a screw-in filter bowl.
Size 660 of the DF filter is also available with a two-piece bowl (tube and cover plate) as an additional version. When changing the element, sizes 500 and 660 have the advantages of diamond knurling and a ring on the bowl. For size 990 and above the two-piece bowl version is used.

The standard models of the DF, MDF and LF are supplied without a bypass valve. Moreover, sizes 30 to 280 are supplied without a pressure release plug. Size 330 and above are supplied with a pressure release plug as standard. The connection for a clogging indicator is available as standard.

Model with one-piece bowl




Model with two-piece bowl




1.1.2 **Materials**

DF SERIES:
Filter Head: GGG 40
Filter Bowl: Cold impact formed steel

MDF SERIES:
Filter Head: GGG 40
Filter Bowl: Cold impact formed steel

LF SERIES:
Filter Head: Al
Filter Bowl: Size 30 - 330: Al
Size 660: Cold impact formed steel

1.1.3 **Seals**

NBR (Perbunan)

1.1.4 **Special models**

– Filters with protective finish
– Filters with bypass valve
– Filters with pressure release plug (size 280 and below)
– Viton seals

1.1.5 **Accessories**

– Visual and/or electrical clogging indicator.
The clogging indicators must be tightened to the recommended torque ratings,
(see brochure no.: E 7.050../..)
– Mating flanges for filters with SAE flange connection.

1.2. NOTE

For larger flow rates and lower pressure ranges, see brochure:
Inline Filters (RFL)
no.: E 7.104../..

For stainless steel filters, see brochure:
Industrial Processing Filters
no.: E 7.700../..

Stainless steel filters also available for offshore applications. For information, contact our sales/technical department.

1.2.1 **Filter elements**

See Filter Element brochure
no.: E 7.200../..

1.2.2 **Cleaning of elements**

**Please note:**
Only wire mesh (W) and metal fibre (V) elements can be cleaned.

Filter elements with Betamicron®-H or Betamicron®-N filter material **cannot** be cleaned.

1.2.3 **Spare parts**

See brochure: Spare Parts and Maintenance Instructions,
no. E 7.501.E./..

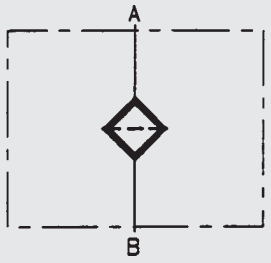
# 2. TECHNICAL SPECIFICATIONS

2.1 GENERAL

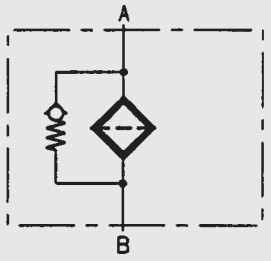
2.1.1 **Designation and hydraulic symbols**

| | |
|---|---|
| High pressure filter | DF |
| Medium pressure filter | MDF |
| Inline filter | LF |

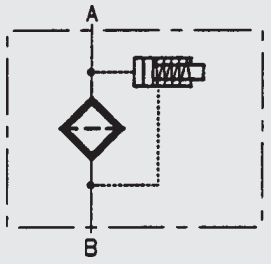
Filter without clogging indicator, without bypass valve (A)



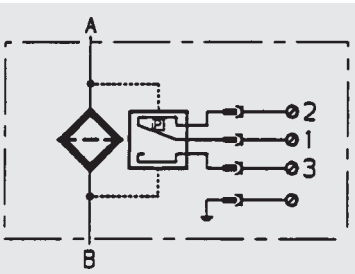

Filter without clogging indicator, with bypass valve (A../-B6)



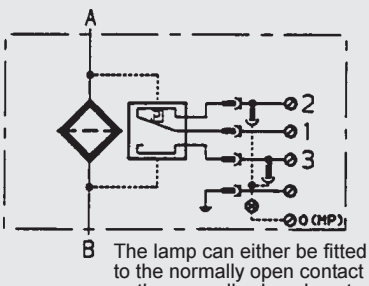

Filter with visual clogging indicator (B)




