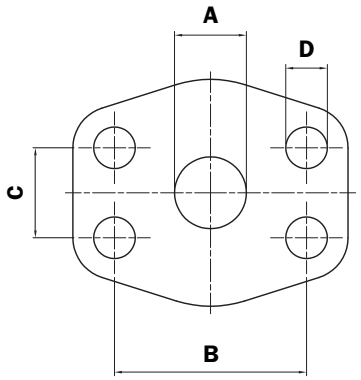
# Sizes - Connections DN - SAE

**FLANGE SAE 3000 PSI**



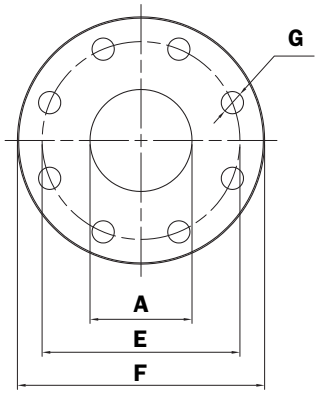

## Connection to 3000 psi SAE flange

| Dimension | 1" SAE 3000 PSI **M** | 1" SAE 3000 PSI **UNC** | 1 1/4" SAE 3000 PSI **M** | 1 1/4" SAE 3000 PSI **UNC** | 1 1/2" SAE 3000 PSI **M** | 1 1/2" SAE 3000 PSI **UNC** |
|---|---|---|---|---|---|---|
| **A** | 25 | 25 | 32 | 32 | 38 | 38 |
| **B** | 52,4 | 52,4 | 58,7 | 58,7 | 70 | 70 |
| **C** | 26,2 | 26,2 | 30,2 | 30,2 | 35,7 | 35,7 |
| **D** | M10 | 3/8" UNC | M10 | 7/16"UNC | M12 | 1/2" UNC |

## Connection to 3000 psi SAE flange

| Dimension | 2" SAE 3000 PSI **M** | 2" SAE 3000 PSI **UNC** | 2 1/2" SAE 3000 PSI **M** | 2 1/2" SAE 3000 PSI **UNC** | 3" SAE 3000 PSI **M** | 3" SAE 3000 PSI **UNC** | 4" SAE 3000 PSI **M** | 4" SAE 3000 PSI **UNC** |
|---|---|---|---|---|---|---|---|---|
| **A** | 51 | 51 | 63 | 63 | 73 | 73 | 99 | 99 |
| **B** | 77,8 | 77,8 | 88,9 | 88,9 | 106,4 | 106,4 | 130,2 | 130,2 |
| **C** | 42,9 | 42,9 | 50,8 | 50,8 | 62 | 62 | 77,8 | 77,8 |
| **D** | M12 | 1/2" UNC | M12 | 1/2" UNC | M16 | 5/8" UNC | M16 | 5/8" UNC |

**FLANGE DN 100 PN 10/16**




| Connection Flange IN-OUT | DN 80 PN 16 | DN 100 PN 16 |
|---|---|---|
| **A** | 73 | 99 |
| **E** | 160 | 180 |
| **F** | 200 | 220 |
| **G** | 18 | 18 |

## SAE flange connections available on In-Line filters

| | Connections | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Filter Type** | **1" SAE 3000** | **1 1/4" SAE 3000** | **1 1/2" SAE 3000** | **2" SAE 3000** | **2 1/2" SAE 3000** | **3" SAE 3000** | **4" SAE 3000** | **DN 80 PN 16** | **DN 100 PN 16** |
| **LMP 210** | X | X | X | | | | | | |
| **LMP 400-1** | | | | X | X | | | | |
| **LMP 430-1** | | | | X | X | | | | |
| **LMP 400-1-31** | | | | | X | | | | |
| **LMP 900-1** | | | | | | X | X | | |
| **LMP 902-3** | | | | | | | X | | |
| **LMP 950-1** | | | | | | X | X | | |
| **LMP 952-3-4-5-6** | | | | | | | X | | |
| **LMD 951 1-2-3** | | | | | | X | X | X | X |

# Filter element

## Element description

| | |
|---|---|
| M - Wire Mesh | Δp 20 bar |
| P - Paper | Δp 20 bar |
| A - Microfibre | Δp 20 bar |

**Characteristics of filter elements with nominal filtration, M series**

For filter elements in wire mesh, filtration degree is defined as the maximum diameter of a sphere corresponding to the mesh size, in microns.

