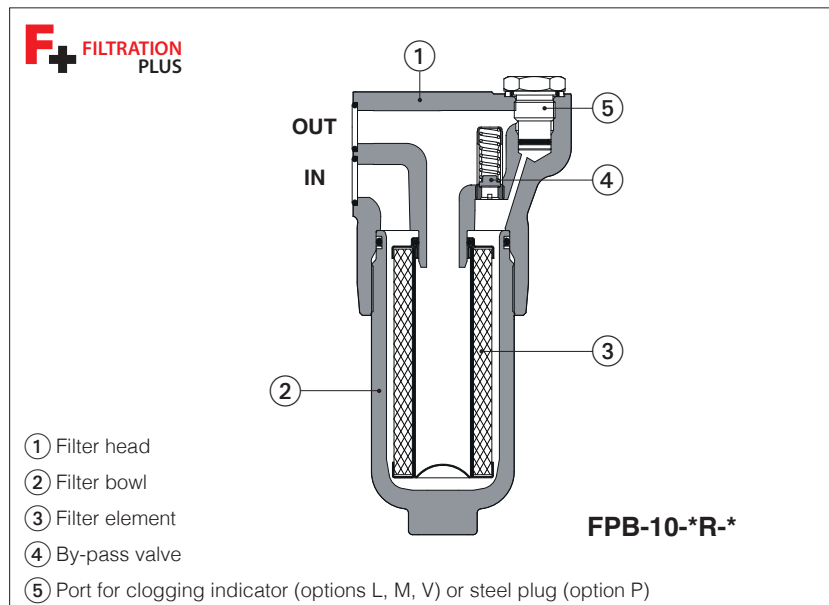


# In line filters type FPB

Flange mounting for manifolds



## FPB

In line filters flange mounting, designed for installation on manifolds, 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.

- four head sizes, with three different mounting flanges
- port sizes: Ø16 to Ø30 mm
- **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 **400 l/min**

