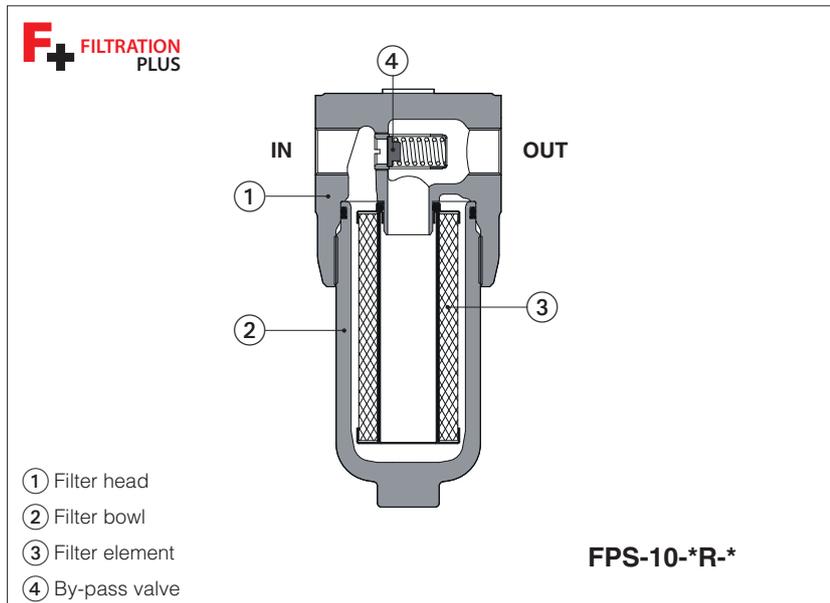


# In line filters, high pressure type FPS

Threaded ports



## FPS

In line filters are designed for installation on the pressure line downstream the pump, to ensure a high cleanliness of the fluid circulating into the hydraulic system. They protect sensible components from contamination present in the working fluid and they are particularly recommended for systems with proportional valves.

- three head sizes
- port sizes: G1/2" to G1 1/2"  
SAE-16, SAE-20, SAE-24
- **Filtration Plus** microfiber elements ensure high efficiency, low pressure drop, high DHC and long lasting performance. Collapse pressure 21 bar for filters equipped with by-pass valve or 210 bar for filters without by-pass
- filtration rating 5 - 7 - 12 - 22 μm(c) (βx(c) >1000, ISO 16889).
- versions without or with by-pass valve with cracking pressure 6 bar.
- without or with differential clogging indicator

