In line filters type FPS
Threaded ports - max flow 330 l/min, max pressure 320 bar

FPS in line filters are designed to protect the whole hydraulic circuit or a single valve from contamination present in the working fluid. They are particularly recommended for systems with proportional valves.

FPS filters are available with following features:
- two head sizes with BSPP or SAE threaded ports, from 3/4” to 1 1/2”
- max working pressure 320 bar
- four filter lengths with max flow 330 l/min
- without or with by-pass valve with cracking pressure 6 bar
- microfibre filter element with filtration rating 4.5 - 7 - 12 µm (c) (βx(c) >1000, ISO 16889). Collapse pressure 21 bar for filters equipped with by-pass valve or 210 bar for filters without by-pass
- without or with electrical differential clogging indicator with optional led

Note:
- filters for use in potentially explosive atmosphere are available on request, contact Atos Technical Office

<table>
<thead>
<tr>
<th>Filter head</th>
<th>Filter bowl</th>
<th>Filter element</th>
<th>By-pass valve</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

**MODEL CODE OF COMPLETE FILTERS**

| FPS   | - | 10 | A  | F10 | - | R  | W  | ** | *
|-------|---|----|----|-----|---|----|----|----|---
|       |   |    |    |     |   |    |    |    |   |
| In line filter |       |

Filter size:
- 10 = ports size 3/4” × 1”
- 30 = ports size 1 1/4” × 1 1/2”

<table>
<thead>
<tr>
<th>Filter</th>
<th>Max flow (l/min) (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>length</td>
<td>FPS-10</td>
</tr>
<tr>
<td>A</td>
<td>75</td>
</tr>
<tr>
<td>B</td>
<td>105</td>
</tr>
<tr>
<td>C</td>
<td>-</td>
</tr>
<tr>
<td>D</td>
<td>-</td>
</tr>
</tbody>
</table>

Microfibre filtration rating, βx(c) >1000 - ISO 16889:
- F03 = 4.5 µm (c)
- F06 = 7 µm (c)
- F10 = 12 µm (c)

Note:
- filters for use in potentially explosive atmosphere are available on request, contact Atos Technical Office

<table>
<thead>
<tr>
<th>Series number</th>
<th>Seals material:</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>= NBR</td>
</tr>
<tr>
<td>PE</td>
<td>= FKM (4)</td>
</tr>
</tbody>
</table>

Electrical differential clogging indicator see sect. 3
- W = without, indicator port unplugged
- P = without, indicator port with steel plug
- L = indicator with LED (3)
- M = indicator without LED (3)

By-pass:
- R = by-pass valve with cracking pressure 6 bar
  (filter element PSH-*R with collapse pressure 21 bar)
- N = without by-pass
  (filter element PSH-*N with collapse pressure 210 bar)

Ports size:
BSPP threaded:
- FPS-10
  - 01 = G 3/4”
  - 02 = G 1”
- FPS-30
  - 03 = G 1 1/4”
  - 04 = G 1 1/2”
SAE J1926-1 threaded (2):
- FPS-10
  - 42 = SAE-16 (1”)
- FPS-30
  - 44 = SAE-24 (1 1/2”)

(1) Max flow rates are performed in following conditions:
- clean filter element
- filtration rating F10 (12 µm (c))
- largest port size
- option /R, filter element with collapse pressure 21 bar
- Δp = 1 bar
- mineral oil with viscosity 32 mm²/s

In case of different conditions the max flow rates have to be recalculated - see section (2)

(2) Filters with SAE threaded ports are available on request

(3) The clogging indicator is supplied disassembled from the filter. The indicator port on filter head is plugged with plastic plug

(4) Filters with FKM seals are available on request
**HYDRAULIC SYMBOLS** (representation according to ISO 1219-1)

![Diagram of hydraulic symbols](image-url)