Filter with electrical clogging indicator (C)




Filter with visual and electrical clogging indicator (D)




The lamp can either be fitted to the normally open contact (3) or the normally closed contact (2)

2.1.2 **Model Code**
(also order example)

**DF BH/HC 60 G 10 C 1 . 1 / -V**

**Filter Type**
DF high pressure filter
MDF medium pressure filter
LF inline filter

**Filter element material**
BH/HC Betamicron®-H3HC element ] absolute filtration
BN/HC Betamicron®-N3HC element ]
V/HC metal fibre element ] nominal filtration
W/HC wire mesh element ]

**Size**
DF 30/60/110/140/160/240/280/330/500/660[1)]/990/1320
MDF 30/60/110/160/240
LF 30/60/110/160/240/330/660

**Type of connection**
G threaded connection
F flange connection

**Filtration rate in µm**
3, 5, 10, 20, 25
Betamicron®-H (BH3HC) ] absolute filtration
Betamicron®-N (BN3HC) ]
metal fibre (V) ] nominal filtration
wire mesh (W/HC) ]

**Type of clogging indicator**
A = without clogging indicator ] see separate brochure on clogging indicators brochure no.: E 7.050../..
B = with visual clogging indicator ]
C = with electrical clogging indicator ]
D = with combined visual and electrical indicator ]

**Type code**
1 = standard connection for inlet and outlet (one-piece filter bowl)
2 = standard connection for inlet and outlet (two-piece filter bowl) sizes 660 to 1320

**Modification number**
1

**Supplementary details**
no details = standard
-V = FPM (Viton) seals, filter suitable for phosphate ester (HFD-R)
-W = NBR (Perbunan) seals, filter suitable for oil-water emulsion (HFA), water polymer solution (HFC)
-L24 = light with 24 V DC ] on type "D" indicators only
-L48 = light with 48 V DC ]
-L110 = light with 110 V DC ]
-L220 = light with 220 V DC ]
-LED = 2 light emitting diodes for up to 24 V DC ]
-B6 = with bypass valve (cracking pressure 6 bar)
-SO 184 = pressure release/oil drain plug (up to size 280)

[1)] for DF series, this filter is available with type code 1 and 2

2.1.3 **Type of construction**
Inline filter

2.1.4 **Mounting method**
4 mounting holes in filter head

2.1.5 **Approx. weights**

| | with element | without element |
|---|---|---|
| DF 30 | 1.9 kg | 1.8 kg |
| DF 60 | 4.1 kg | 3.9 kg |
| DF 110 | 6.0 kg | 5.7 kg |
| DF 140 | 6.6 kg | 6.2 kg |
| DF 160 | 9.6 kg | 9.1 kg |
| DF 240 | 11.3 kg | 10.6 kg |
| DF 280 | 15.9 kg | 14.5 kg |
| DF 330 | 22.6 kg | 21.4 kg |
| DF 500 | 26.9 kg | 25.2 kg |
| DF 660[2] | 30.5 kg | 28.3 kg |
| DF 660[3] | 36.2 kg | 34.0 kg |
| DF 990 | 43.4 kg | 40.0 kg |
| DF1320 | 52.4 kg | 48.0 kg |
| MDF 30 | 1.9 kg | 1.8 kg |
| MDF 60 | 3.2 kg | 3.0 kg |
| MDF110 | 3.7 kg | 3.2 kg |
| MDF160 | 7.2 kg | 6.7 kg |
| MDF240 | 8.1 kg | 7.4 kg |
| LF 30 | 0.8 kg | 0.7 kg |
| LF 60 | 1.5 kg | 1.3 kg |
| LF 110 | 1.8 kg | 1.5 kg |
| LF 160 | 3.7 kg | 3.2 kg |
| LF 240 | 4.3 kg | 3.6 kg |
| LF 330 | 8.2 kg | 7.0 kg |
| LF 660 | 17.8 kg | 15.6 kg |