Max flow **450 l/min**

Max working pressure **420 bar**

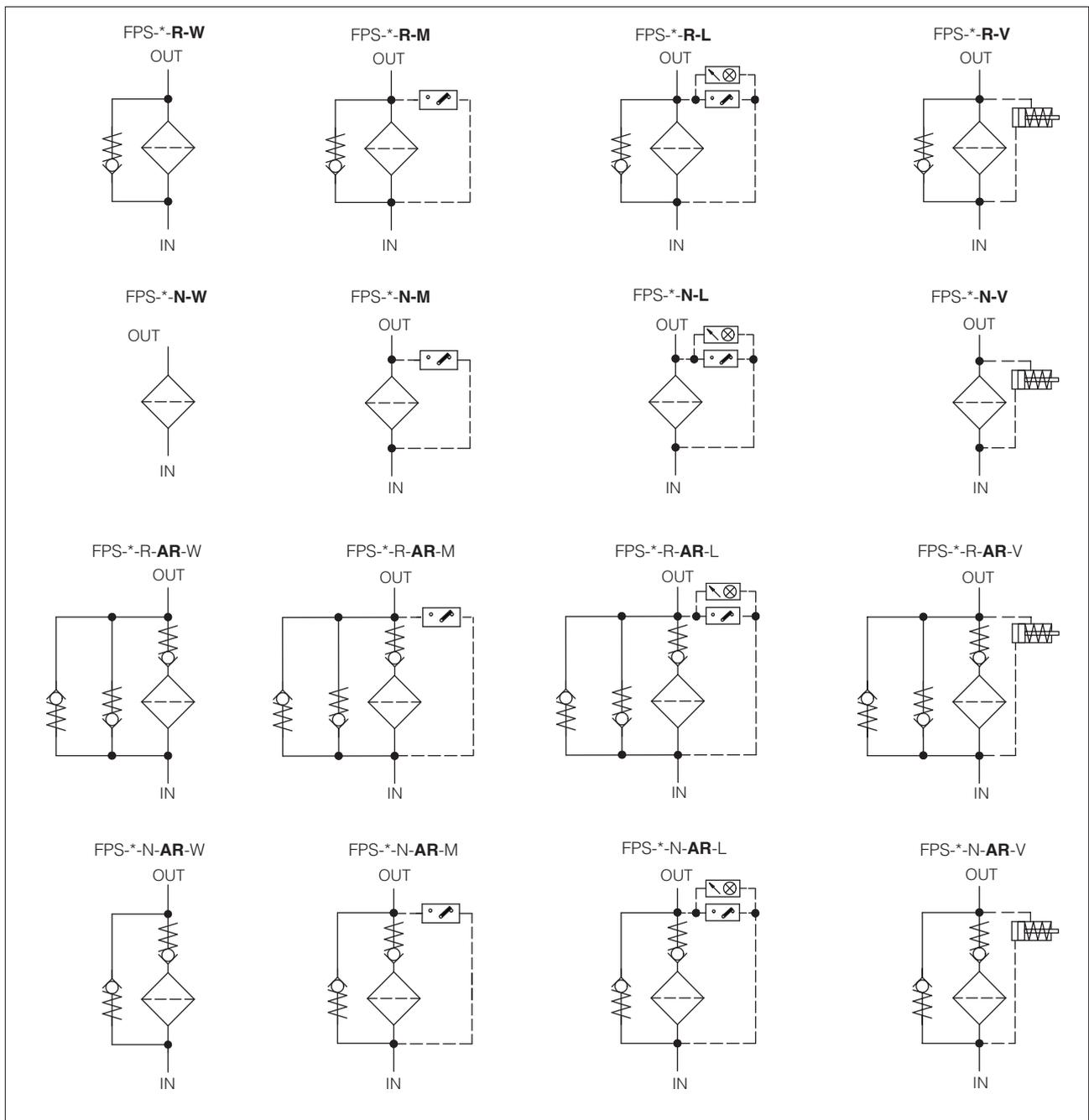
## 1 MODEL CODE OF COMPLETE FILTERS

<b>FPS</b>	-	<b>10</b>	-	<b>A</b>	-	<b>F10</b>	-	<b>01</b>	-	<b>R</b>	-	<b>*</b>	-	<b>W</b>	-	<b>*</b>	/	<b>*</b>
In line filter, high pressure																	Series number	Seals material: - = NBR <b>PE</b> = FKM
<b>Filter size</b> (ports size): <b>10</b> = G1/2" ÷ G1" or SAE-16 <b>20</b> = G1" ÷ G1 1/4" or SAE-20 <b>30</b> = G1 1/4" ÷ G1 1/2" or SAE-24																		
<b>Filter length:</b>																		
<b>Filter</b>																		
<b>length:</b>	FPS-10	FPS-20	FPS-30															
<b>A</b>	= 115	191	256															
<b>B</b>	= 137	205	361															
<b>C</b>	= -	226	406															
<b>D</b>	= -	-	450															
<b>Filter element:</b> <b>SN</b> = only body, without filter element <b>F+ microfibre filter element</b> βx(c) >1000 - ISO 16889: <b>F03</b> = 5 μm (c) <b>F10</b> = 12 μm (c) <b>F06</b> = 7 μm (c) <b>F20</b> = 22 μm (c) Filter element <b>F01</b> = 4 μm (c) available on request																		
<b>Ports size:</b>	FPS-10	FPS-20	FPS-30															
BSP	<b>00</b> = G 1/2"	<b>02</b> = G 1"	<b>03</b> = G 1 1/4"															
threaded:	<b>01</b> = G 3/4" <b>02</b> = G 1"	<b>03</b> = G 1 1/4"	<b>04</b> = G 1 1/2"															
SAE J1926-1	FPS-10	FPS-20	FPS-30															
threaded:	<b>42</b> = SAE-16 (1")	<b>43</b> = SAE-20 (1 1/4")	<b>44</b> = SAE-24 (1 1/2")															
<b>Differential clogging indicator</b> see sect. 14: <b>W</b> = without, indicator port with plastic plug (2) <b>P</b> = without, indicator port with steel plug (1) <b>L</b> = electrical indicator with LED (3) <b>M</b> = electrical indicator without LED (3) <b>V</b> = visual indicator (3) <b>see also note (4)</b>																		
<b>Options</b> see sect. 10: - = none <b>AR</b> = anti-back flow valve and reverse valve																		
<b>By-pass valve</b> see sect. 9: <b>R</b> = by-pass valve with cracking pressure 6 bar (filter element PSH-*R with collapse pressure 21 bar) <b>N</b> = without by-pass (filter element PSH-*N with collapse pressure 210 bar)																		

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

- (1) Max flow rates are measured with: Δp 1 bar, filter element F20, largest port size, option -R, oil viscosity 32 mm<sup>2</sup>/s - see also section 6  
In case of different conditions see section 11 for filter sizing
- (2) The plastic plug (option W) is factory assembled to prevent impurities from entering the filter through the clogging indicator port. A clogging indicator must be fitted on the filter before commissioning. Do not install the filter with the plastic cap on the hydraulic system
- (3) The clogging indicator is supplied disassembled from the filter. The indicator port on filter head is plugged with plastic plug
- (4) Differential thermostated indicator CID-T and differential electronic transmitter with output signal 4÷20 mA CID-Z are available on request, see section 4

**2 HYDRAULIC SYMBOLS** (representation according to ISO 1219-1)



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

<p><b>PSH</b></p> <p>Spare filter element for in line filter type FPS</p>	-	<p><b>10</b></p>	-	<p><b>A</b></p>	-	<p><b>F10</b></p>	-	<p><b>R</b></p>	/	<p><b>*</b></p>													
<p><b>Filter element size:</b></p> <p><b>10</b> = for FPS-10 <b>20</b> = for FPS-20 <b>30</b> = for FPS-30</p> <p><b>Filter element length:</b></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 33%;">for FPS-10</td> <td style="width: 33%;">for FPS-20</td> <td style="width: 33%;">for FPS-30</td> </tr> <tr> <td><b>A</b></td> <td><b>A</b></td> <td><b>A</b></td> </tr> <tr> <td><b>B</b></td> <td><b>B</b></td> <td><b>B</b></td> </tr> <tr> <td></td> <td><b>C</b></td> <td><b>C</b></td> </tr> <tr> <td></td> <td></td> <td><b>D</b></td> </tr> </table>	for FPS-10	for FPS-20	for FPS-30	<b>A</b>	<b>A</b>	<b>A</b>	<b>B</b>	<b>B</b>	<b>B</b>		<b>C</b>	<b>C</b>			<b>D</b>								<p>Series number</p> <p>Seals material: - = NBR <b>PE</b> = FKM</p> <p><b>R</b> = filter element with collapse pressure 21 bar, for filter FPS-*-R with by-pass valve</p> <p><b>N</b> = filter element with collapse pressure 210 bar, for filter FPS-*-N without by-pass valve</p> <p><b>Microfibre filter element, <math>\beta_{x(c)} &gt; 1000</math> - ISO 16889:</b></p> <p><b>F03</b> = 5 <math>\mu\text{m}</math> (c) <b>F06</b> = 7 <math>\mu\text{m}</math> (c) <b>F10</b> = 12 <math>\mu\text{m}</math> (c) <b>F20</b> = 22 <math>\mu\text{m}</math> (c) Filter element <b>F01</b> = 4 <math>\mu\text{m}</math> (c) available on request</p>
for FPS-10	for FPS-20	for FPS-30																					
<b>A</b>	<b>A</b>	<b>A</b>																					
<b>B</b>	<b>B</b>	<b>B</b>																					
	<b>C</b>	<b>C</b>																					
		<b>D</b>																					

(1) Select the filter element according to the model code reported on the filter nameplate, see section 18