**MODEL CODE OF FILTER ELEMENTS** - only for spare (1)

<table>
<thead>
<tr>
<th>PSH</th>
<th>10</th>
<th>A</th>
<th>F10</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spare filter element for in line filter type FPS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Filter element size:**
- 10 = for FPS-10
- 30 = for FPS-30

**Filter element length:**
- for FPS-10
- for FPS-30

**Seals material:**
- = NBR
- PE = FKM (2)

**Microfibre filtration rating, \( \beta_x(c) > 1000 \) - ISO 16889:**
- F03 = 4.5 µm (c)
- F06 = 7 µm (c)
- F10 = 12 µm (c)

**Series number**
- R = filter element with collapse pressure 21 bar,
  for filter FPS-*R* with by-pass valve
- N = filter element with collapse pressure 210 bar,
  for filter FPS-*N* without by-pass valve

(1) Select the filter element according to the model code reported on the filter nameplate, see section 14.1
(2) Filters element with FKM seals are available on request

**MODEL CODE OF ELECTRICAL DIFFERENTIAL CLOGGING INDICATORS** - only for spare

<table>
<thead>
<tr>
<th>CID</th>
<th>E05</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spare electrical differential clogging indicator for in line filter</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Differential switching pressure:**
- E05 = 5 bar for filters with by-pass valve
- E06 = 8 bar for filters without by-pass valve

**Seals material:**
- = NBR
- PE = FKM

**Optional LED for visual indication:**
- L = with LED
- M = without LED
5 GENERAL CHARACTERISTICS

Assembly position / location: Vertical position with the bowl downward

Ambient temperature range:
- Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C

Storage temperature range:
- Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C

Materials:
- Filter head: Cast iron
- Filter bowl: Steel
- Surface protection: Phosphatized

Fatigue strength: min. 1 x 10⁶ cycles at 320 bar

6 HYDRAULICS CHARACTERISTICS

<table>
<thead>
<tr>
<th>Filter size</th>
<th>10</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port size code</td>
<td>01</td>
<td>02</td>
</tr>
<tr>
<td>Port dimension</td>
<td>BSPP threaded</td>
<td>G3/4&quot;</td>
</tr>
<tr>
<td>Max operating pressure (bar)</td>
<td>320</td>
<td></td>
</tr>
<tr>
<td>Max flow (l/min) R = filter with by-pass</td>
<td>60 ÷ 80</td>
<td>75 ÷ 105</td>
</tr>
<tr>
<td>N = filter without by-pass</td>
<td>55 ÷ 75</td>
<td>65 ÷ 90</td>
</tr>
</tbody>
</table>

Direction of filtration: See the arrow on the filter head

(1) Max flow rates are performed in following conditions:
- clean filter element
- filtration rating F10 (12 µm (c))
- Δp 1 bar
- min = max filter length
- mineral oil with viscosity 32 mm²/s

In case of different conditions the max flow rates have to be recalculated - see section 10

7 FILTER ELEMENTS

<table>
<thead>
<tr>
<th>Material</th>
<th>Inorganic microfibre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filtration rating as per ISO16889</td>
<td>F03</td>
</tr>
<tr>
<td>β_{4.5µm (c)} ≥ 1000</td>
<td>β_{7.5µm (c)} ≥ 1000</td>
</tr>
<tr>
<td>Filter element collapse pressure</td>
<td>R = for filter with by-pass valve</td>
</tr>
<tr>
<td>N = for filter without by-pass valve</td>
<td>210 bar</td>
</tr>
</tbody>
</table>

8 SEALS AND HYDRAULIC FLUIDS

NBR seals (standard) = -25°C ÷ +100°C, with HFC hydraulic fluids = +10°C ÷ +50°C

Recommended viscosity: 15 ÷ 100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s

9 ELECTRICAL DIFFERENTIAL CLOGGING INDICATORS

Differential switching pressure:
- CID-E05 5 bar ± 10% for filters with by-pass valve
- CID-E08 8 bar ± 10% for filters without by-pass valve