**Characteristics of filter elements with nominal filtration, P series**

For filter element in cellulose, filtration efficiency expressed in micron is to be construed as nominal $\beta_{X©} > 2$

**Characteristics of filter elements with absolute filtration, A series**

For filter element in microfibre, filtration degree is defined by the test bench MULTIPASS ISO 16889.

**Reference standards**

All filter elements comply with the following **ISO** standards.

| | | |
|---|---|---|
| **ISO** | **2941** | - Collapse and burst resistance |
| **ISO** | **2942** | - Bubble point test resistance. |
| **ISO** | **2943** | - Compatibility with fluids. |
| **ISO** | **3723** | - Resistance to axial deformation. |
| **ISO** | **3724** | - Fatigue test with flow. |
| **ISO** | **3968** | - Pressure drop. |
| **ISO** | **16889** | - Filtration efficiency by means of Multipass. |

**N.B**. P series cellulose cartridges are compatible only with mineral oils in according to ISO 2943 - 4.

**Multipass test in compliance new ISO 16889**
**Contaminant ISO MTD**

| **Filtration** | $\beta_{X©} \geq 1000$ |
|---|---|
| Filter element | |
| A01 | <4 |
| A03 | 5 |
| A06 | 7 |
| A10 | 10 |
| A16 | 15 |
| A25 | 20 |

## International standards for fluid contamination control

| **Components** | **Recommended filtrations** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Servo valves | | | ● | ● | ● | | | | |
| Proportional Valves | | | | ● | ● | ● | | | |
| Variable displacement pumps. | | | | | ● | ● | ● | | |
| Cartridge valves | | | | | | ● | ● | ● | |
| Piston pumps | | | | | | ● | ● | ● | |
| Vane pumps | | | | | | | ● | ● | ● |
| Pressure - flow rate control valves | | | | | | | ● | ● | ● |
| Solenoid valves | | | | | | | ● | ● | ● |
| ISO code | 12/10/7 | 13/11/8 | 14/12/9 | 15/13/10 | 16/14/11 | 17/15/12 | 18/16/13 | 19/17/14 | 20/18/15 |
| NAS code | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Absolute filtration recommended | $\beta_{5©} \geq 1000$ | | | | $\beta_{7©} \geq 1000$ | | $\beta_{10©} \geq 1000$ | | $\beta_{20©} \geq 1000$ |

# Filter sizing

Correct sizing of the filter must be based on a variable pressure drop depending on the application:

| | |
|---|---|
| • return filter | Δp from 0,4 to 0,6 bar |
| • filter on lubrication lines | Δp from 0,3 to 0,5 bar |
| • off-line fluid power plants | Δp from 0,3 to 0,4 bar |
| • off-line filter test benches | Δp from 0,1 to 0,3 bar |
| • over-boost filte | Δp from 0,4 to 0,6 bar |

The pressure drop calculation is performed by adding together the value for the housing and the value for the filter element. The pressure drop in the housing is proportional to the fluid density kg/dm³; all the graphs in the catalogue are referred to mineral oil with density of 0.86 kg/dm³.
The filter element pressure drop value is proportional to viscosity mm²/s, the Y values in the catalogue are referred to viscosity of 30 mm²/s.

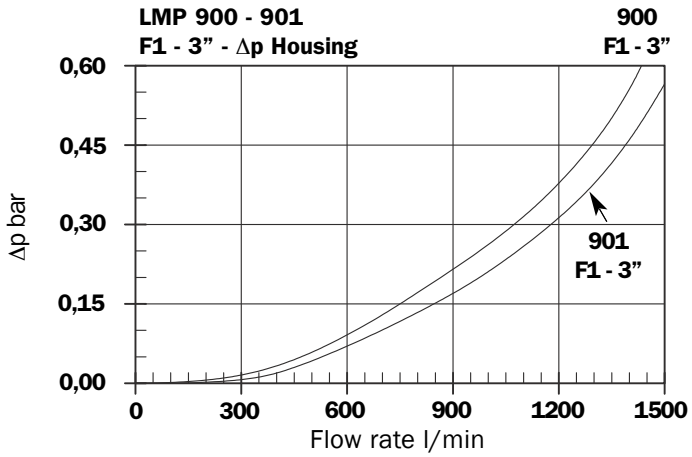
## Number of working cartridges installed in LMP - LMD filters

| | |
|---|---|
| All the LMP | 1 cartouche |
| Exclouding: | |
| LMP 900 2 | 2 cartridges CU 900 |
| LMP 902 2 | 4 cartridges CU 900 |
| LMP 903 2 | 6 cartridges CU 900 |
| LMP 952 3 | 2 cartridges CU 950 3 |
| LMP 953 3 | 3 cartridges CU 950 3 |
| LMP 954 3 | 4 cartridges CU 950 3 |
| LMP 955 3 | 5 cartridges CU 950 3 |
| LMP 956 3 | 6 cartridges CU 950 3 |
| LMD 952 3 | 2 cartridges CU 950 3 |
| LMD 953 3 | 3 cartridges CU 950 3 |

**Filter housings Δp pressure drop**

The curves are plotted utilising mineral oil with density of 0.86 kg/dm³ to ISO 3968.