2.1.6 **Housing volumes**
Filter type LF and DF

| Size | Volume |
|---|---|
| 30 | 0.13 l |
| 60 | 0.20 l |
| 110 | 0.33 l |
| 140[1] | 0.40 l |
| 160 | 0.60 l |
| 240 | 0.80 l |
| 280[1] | 1.45 l |
| 330 | 1.50 l |
| 500[1] | 2.30 l |
| 660 | 3.00 l |
| 990[1] | 4.20 l |
| 1320[1] | 5.60 l |

Filter type MDF

| Size | Volume |
|---|---|
| 30 | 0.10 l |
| 60 | 0.18 l |
| 110 | 0.32 l |
| 160 | 0.55 l |
| 240 | 0.79 l |

[1] for DF series only
[2] size 660, type code 2
[3] size 660, type code 1

2.1.7 **Pipe connection sizes**
(threaded connection to ISO 228) and the relevant type codes

| | | | | |
|---|---|---|---|---|
| DF | 30 | G | G ½ | 1.1 |
| DF | 60 | G | G ¾ | 1.1 |
| DF | 110 | G | G ¾ | 1.1 |
| DF | 140 | G | G ¾ | 1.1 |
| DF | 160 | G | G 1 ¼ | 1.1 |
| DF | 240 | G | G 1 ¼ | 1.1 |
| DF | 280 | G | G 1 ¼ | 1.1 |
| DF | 330 | G | G 1 ½ | 1.1 |
| DF | 330 | F | SAE flange DN 50 / 6000 psi | 1.1 |
| DF | 500 | G | G 1 ½ | 1.1 |
| DF | 500 | F | SAE flange DN 50 / 6000 psi | 1.1 |
| DF | 660 | G | G 1 ½ | 1.1<br>2.1 |
| DF | 990 | G | G 1 ½ | 2.1 |
| DF | 990 | F | SAE flange DN 50 / 6000 psi | 2.1 |
| DF | 1320 | G | G 1 ½ | 2.1 |
| DF | 1320 | F | SAE flange DN 50 / 6000 psi | 2.1 |
| MDF | 30 | G | G ½ | 1.1 |
| MDF | 60 | G | G ¾ | 1.1 |
| MDF | 110 | G | G ¾ | 1.1 |
| MDF | 160 | G | G 1 ¼ | 1.1 |
| MDF | 240 | G | G 1 ¼ | 1.1 |
| LF | 30 | G | G ½ | 1.1 |
| LF | 60 | G | G ¾ | 1.1 |
| LF | 110 | G | G ¾ | 1.1 |
| LF | 160 | G | G 1 ¼ | 1.1 |
| LF | 240 | G | G 1 ¼ | 1.1 |
| LF | 330 | G | G 1 ½ | 1.1 |
| LF | 660 | G | G 1 ½ | 1.1 |

2.1.8 **Mounting position**
Vertical

2.1.9 **Flow direction**
Inlet and outlet: side connection
At the same level, on opposite sides.

2.2. HYDRAULIC DATA

2.2.1 **Operating pressure/ temperature**
The operating pressure is generally dependent on the operating temperature.
The following apply:

δ min…δ max…= -10 °C…+100 °C

DF 30 - 660[3]: $p_{max}$ = 420 bar

DF 660[2] - 1320: $p_{max}$ = 315 bar

(420 bar available on request)

MDF all sizes: $p_{max}$ = 210 bar

LF all sizes: $p_{max}$ = 100 bar

δ min…δ max…= -30 °C…-10 °C only possible with Perbunan (NBR) seals.

DF 30 - 660[3]: $p_{max}$ = 210 bar

DF 660[2] - 1320: $p_{max}$ = 157.5 bar

LF sizes 30 - 330: $p_{max}$ = 100 bar

LF size 660: $p_{max}$ = 75 bar

Proof of fatigue strength for complete filters to HYDAC test standard. Min. 1 mill. stress cycles, from 0 bar to permissible operating pressure (= $p_{max}$).

For other temperature ranges, please contact our sales/technical department.