**4 MODEL CODE OF DIFFERENTIAL CLOGGING INDICATORS** - only for spare - see section 14 and 15

<b>CID</b>	-	<b>E</b>	<b>05</b>	-	<b>M</b>	*	/	*
Spare differential clogging indicator for in line filter						Series number		Seals material: - = NBR <b>PE</b> = FKM
<b>Type of indicator:</b> <b>E</b> = electrical <b>V</b> = visual <b>T</b> = thermostated (available on request) <b>Z</b> = electronic transmitter 4÷20 mA (available on request)								
<b>Differential switching pressure</b> (only for CID-E and CID-V): <b>05</b> = 5 bar for filters with by-pass valve <b>08</b> = 8 bar for filters without by-pass valve						<b>Optional LED</b> - only for CID-E <b>L</b> = with LED <b>M</b> = without LED		

**5 GENERAL CHARACTERISTICS**

Assembly position / location	Vertical position with the bowl downward	
Ambient temperature range	<b>Standard</b> = -20°C ÷ +70°C / <b>PE</b> option = -20°C ÷ +70°C	
Storage temperature range	<b>Standard</b> = -20°C ÷ +80°C / <b>PE</b> option = -20°C ÷ +80°C	
Materials	Filter head	Cast iron
	Filter bowl	Carbon steel
Surface protection	Zinc coating with black passivation	
Corrosion resistance	Salt spray test (EN ISO 9227) > 600 h	
Fatigue strength	min. 1 x 10 <sup>6</sup> cycles at 420 bar	
Compliance	RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006	

**6 HYDRAULICS CHARACTERISTICS** - based on mineral oil ISO VG 46 at 50 °C (viscosity 32mm<sup>2</sup>/s)

Filter size	FPS-10						FPS-20						FPS-30								
	00		01		02, 42		02		03, 43		03		04, 44								
Ports size code	G1/2"		G3/4		G1", SAE-16		G1"		G1 1/4, SAE-20		G1 1/4		G1 1/2, SAE-24								
Ports dimension	G1/2"		G3/4		G1", SAE-16		G1"		G1 1/4, SAE-20		G1 1/4		G1 1/2, SAE-24								
Filter length	<b>A</b>	<b>B</b>	<b>A</b>	<b>B</b>	<b>A</b>	<b>B</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	
Max flow (l/min) at Δp= 1 bar Filter with by-pass - <b>R</b> (see note)	<b>F03</b>	36	56	40	62	43	73	73	84	105	80	93	118	88	164	213	259	91	172	226	277
	<b>F06</b>	48	69	53	79	61	98	100	112	135	112	127	154	127	225	277	330	132	239	297	356
	<b>F10</b>	63	79	72	92	86	120	135	148	170	154	170	195	183	275	321	380	193	295	347	414
	<b>F20</b>	78	87	90	101	115	137	166	178	196	191	205	226	240	333	373	412	256	361	406	450
Max flow (l/min) at Δp= 1 bar Filter without by-pass - <b>N</b> (see note)	<b>F03</b>	31	43	34	48	36	53	60	70	88	65	76	98	71	120	191	215	74	125	202	228
	<b>F06</b>	47	55	52	61	58	71	83	94	116	91	105	131	93	187	228	290	97	197	242	311
	<b>F10</b>	54	75	60	87	70	111	117	130	153	133	149	176	158	245	298	343	166	260	321	372
	<b>F20</b>	72	85	82	99	103	131	154	166	187	177	192	215	210	315	367	380	223	340	400	414
Max operating pressure [bar]	<b>420</b>																				
Burst pressure [bar]	<b>&gt; 1260</b>																				

**Note:** Max flow rates are measured with Δp= 1 bar and viscosity 32mm<sup>2</sup>/s. In case of different conditions see section 11 for filter sizing

**7 FILTER ELEMENTS** 

Material		Inorganic microfibre
Filtration rating as per ISO16889	<b>F03</b>	β <sub>4,5μm(c)</sub> ≥ 1000
	<b>F06</b>	β <sub>7μm(c)</sub> ≥ 1000
	<b>F10</b>	β <sub>12μm(c)</sub> ≥ 1000
	<b>F20</b>	β <sub>22μm(c)</sub> ≥ 1000
Filter element collapse pressure	<b>R</b> = for filter with by-pass valve	21 bar
	<b>N</b> = for filter without by-pass valve	210 bar

**8 SEALS AND HYDRAULIC FLUIDS** - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -30°C ÷ +100°C, with HFC hydraulic fluids = +10°C ÷ +50°C FKM seals (/PE option) = -25°C ÷ +120°C		
Recommended viscosity	15 ÷ 100 mm <sup>2</sup> /s - max allowed range 2.8 ÷ 500 mm <sup>2</sup> /s		
<b>Hydraulic fluid</b>	<b>Suitable seals type</b>	<b>Classification</b>	<b>Ref. Standard</b>
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLDP	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR	HFC	

**9 BY-PASS VALVE**

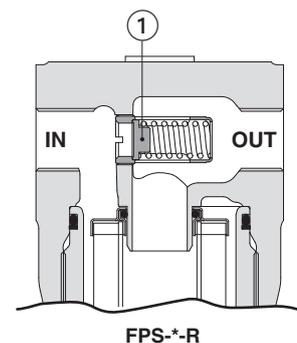
**Filter with by-pass valve - version -R**

The filter with by-pass valve ① is used in combination with filter elements PSH-\*-R with collapse pressure 21 bar.

The by-pass valve allows the oil flow to by-pass the filter element in particular conditions:

- it protects the filter element from pressure peaks that could be generated, especially at the cold system start-up. In these cases the valve opens only for the instant necessary to discharge the pressure peak, limiting the quantity of oil that bypasses the filter.
- it allows the free passage of the oil flow in case of completely clogged filter element ( $\Delta p > 6$  bar).

This situation should be carefully avoided, by means of a scheduled maintenance, otherwise the contaminated oil will pass to the clean side of the filter and then it will circulate in the hydraulic system. The filter element must be replaced before the clogging condition, at this purpose the use of a differential clogging indicator CID-V (visual, option V) or CID-E (electrical, options L or M) is highly recommended.

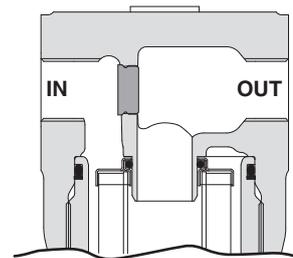


FPS-\*-R

**Filter without by-pass valve - version -N**

The filter version without by-pass is recommended when the hydraulic system must be absolutely protected by contamination, then avoiding the risk that the contaminant passes through the by-pass valve.