Max pressure: 450 bar
Max differential pressure: 200 bar

Power supply:
- CID-*-L 24 Vdc ± 10%
- CID-*-M 14 Vdc ÷ 30 Vdc, 125 VAC ÷ 250 VAC

Max current - resistive (inductive):
- 5 A (4 A) ÷ 4 A (3 A)
- 5 A (3 A) ÷ 3 A (2 A)

Fluid temperature: -25°C ÷ +100°C

Protection degree to DIN EN 60529: IP65 with mating connector

Hydraulic connection:
- M20x1.5
- SAE J1926-1 threaded

Duty factor: 100%
Mechanical life: 1 x 10⁶ operations
Mass (Kg): 0.16

Electrical scheme shown with switch position in case of clean filter element:

CID-*-L
1 ( + )
2 NC
3 NO
G
CID-*-M
1 C
2 NC
3 NO
10 FILTERS SIZING

For the filter sizing it is necessary to consider the Total $\Delta p$ at the maximum flow at which the filter must work. The Total $\Delta p$ is given by the sum of filter head $\Delta p$ plus the filter element $\Delta p$:

$\text{Total } \Delta p = \text{filter head } \Delta p + \text{filter element } \Delta p$

In the best conditions the total $\Delta p$ should not exceed 1,0 bar

See below sections to calculate the $\Delta p$ of filter head and $\Delta p$ of the filter element

10.1 $Q/\Delta p$ DIAGRAMS OF FILTER HEAD

The pressure drop of filter head mainly depends on the ports size and fluid density

In the following diagrams are reported the $\Delta p$ characteristics of filter head based on mineral oil with density 0.86 kg/dm³ and viscosity 30 mm²/s

![FPS-10 Diagram](image1)

$1 = \text{FPS-10}^{***} 02 \text{ (G 1")}$

$2 = \text{FPS-10}^{***} 42 \text{ (SAE-16)}$

![FPS-30 Diagram](image2)

$3 = \text{FPS-30}^{***} 03 \text{ (G 1\(\frac{1}{4}\)“)}$

$4 = \text{FPS-30}^{***} 04 \text{ (G 1\(\frac{1}{2}\)“)}$

10.2 FILTER ELEMENT $\Delta p$

The pressure drop through the filter depends on:
- size of filter element
- filtration rating
- fluid viscosity

The $\Delta p$ of filter element is given by the formula:

$\Delta p \text{ of filter element} = Q \times \frac{Gc}{1000} \times \frac{\text{Viscosity}}{30}$

$Q = \text{working flow (l/min)}$

$Gc = \text{Gradient coefficient (mbar/(l/min))}$. The Gc values are reported in the following table

$\text{Viscosity} = \text{effective fluid viscosity in the working conditions (mm²/s)}$

Gradient coefficient Gc of PSH filter elements

<table>
<thead>
<tr>
<th>Filter element size</th>
<th>10</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filter element length</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Filter element type</td>
<td>Filtration rating</td>
<td>$Gc$ Gradient coefficient</td>
</tr>
<tr>
<td>R for filter with bypass valve</td>
<td>F03</td>
<td>27.75</td>
</tr>
<tr>
<td></td>
<td>F06</td>
<td>15.12</td>
</tr>
<tr>
<td></td>
<td>F10</td>
<td>9.37</td>
</tr>
<tr>
<td>N for filter without bypass valve</td>
<td>F03</td>
<td>32.2</td>
</tr>
<tr>
<td></td>
<td>F06</td>
<td>22.38</td>
</tr>
<tr>
<td></td>
<td>F10</td>
<td>11.2</td>
</tr>
</tbody>
</table>

Example:

Calculation of Total $\Delta p$ for filter type FPS-10-B-F10-02-R at $Q = 80 \text{ l/min}$ and viscosity 46 mm²/s (filter element PSH-10-B-F10-R)