2.2.2 **Permissible Δp across element**
Betamicron®-H (BH3HC): 210 bar
Betamicron®-N (BN3HC): 25 bar
Metal fibre (V): 210 bar
Wire mesh (W): 30 bar

2.2.3 **Compatibility with hydraulic media**
Mineral oils:
test criteria to ISO 2943

Lubricating oils:
test criteria to ISO 2943

Suitable for use with non-flam fluids, synthetic oils and rapidly biodegradable oils. For use with water please check with our sales/technical department.

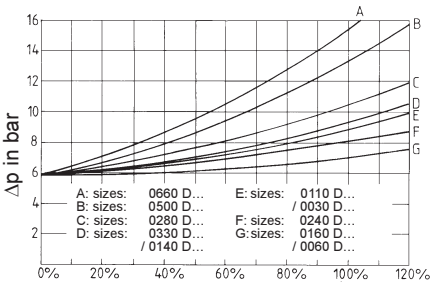
2.2.4 **Flow fatigue resistance to ISO 3724**
High fatigue resistance due to solid filter material supports on both sides and high inherent stability of filter materials.

2.2.5 **Pressure setting of clogging indicator**
$\Delta p_a$ = 5 bar - 10%

2.2.6 **Cracking pressure of bypass valve**
$\Delta p_O$ = 6 bar + 10%

2.2.7 **Bypass valve graphs**
The bypass valve graphs apply to mineral oil with a density of 0.86 kg/dm³.

The differential pressure of the valve changes proportionally to the density.

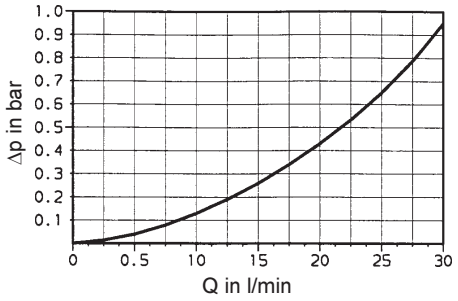


Q in l/min as a % value of the size

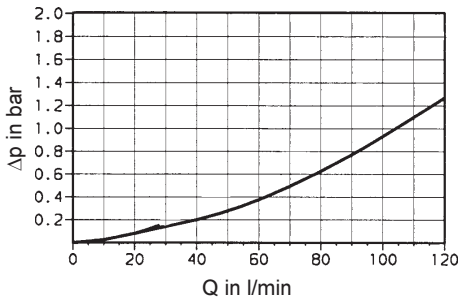
## 2.3. HOUSING GRAPHS

The housing graphs apply to mineral oil with a density of 0.86 kg/dm³ and a kinematic viscosity of 30 mm²/s.
For turbulent flows the differential pressure changes proportionally to the density.
For laminar flows the pressure changes proportionally to the density and the viscosity.

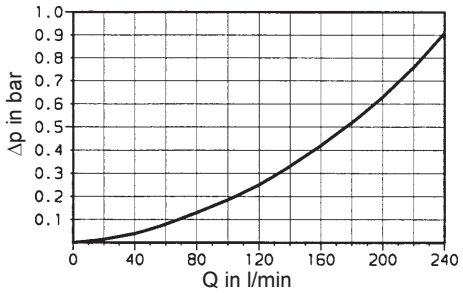
**DF/MDF/LF 30**



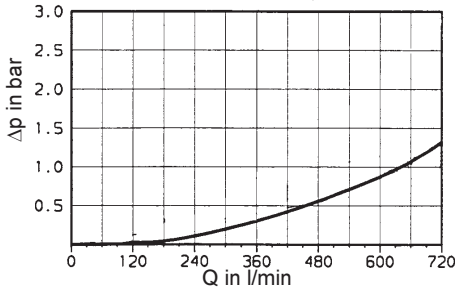

**DF/MDF/LF 60/110/140***




**DF/MDF/LF 160/240/280***




**DF/LF 330/500*/660/990*/1320***




* only for DF model

# 3. FILTER CALCULATION

## 3.1. TOTAL DIFFERENTIAL PRESSURE ACROSS THE COMPLETE FILTER

The total differential pressure of the clean filter is the sum of housing and element differential pressure at operating viscosity.