**Δp varies proportionally with density.**




**For Y values see next page:**

**Sizing data for single cartridge, head at top**

Δp Tot.
Δpc Filter housing
Δpe Filter element
**Y** Multiplication factor (see page 9)
**Q** l/min = flow rate
**V1** = reference viscosity 30 mm²/s (cSt)
**V2** = operating viscosity in mm²/s (cSt)
**Δp Tot. = Δpc + Δpe**
**Δpe = Y : 1000 x Q x (V2/V1)**

**Calculation example with HLP Mineral Oil Variation in viscosity**

Data:
Filter with in-line connections
Pressure = 15 bar
Flow rate = 700 l/min
Viscosity = 46 mm²/s (cSt)
Density = 0,86 Kg/dm³
Filtration = 10 μ absolute
With bypass valve

Filter type - LMP 900 1 (see housings pressure drop graphs on page 65)

**Practical example**

Q = 700 l/min
$V_2$ = 46 mm²/s (cSt)
Pmax = 15 bar
Filtration = 10 μ absolute
Δp Tot. max = **0,6 bar** (max. recommended value)
Filter element series N, Δp max 20 bar
**Δpc = 0,13 bar (* see diagram)**
**Δpe = (0,3166 : 1000) x 700 x (46/30) = 0,34 bar**
**Δp Tot. = 0,13 + 0,34 = 0,47 bar**

Sized filter type:
**LMP 900 1 B A F1 A10 N P01**

**Calculation examples with HFD fluid Variations in viscosity and density**

Data:
Filter with in-line connections
Pressure = 15 bar
Flow rate = 700 l/min
Viscosity = 46 mm²/s (cSt)
Density = 1,1 Kg/dm³
Filtration = 10 μ absolute
With bypass valve

Filter type - LMP 900 1 (see housings pressure drop graphs on page 65)

**Practical example**

Q = 700 l/min
$V_2$ = 46 mm²/s (cSt)
Pmax = 15 bar
Filtration = 10 μ absolute
Δp Tot. max = **0,6 bar** (max. recommended value)
Filter element series N, Δp max 20 bar
**Δpc = 0,13 x (1,1/0,86)= 0,17**
**Δpe = (0,3166 : 1000) x 700 x (46/30) = 0,34 bar**
**Δp Tot. = 0,17 + 0,34 = 0,51 bar**

Filter type:
**LMP 900 1 B V F1 A10 N P01**

**Data for sizing multicartridge filters with head at top**

Δp Tot.
Δpc Filter housing
Δpe Filter element
**Y** Multiplication factor (see below)
**Q** l/min = flow rate
**V1** = reference viscosity 30 mm²/s (cSt)
**V2** = operating viscosity in mm²/s (cSt)
**Δp Tot. = Δpc + Δpe**
**Δpe = Y : 1000 x Q x (V2/V1)**

For multicartridge filter sizing, the value of flow rate "Q l/min" must be divided by the number of cartridges.

**Calculation example with HLP Mineral Oil Variation in viscosity**

Data:
Filter with in-line connections
Pressure = 10 bar
Flow rate = 1400 l/min
Viscosity = 46 mm²/s (cSt)
Density = 0,86 Kg/dm³
Filtration = 6 μ absolute
With bypass valve

Filter type - LMP 952 number of installed cartridges 2
(see housings pressure drop graphs see page 87 and 88)

**Practical example**

Q = 1400 l/min
$V_2$ = mm²/s (cSt)
Pmax = 10 bar
Filtration = 6 μ absolute
Δp Tot. max = **0,6 bar** (max. recommended value)
Filter element series N, Δp max 20 bar
**Δpc = 0,1 bar (* see diagram)**
**Δpe = (0.4 : 1000) x (1400/2) x (46/30) = 0.43 bar**
**Δp Tot. = 0.1 + 0.43 = 0.53 bar**