$\Delta p$ of filter head = 0.31 bar

$Gc = 4.91 \text{ mbar/(l/min)}$

Filter element $\Delta p = 80 \times \frac{4.91}{1000} \times \frac{46}{30} = 0.60 \text{ bar}$

Total $\Delta p = 0.31 + 0.60 = 0.91 \text{ bar}$
### INSTALLATION DIMENSIONS OF FPS FILTERS [mm]

<table>
<thead>
<tr>
<th>Code</th>
<th>A</th>
<th>B1</th>
<th>B2</th>
<th>B3</th>
<th>B4</th>
<th>B5</th>
<th>B6</th>
<th>D1</th>
<th>F</th>
<th>H1</th>
<th>H2</th>
<th>L1</th>
<th>Mass (Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FPS-10-A</td>
<td>3/4“ BSPP</td>
<td>22.5</td>
<td>47.5</td>
<td>43.5</td>
<td>27.5</td>
<td>70</td>
<td>70</td>
<td>200</td>
<td>293</td>
<td>92</td>
<td>90</td>
<td>110</td>
<td>3.5</td>
</tr>
<tr>
<td>FPS-10-B</td>
<td>SAE-16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.5</td>
</tr>
<tr>
<td>FPS-30-A</td>
<td>1 1/4“ BSPP</td>
<td>40</td>
<td>55</td>
<td>-</td>
<td>-</td>
<td>107</td>
<td>50</td>
<td>248</td>
<td>341</td>
<td>129</td>
<td>140</td>
<td>130</td>
<td>9.0</td>
</tr>
<tr>
<td>FPS-30-B</td>
<td>1 1/2 BSPP</td>
<td>461</td>
<td>554</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14.4</td>
</tr>
<tr>
<td>FPS-30-C</td>
<td>SAE-24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>18.8</td>
</tr>
<tr>
<td>FPS-30-D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Optional electrical differential clogging indicator

Diagram showing dimensions and components of FPS-10 and FPS-30 filters.

- Locking torque: 20Nm for FPS-10, 75Nm for FPS-30.
- Clogging indicator ports (plugged for FPS-10-**P\_\_).
The max operating pressure of the system must not exceed the max working pressure of the filter. During the filter installation, pay attention to respect the flow direction, shown by the arrow on the filter head. The filter should be preferably mounted with the bowl downward. The filter head should be properly secured using the threaded fixing holes on the filter head. Make sure that there is enough space for the replacement of the filter element. Never run the system without the filter element.

For filters ordered with clogging indicator, code L or M:
- remove the plastic plug from the indicator port on the filter head
- install the clogging indicator and lock it at the specified torque
During the cold start up (fluid temperature lower than 30°C), a false clogging indicator signal can be given due to the high fluid viscosity.

The filter element must be replaced as soon as the clogging indicator switches to highlight the filter clogged condition. For filters without clogging indicator, the filter element must be replaced according to the system manufacturer’s recommendations.

Select the new filter element according to the model code reported on the filter nameplate, see section 14.1. For the replacement of the filter element, proceed as follows:
- releases the system pressure; the filter has no pressure bleeding device
- pay attention to the fluid and filter surface temperature. Always use suitable gloves and protection glasses
- unscrew the bowl (3) from the filter head (1) by turning counterclockwise (view from bottom side)
- remove the dirty filter element (3) pulling it carefully
- lubricate the seal of new filter element and insert it over the spigot in the filter head
- clean the bowl internally, lubricate the threads and screw by hand the bowl to the filter head by turning clockwise (view from bottom side). Tighten at the recommended torque.

**WARNING**: The dirty filter elements cannot be cleaned and re-used. They are classified as “dangerous waste material”, then they must be disposed of by authorized Companies, according to the local laws.

**14.1 FILTER IDENTIFICATION NAMEPLATE**

1. Model code of complete filter
2. Model code of filter element
3. Max working pressure
4. Filter matrix code