The filter without by pass must be used in combination with filter elements PSH-N with high collapse pressure 210 bar



FPS-\*-N

**10 ANTI BACK-FLOW AND REVERSE VALVE**

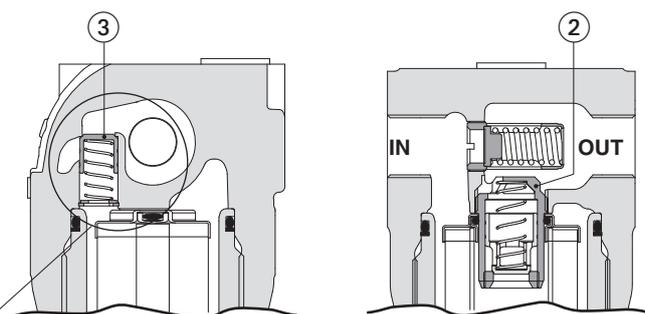
**Anti-back flow and Reverse valves - version -AR**

The filter version -AR allows the oil flow to return from the pressure line back to the pump.

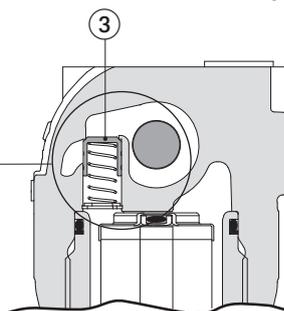
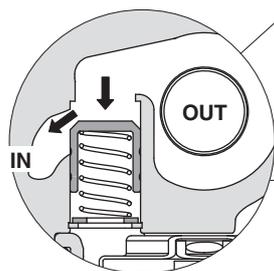
The return flow passes from the OUT port to the IN port of the filter through the reverse valve ③, bypassing the filter element.

The anti-back flow valve ② prevents the flow passing through the filter element in reverse direction, removing the accumulated contaminant.

Version **AR** is available for filters with by-pass (FPS-\*-R-AR) or without by-pass (FPS-\*-N-AR)



FPS-\*-R-AR



FPS-\*-N-AR

## 11 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

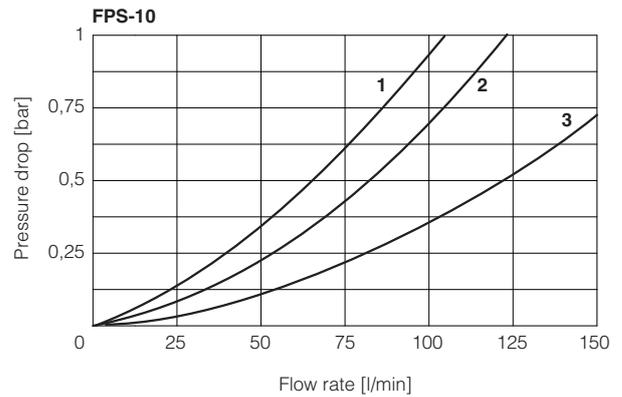
### 11.1 Q/ $\Delta p$ DIAGRAMS OF FILTER HEAD

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/dm<sup>3</sup> and viscosity 30 mm<sup>2</sup>/s

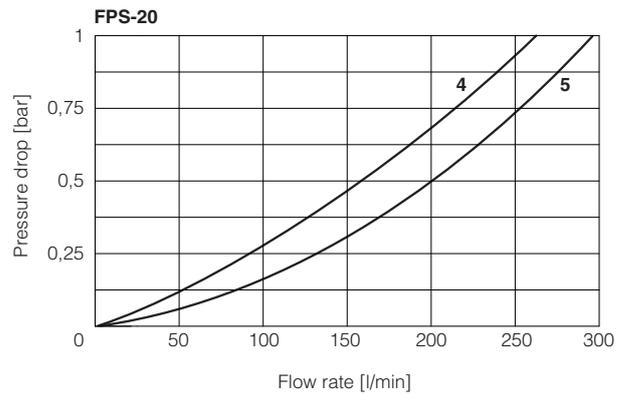
#### FPS-10

- 1 = FPS-10\*\*\* 00 (G 1/2")
- 2 = FPS-10\*\*\* 01 (G 3/4")
- 3 = FPS-10\*\*\* 02 (G 1")  
FPS-10\*\*\* 42 (SAE-16)



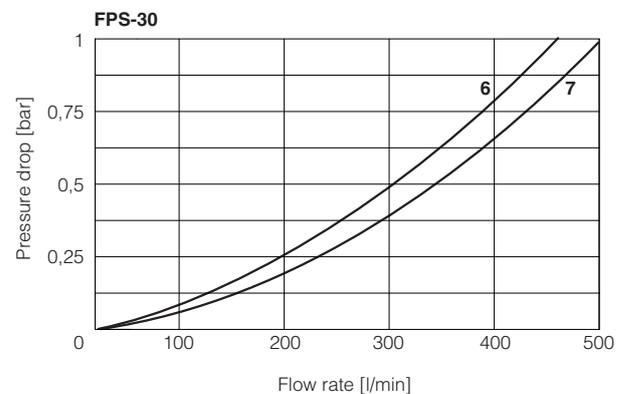
#### FPS-20

- 4 = FPS-20\*\*\* 02 (G 1")
- 5 = FPS-20\*\*\* 03 (G 1 1/4")  
FPS-20\*\*\* 43 (SAE-20)



#### FPS-30

- 6 = FPS-30\*\*\* 03 (G 1 1/4")
- 7 = FPS-30\*\*\* 04 (G 1 1/2")  
FPS-30\*\*\* 44 (SAE-24)



### 11.2 FILTER ELEMENT $\Delta p$

The pressure drop through the filter depends to:

- size of filter element
- filtration rating
- fluid viscosity

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

$$\Delta p \text{ of filter element} = Q \times \frac{Gc}{1000} \times \frac{\text{Viscosity}}{32}$$