$\Delta p_{total} = \Delta p_{housing\ at\ Q} + f \times \Delta p_{element\ at\ Q}$

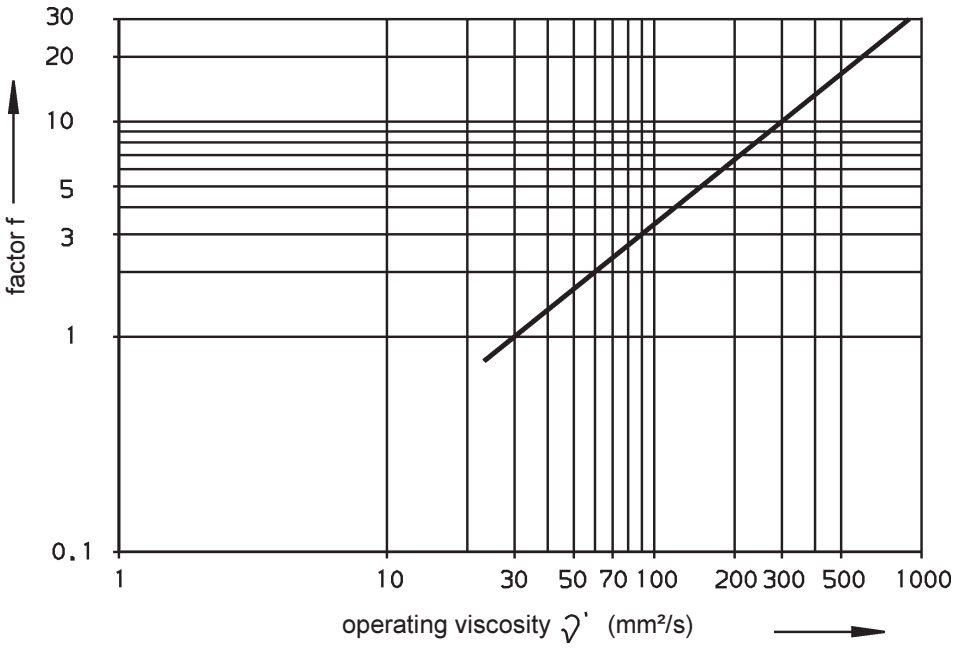
$\Delta p_{total}$ = total differential pressure across complete filter

$\Delta p_{housing\ at\ Q}$ = housing differential (obtainable from housing graphs see point 2.3.)

$\Delta p_{element\ at\ Q}$ = element differential pressure at 30 mm²/s at max. flow in l/min: (obtainable from element graphs see brochure no. E 7.200/.., Filter Elements)

f = viscosity conversion factor - see point 3.1.1.

### 3.1.1 Viscosity conversion factor f




### 3.1.2 Calculation guidelines

Due to the high contamination retention capacity of the Betamicron® elements, we recommend that the calculation of the filters (with clean element and at operating viscosity) be based on the following initial pressure drop:

$\Delta p_{total}$ = 0.2 x pressure setting of clogging indicator.

For pressure setting of clogging indicator see point 2.2.5.

Other calculations are possible, depending on the system.

An approximate calculation of the filter size can be made by means of the pre-selection chart - see point 3.2.

## 3.2. FILTER PRE-SELECTION CHART

The pre-selection chart applies to a viscosity of 30 mm²/s at the usual hydraulic loads and favourable application conditions and applies to the following filters:

**Filter type**: DF, MDF, LF

**Element type**: ...D...BN3HC and ...D...BH3HC

The following example explains the procedure using the pre-selection chart:

**Example:**

- System related details:

  Flow rate of variable displacement pump:
  $Q_p$ = 120 - 350 l/min

  Max. operating pressure:
  $p_B$ = 280 bar

  Required filtration rating:
  5 µm absolute

  Filter material:
  BH3HC

- Method:

  Determination of filter type

  Max. operating pressure:
  $p_B$ = 280 bar

  thus $p_B \leq p_{max}$

  ⇒ filter type: DF (see point 2.2.1)