Sized filter type:
**LMP 952 B A FB A06 N P01**

**Calculation examples with HFD fluid Variations in viscosity and density**

Data:
Filter with in-line connections
Pressure = 10 bar
Flow rate = 1400 l/min
Viscosity = 46 mm²/s (cSt)
Density = 1,1 Kg/dm³
Filtration = 6 μ absolute
With bypass valve

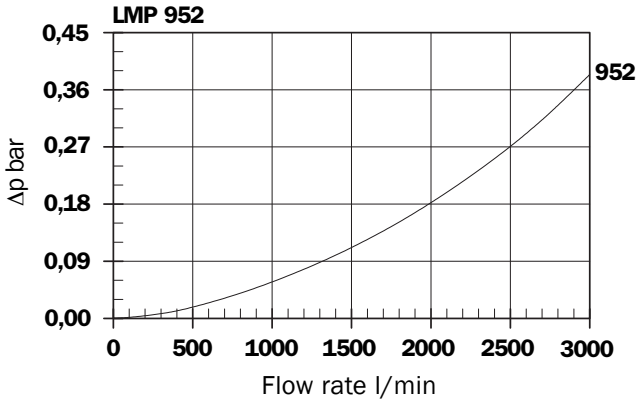
Filter type - LMP 952 (see housings pressure drop graphs see page 87 and 88)

**Practical example**

Q = 1400 l/min
$V_2$ = mm²/s (cSt)
Pmax = 10 bar
Filtration = 6 μ absolute
Δp Tot. max = **0,6 bar** (max. recommended value)
Filter element series N, Δp max 20 bar
**Δpc = 0,1 x (1,1/0,86)= 0,127 bar**
**Δpe = (0,4 : 1000) x (1400/2) x (46/30) = 0,43 bar**
**Δp Tot. = 0,127 + 0,43 = 0,557 bar**
Filter type:
**LMP 952 B V FB A06 N P01**

**Filter housing Δp pressure drop**

The curves are plotted utilising mineral oil with density of 0.86 kg/dm³ to ISO 3968.
Δp varies proportionally with density.




## Multiplication factor "Y" for definition of the pressure drop of filter elements.

**Reference viscosity 30 mm²/s**

| Filter Element | Absolute Filtration N - W Series | | | | | Nominal Filtration N Series | | Nominal Filtration N Series |
|---|---|---|---|---|---|---|---|---|
| **Type** | **A 0 3** | **A 0 6** | **A 1 0** | **A 1 6** | **A 2 5** | **P 1 0** | **P 2 5** | **M 2 5** |
| **CU 110** 1 | 16,25 | 15,16 | 8,754 | 8,142 | 5,875 | 2,862 | 2,651 | 0,1431 |
| 2 | 12,62 | 10,44 | 6,111 | 6,024 | 4,155 | 1,598 | 1,486 | 0,1253 |
| 3 | 8,571 | 7,951 | 5,066 | 4,066 | 2,397 | 1,242 | 1,153 | 0,1067 |
| 4 | 5,759 | 4,051 | 2,798 | 2,358 | 1,142 | 0,9072 | 0,8491 | 0,0558 |
| **CU 210** 1 | 5,3 | 3,92 | 1,9 | 1,66 | 1,2 | 0,48 | 0,41 | 0,098 |
| 2 | 3 | 2,3 | 1,21 | 0,88 | 0,68 | 0,42 | 0,35 | 0,065 |
| 3 | 1,55 | 1,33 | 0,69 | 0,49 | 0,42 | 0,23 | 0,17 | 0,049 |
| **CU 400** 2 | 3,133 | 2,550 | 1,457 | 1,225 | 0,780 | 0,750 | 0,640 | 0,192 |
| 3 | 2,150 | 1,700 | 0,940 | 0,781 | 0,500 | 0,400 | 0,340 | 0,102 |
| 4 | 1,600 | 1,285 | 0,709 | 0,615 | 0,400 | 0,340 | 0,270 | 0,084 |
| 5 | 1,000 | 0,833 | 0,475 | 0,340 | 0,200 | 0,240 | 0,190 | 0,057 |
| 6 | 0,822 | 0,580 | 0,300 | 0,267 | 0,175 | 0,220 | 0,177 | 0,053 |
| **CU 900** 1 | 0,860 | 0,6333 | 0,3166 | 0,300 | 0,2142 | - | - | 0,050 |
| **CU 950** 2 | 1,030 | 0,8 | 0,5875 | 0,4 | 0,2571 | - | - | 0,050 |
| 3 | 0,443 | 0,4 | 0,2625 | 0,1833 | 0,152 | | | 0,020 |