**Q** = working flow (l/min)

**Gc** = Gradient coefficient (mbar/(l/min)).

The Gc values are reported in the following table

**Viscosity** = effective fluid viscosity in the working conditions (mm<sup>2</sup>/s)

#### Gradient coefficient Gc of PSH filter elements

Filter element size		10		20			30			
Filter element length		A	B	A	B	C	A	B	C	D
Filter element type	Filtration rating	Gc Gradient coefficient								
<b>R</b> for filter with bypass valve	<b>F03</b>	21.30	10.84	11.07	9.23	6.74	10.26	4.82	3.27	2.30
	<b>F06</b>	13.97	6.79	7.27	6.06	4.43	6.73	2.98	1.99	1.26
	<b>F10</b>	8.39	4.42	4.45	3.71	2.71	4.12	2.02	1.36	0.70
	<b>F20</b>	4.78	2.93	2.87	2.39	1.75	2.66	1.21	0.77	0.40
<b>N</b> for filter without bypass valve	<b>F03</b>	26.03	16.72	14.19	11.83	8.64	13.00	7.15	3.87	3.21
	<b>F06</b>	14.77	11.25	9.50	7.92	5.79	9.63	4.00	2.93	1.80
	<b>F10</b>	11.57	5.25	5.66	4.72	3.45	5.05	2.57	1.67	1.10
	<b>F20</b>	6.13	3.34	3.41	2.84	2.07	3.33	1.44	0.83	0.70

#### Example:

Calculation of Total  $\Delta p$  for filter type FPS-10-B-F10-02-R at Q = 80 l/min and viscosity 46 mm<sup>2</sup>/s (filter element PSH-10-B-F10-R)

**Dp** of filter head = 0,24 bar

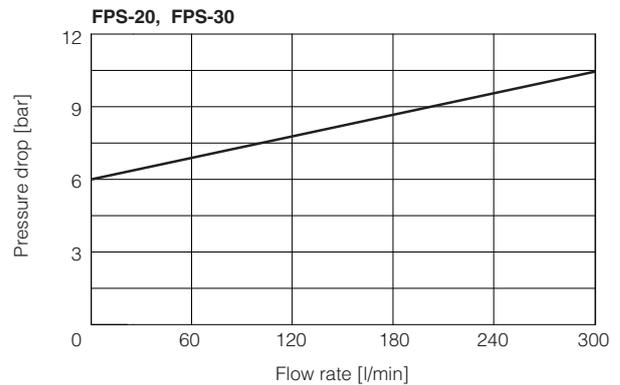
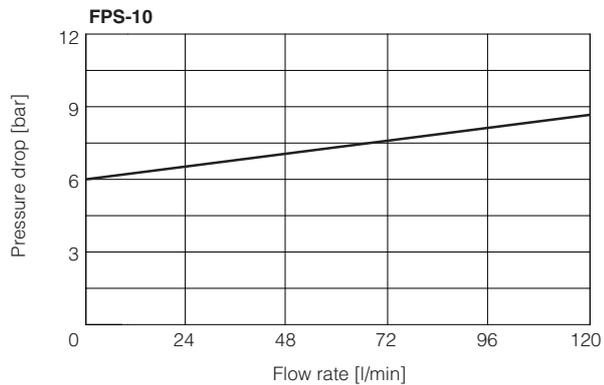
**Gr** = 4,42 mbar/(l/min)

$$\text{Filter element } \Delta p = 80 \times \frac{4,42}{1000} \times \frac{46}{32} = 0,51 \text{ bar}$$

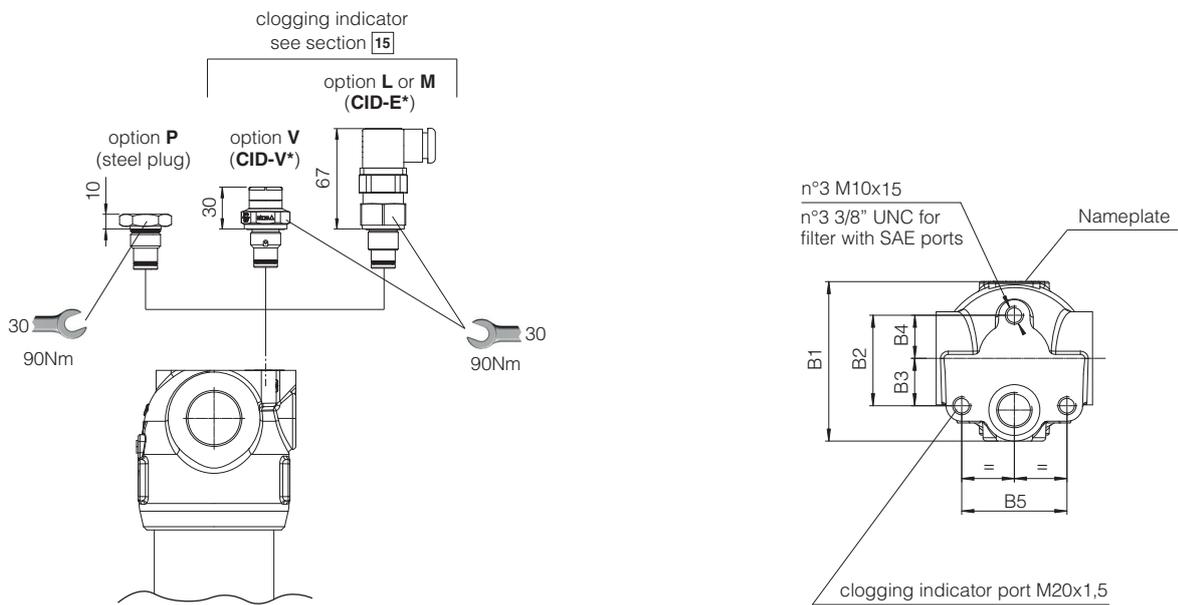
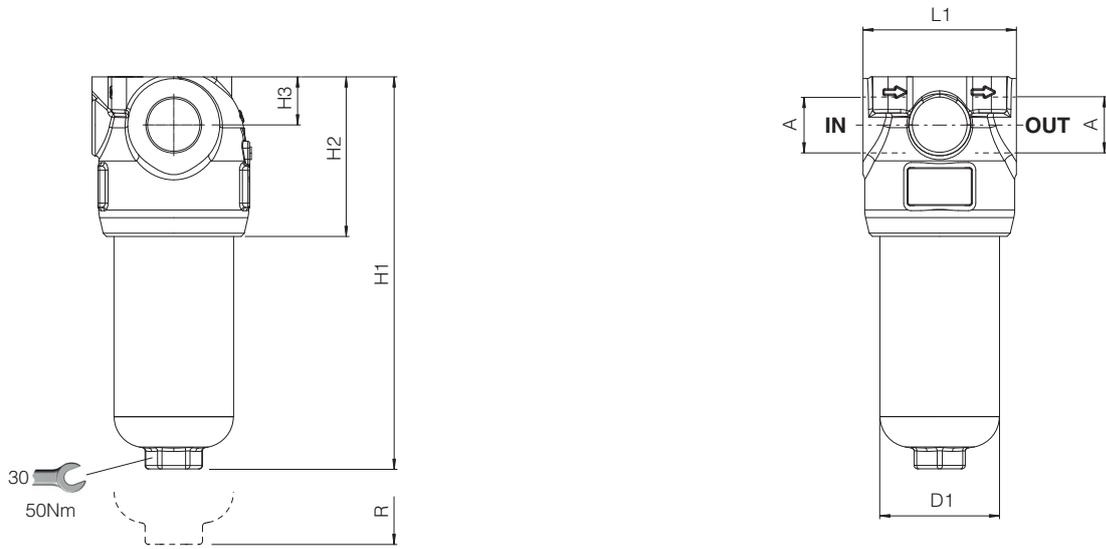
**Total  $\Delta p$**  = 0,24 + 0,51 = **0,75 bar**