- Determination of calculation flow rate $Q_A$

  $Q_A$ = max. flow rate through the filter

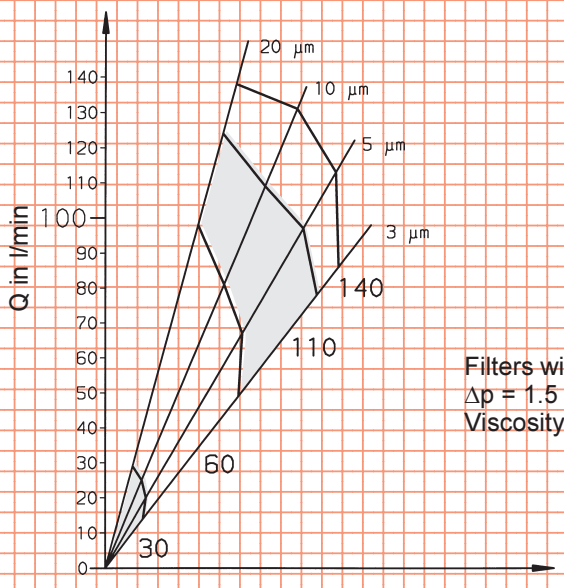
  $Q_A$ = $Q_p$ max. = 350 l/min

- Determination of filter size

  For a calculation flow rate of $Q_A$ = 200 l/min and a filtration rating of 5 µm absolute, the filter size according to the pre-selection chart is 500

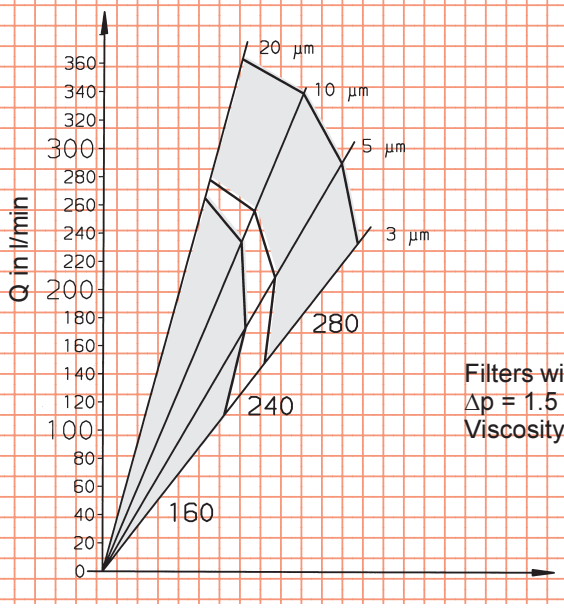
  Filter type:
  DF BH/HC 500 .. 5 ..

**Size 30 - 140**



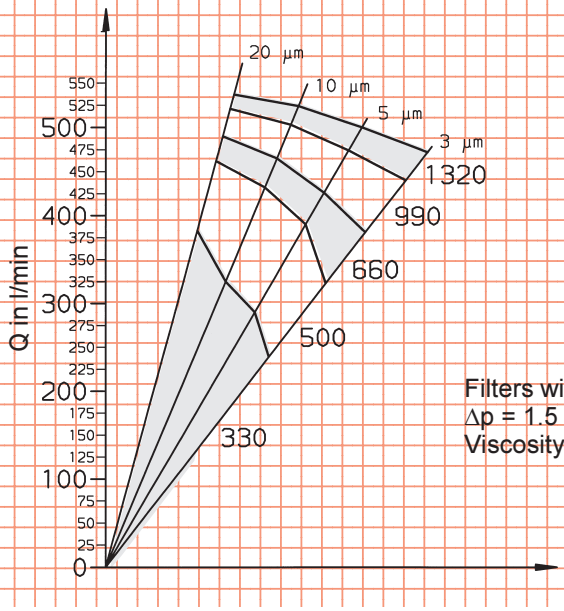

Filters with Betamicron® elements
Δp = 1.5 bar
Viscosity 30 mm²/s

**Size 160 - 280**




Filters with Betamicron® elements
Δp = 1.5 bar
Viscosity 30 mm²/s

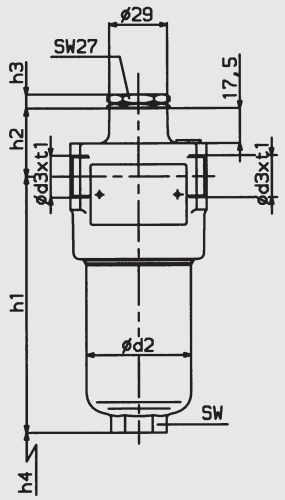
**Size 330 - 1320**



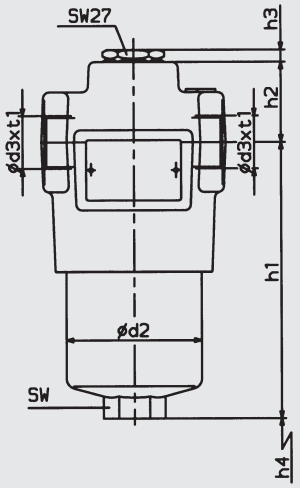

Filters with Betamicron® elements
Δp = 1.5 bar
Viscosity 30 mm²/s

## 4. DIMENSIONS

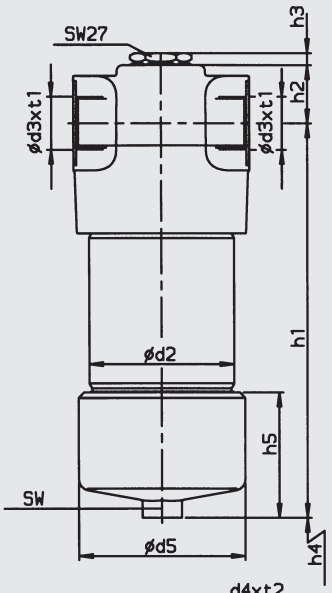
**DF/MDF/LF 30 G**



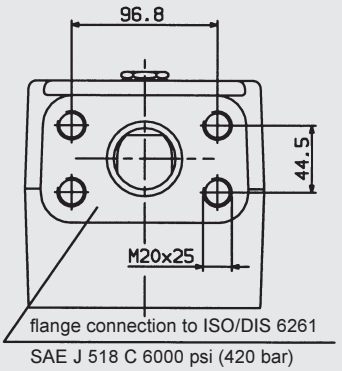

**DF/LF 60 - 660 G**
**MDF 60 - 240 G**



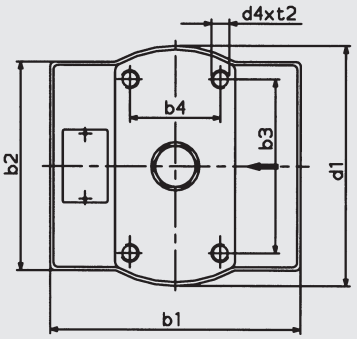

**DF/LF 660 - 1320 G**

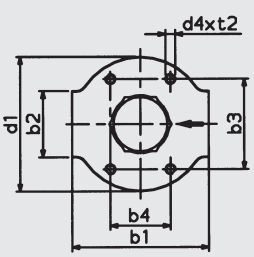


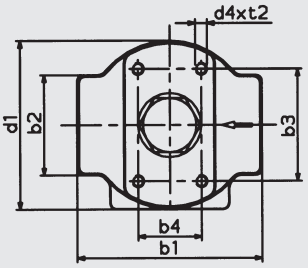

**DF/LF 330 - 1320 F**

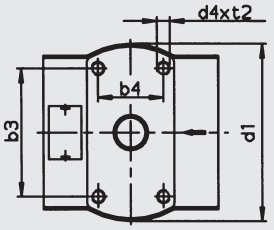



**DF 330 - 1320 G/F**




Threaded connection to ISO 228

Dimensions in mm

| Typ | $b_1$ | $b_2$ | $b_3$ | $b_4$ | Ø $d_1$ | Ø $d_2$ | $d_3$ | $d_4$ | Ø $d_5$ | $h_1$ | $h_2$ | $h_3$ | $h_4$ | $h_5$ | SW | $t_1$* | $t_2$* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LF 30 G | 69 | 33 | 45 | 30 | 67 | 52 | G ½ | M 5 | – | 125.5 | 35 | 7 | 75 | – | 24 | 15 | 6 |
| LF 60 G<br>LF 110 G | 92 | 50 | 56 | 32 | 84 | 68 | G ¾ | M 6 | –<br>– | 137.5<br>205.0 | 40 | 6 | 75 | –<br>– | 27 | 17 | 9 |
| LF 160 G<br>LF 240 G | 128 | 65 | 85 | 35 | 116 | 95 | G 1¼ | M 10 | –<br>– | 190.5<br>250.5 | 47 | 6 | 95 | –<br>– | 32 | 21 | 14 |
| LF 330 G<br>LF 660 G | 162 | 85 | 115 | 60 | 159 | 130<br>127 | G 1½ | M 12 | –<br>– | 252.5<br>417.5 | 50 | 6 | 105 | –<br>– | 36 | 23 | 17 |
| DF/MDF 30 G | 68/<br>66 | 33/<br>54 | 45/<br>43 | 30/<br>21 | 67/<br>60 | 52/<br>45 | G ½ | M 5 | – | 127.5/<br>130 | 34/<br>36 | 7 | 75 | – | 24 | 15 | 6 |