### 12 BY-PASS VALVE - based on mineral oil ISO VG46 at 50°C (viscosity = 32 mm<sup>2</sup>/s)

Q/ $\Delta p$  diagrams of flow through the by-pass valve

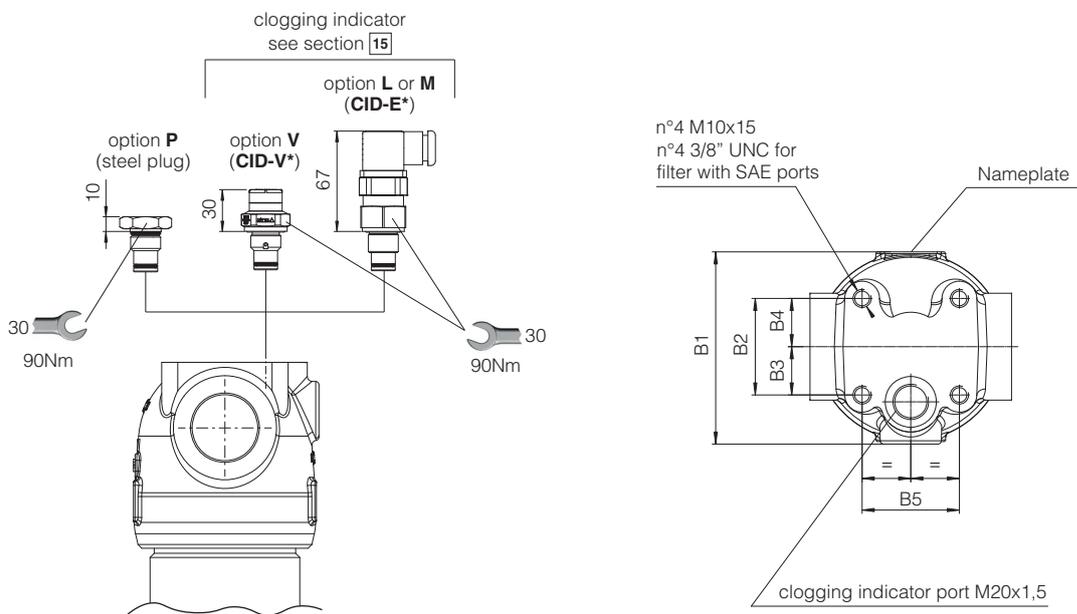
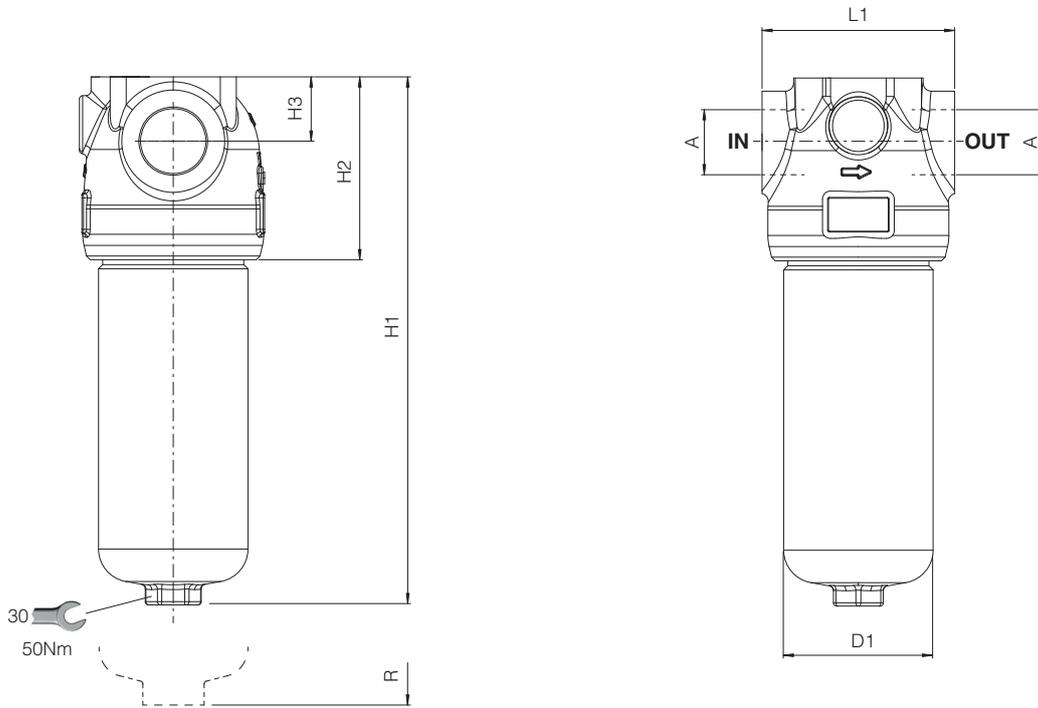


### FPS -10



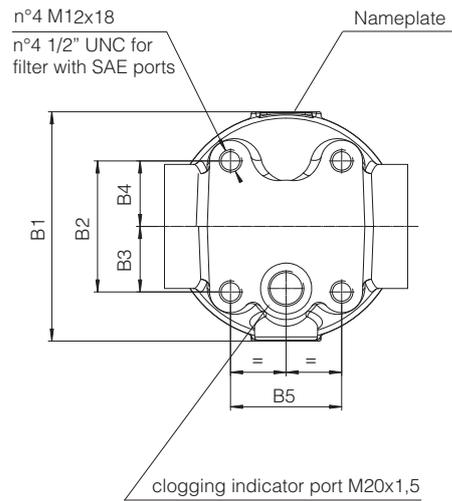
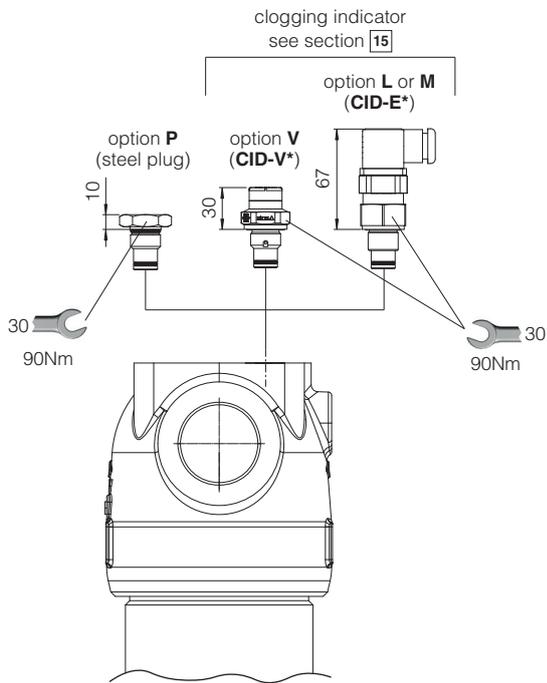
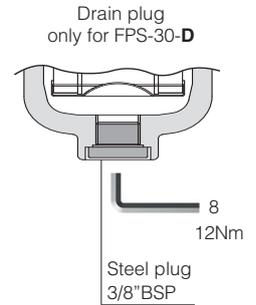
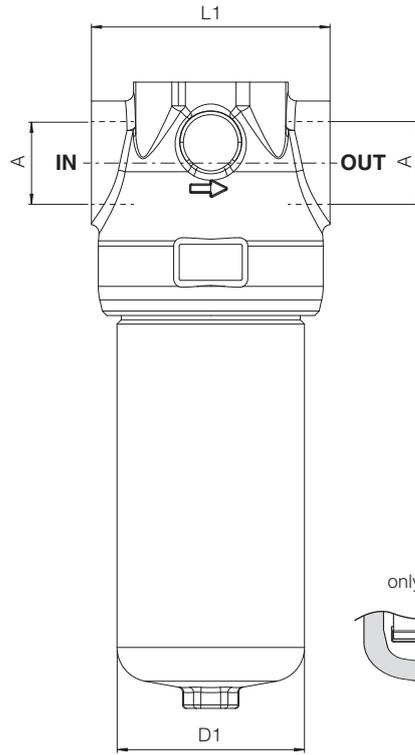
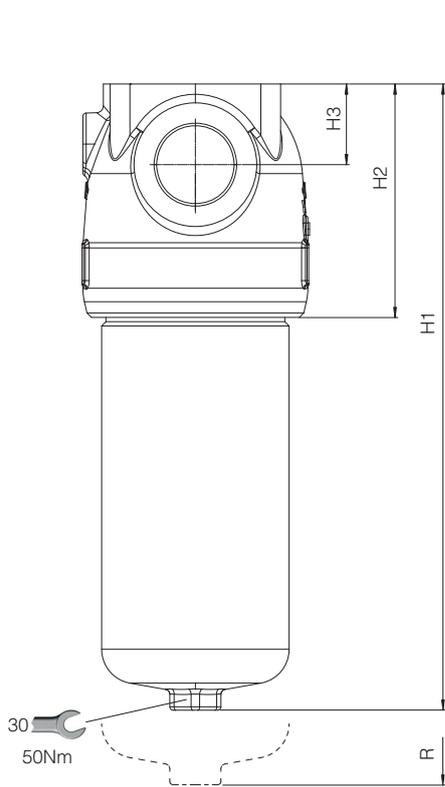
Code	A	B1	B2	B3	B4	B5	D1	H1	H2	H3	L1	R (element removal)	Mass (Kg)
FPS-10-A	1/2" BSPP	93.5	52.5	27.5	25	60.6	70	203	93	28	90	110	4
FPS-10-B	3/4" BSPP 1" BSPP SAE-16							296					

# FPS -20



Code	A	B1	B2	B3	B4	B5	D1	H1	H2	H3	L1	R (element removal)	Mass (Kg)
FPS-20-A	1" BSPP 1 1/4" BSPP SAE-20	111.5	56	28	28	56	90	261	111	39	116	120	7.4
FPS-20-B								320					8.5
FPS-20-C								390					9.9