| DF/MDF 60 G<br>DF/MDF 110 G<br>DF 140 G | 93/<br>92 | 50/<br>66 | 56 | 32 | 84/<br>78 | 68/<br>59 | G ¾ | M 6 | –<br>–<br>– | 137.5/133<br>205 /201<br>248.5 | 40 | 6 | 85/<br>75 | –<br>–<br>– | 27 | 17 | 9 |
| DF/MDF 160 G<br>DF/MDF 240 G<br>DF 280 G | 128/<br>124 | 65/<br>80 | 85 | 35 | 117/<br>112 | 95/<br>84 | G 1¼ | M 10 | –<br>–<br>– | 193.5/178<br>253.5/237<br>435.5 | 47 | 6 | 105/<br>85 | –<br>–<br>– | 32 | 21 | 14 |
| DF 330 G | 167 | | | | | | G 1½ | | – | 255.5 | | | | – | | | |
| DF 330 F | 160 | | | | | | SAE DN 50 | | – | 255.5 | | | | – | | | |
| DF 500 G | 167 | | | | | | G 1½ | | – | 348.5 | | | | – | | | |
| DF 500 F | 160 | 138 | 115 | 60 | 159 | 130 | SAE DN 50 | M 12 | – | 348.5 | 52 | 6 | 115 | – | 36 | 23 | 17 |
| DF 660 G | 167 | | | | | | G 1½ | | – | 426.0 | | | | – | | | |
| DF 660 F | 160 | | | | | | SAE DN 50 | | – | | | | | – | | | |
| DF 660 G [1)] | 167 | | | | | | G 1½ | | | 420 | | | 350 | | | | |
| DF 660 F [1)] | 160 | | | | | | SAE DN 50 | | | 420 | | | 350 | | | | |
| DF 990 G | 167 | | | | | | G 1½ | | | 576 | | | 500 | | | | |
| DF 990 F | 160 | 138 | 115 | 60 | 159 | 132 | SAE DN 50 | M 12 | 152 | 576 | 52 | 6 | 500 | 112 | 36 | 23 | 17 |
| DF 1320 G | 167 | | | | | | G 1½ | | | 742 | | | 670 | | | | |
| DF 1320 F | 160 | | | | | | SAE DN 50 | | | 742 | | | 670 | | | | |

* = thread depth
[1)] = size 660 with type code 2

## 5. NOTE

The information in this brochure relates to the operating conditions and applications described.
For applications or operating conditions not described, please contact the relevant technical department.
Subject to technical modifications.