# FPS -30

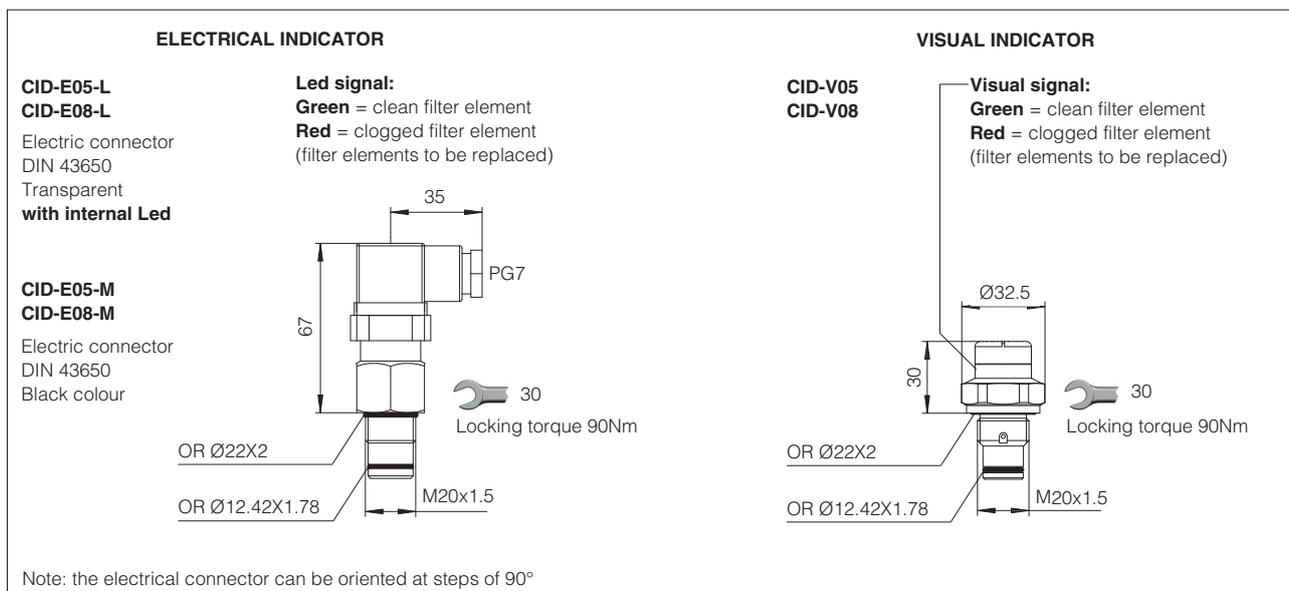


Code	A	B1	B2	B3	B4	B5	D1	H1	H2	H3	L1	R (element removal)	Mass (Kg)
FPS-30-A	1 1/4" BSPP 1 1/2 BSPP SAE-24	133.5	76	38	38	64	110	240.5	136	47	140	130	10.5
FPS-30-B								333.5					13
FPS-30-C								453.5					16.4
FPS-30-D								552.5					19

**14 CHARACTERISTICS OF DIFFERENTIAL CLOGGING INDICATORS**

Model code	CID-E* ELECTRICAL		CID-V* VISUAL
Differential switching pressure	CID-E05, CID-V05	5 bar ± 10%	5 bar ± 15%
	CID-E08, CID-V08	8 bar ± 10%	8 bar ± 10%
Max pressure	450 bar		420 bar
Max differential pressure	200 bar		
Ambient temperature	-25°C ÷ +100°C		-25°C ÷ +80°C
Hydraulic connection	M20x1,5		
Duty factor	100%		
Mechanical life	1 x 10 <sup>6</sup> operations		
Mass (Kg)	0,16		0,11
Electric connection	Electric plug connection as per DIN 43650 with cable gland type PG7		-
Power supply	CID-E05-L, CID-E08-L	24 V <sub>DC</sub> ± 10%	
	CID-E05-M, CID-E08-M	14 V <sub>DC</sub> ÷ 30 V <sub>DC</sub>	125 V <sub>AC</sub> ÷ 250 V <sub>AC</sub>
Max current - resistive (inductive)	5 A (4 A) ÷ 4 A (3 A)	5 A (3 A) ÷ 3 A (2 A)	
Protection degree to DIN EN 60529	IP65 with mating connector		-
Switching scheme	<b>CID*-L</b>	<b>CID*-M</b>	GREEN
	clean filter element		
Switching scheme	<b>CID*-L</b>	<b>CID*-M</b>	RED
	clogged filter element		

**15 DIMENSIONS OF DIFFERENTIAL CLOGGING INDICATORS**



**NOTE:** Differential thermostated indicator CID-T and differential electronic transmitter with output signal 4÷20 mA CID-Z are available on request

## 16 INSTALLATION AND COMMISSIONING

The max operating pressure of the system must not exceed the max working pressure of the filter (420 bar).

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 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, see dimension "R" at section 13.

Never run the system without the filter element.



For filters ordered with clogging indicator:

- 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.

To avoid false signal, a differential threaded clogging indicator CID-T can be used.



## 17 MAINTENANCE

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 18.

For the replacement of the filter element, proceed as follow:

- 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 (2) 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, check the o-ring (6) and replace it if damaged
- lubricate the o-ring, the threads and screw by hand the bowl to the filter head by turning clockwise (view from bottom side). Tighten at the recommended torque.



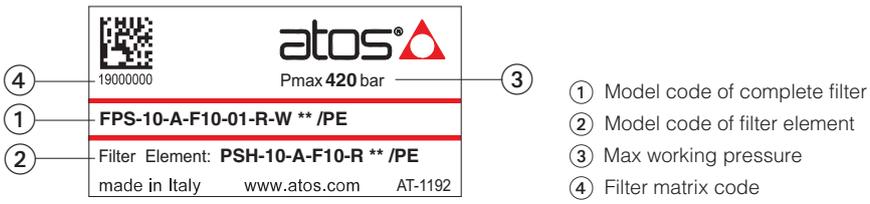
**WARNING:** The dirty filter elements cannot be cleaned and re-used. They are classified as "dangerous waste material", then they must be disposed of by authorized Companies, according to the local laws.

### 17.1 SEALS KIT

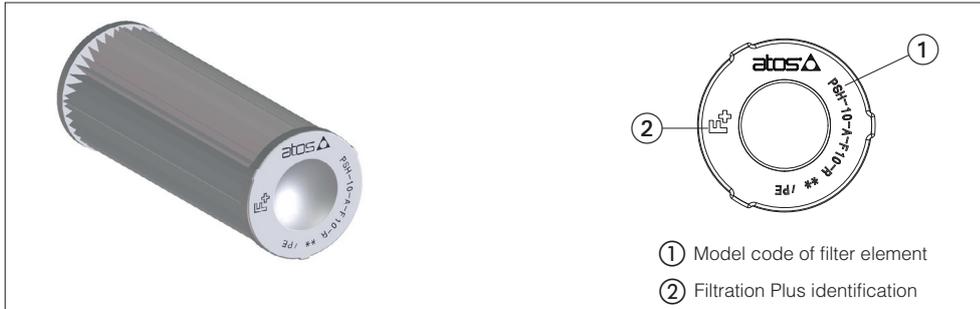
Filter type	Seal kit code (NBR)	Seal kit code (FKM)	Seal kit composition
FPS-10	GUARN FPS-10	GUARN FPS-10 /PE	④+⑤+⑥+⑦
FPS-20	GUARN FPS-20	GUARN FPS-20 /PE	④+⑤+⑥+⑦
FPS-30	GUARN FPS-30	GUARN FPS-30 /PE	④+⑤+⑥+⑦+⑧



## 18 FILTER IDENTIFICATION NAMEPLATE



### 18.1 IDENTIFICATION OF FILTER ELEMENT



## 19 RELATED DOCUMENTATION

<b>LF010</b>	Fluid contamination
<b>LF020</b>	Filtration guidelines