Max working pressure **250 bar**

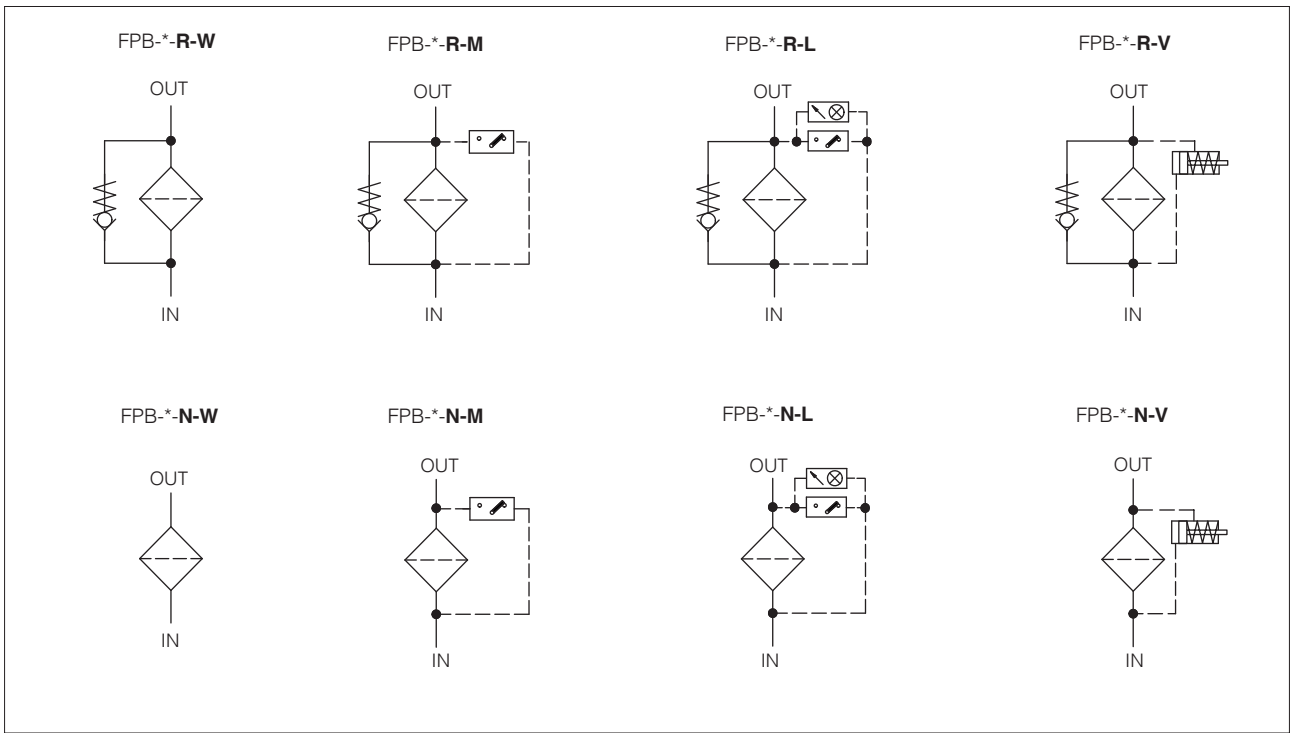
## 1 MODEL CODE OF COMPLETE FILTERS

<b>FPB</b>	-	<b>10</b>	-	<b>A</b>	-	<b>F10</b>	-	<b>R</b>	-	<b>W</b>	<b>*</b>	/	<b>*</b>																									
In line filter											Series number	Seals material: - = NBR <b>PE</b> = FKM																										
<b>Filter size</b> (ports size): <b>10</b> = 2 fixing bolts, ports Ø16 mm <b>15</b> = 4 fixing bolts, ports Ø20 mm <b>20</b> = 4 fixing bolts, ports Ø30 mm (1) <b>30</b> = 4 fixing bolts, ports Ø30 mm (1)																																						
<table border="1"> <thead> <tr> <th>Filter length:</th> <th>FPB-10</th> <th>FPB-15</th> <th>FPB-20</th> <th>FPB-30</th> </tr> </thead> <tbody> <tr> <td><b>A</b></td> <td>= 90</td> <td>132</td> <td>225</td> <td>261</td> </tr> <tr> <td><b>B</b></td> <td>= 100</td> <td>160</td> <td>246</td> <td>343</td> </tr> <tr> <td><b>C</b></td> <td>= -</td> <td>-</td> <td>281</td> <td>375</td> </tr> <tr> <td><b>D</b></td> <td>= -</td> <td>-</td> <td>-</td> <td>400</td> </tr> </tbody> </table>														Filter length:	FPB-10	FPB-15	FPB-20	FPB-30	<b>A</b>	= 90	132	225	261	<b>B</b>	= 100	160	246	343	<b>C</b>	= -	-	281	375	<b>D</b>	= -	-	-	400
Filter length:	FPB-10	FPB-15	FPB-20	FPB-30																																		
<b>A</b>	= 90	132	225	261																																		
<b>B</b>	= 100	160	246	343																																		
<b>C</b>	= -	-	281	375																																		
<b>D</b>	= -	-	-	400																																		
<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>Differential clogging indicator</b> see sect. 14 (3) : <b>W</b> = without, indicator port with plastic plug (4) <b>P</b> = without, indicator port with steel plug <b>L</b> = electrical indicator with LED <b>M</b> = electrical indicator without LED <b>V</b> = visual indicator <b>see also note (5)</b>																																						
<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) Filter size 20 and 30 have the same mounting flange but different blow size
- (2) Max flow rates are measured with: Δp 1 bar, filter element F20, option -R, oil viscosity 32 mm<sup>2</sup>/s - see also section 6  
In case of different conditions see section 10 for filter sizing
- (3) The clogging indicator is supplied disassembled from the filter. The indicator port on filter head is plugged with plastic plug.
- (4) 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
- (5) Differential clogging indicator CID-E\*-M/UL with cURus certification is available on request, see section 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 FPB</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 FPB-10 and FPB-15  <b>20</b> = for FPB-20  <b>30</b> = for FPB-30</p> <p><b>Filter element length:</b></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 33%;">for FPB-10 and PFB-15</td> <td style="width: 33%;">for FPB-20</td> <td style="width: 33%;">for FPB-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 FPB-10 and PFB-15	for FPB-20	for FPB-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><b>Series number</b></p> <p><b>Seals material:</b>          - = NBR  <b>PE</b> = FKM</p> <p><b>R</b> = filter element with collapse pressure 21 bar, for filter FPB-*R with by-pass valve  <b>N</b> = filter element with collapse pressure 210 bar, for filter FPB-*N without by-pass valve</p> <p><b>Microfibre filter element, <math>\beta_{x(c)} &gt; 1000</math> - ISO 16889:</b>  <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 FPB-10 and PFB-15	for FPB-20	for FPB-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 17

**4 MODEL CODE OF DIFFERENTIAL CLOGGING INDICATORS** - only for spare - see section 13 and 14

<p><b>CID</b></p> <p>Spare differential clogging indicator for in line filter</p>	-	<p><b>E</b></p>	-	<p><b>05</b></p>	-	<p><b>M</b></p>	/	<p><b>*</b></p>
<p><b>Type of indicator:</b></p> <p><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)</p> <p><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</p>						<p><b>Series number</b></p> <p><b>Seals material:</b>          - = NBR  <b>PE</b> = FKM</p> <p><b>Optional LED</b> - only for CID-E  <b>L</b> = with LED  <b>M</b> = without LED  <b>M/UL</b> = without LED, certified according to North American Standard          cURus (available on request)</p>		

## 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 0 ÷ 250 bar	
Compliance	Tested to NFPA T3.10.5.1, ISO 10771, ISO 3968 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		FPB-10		FPB-15		FPB-20			FPB-30			
		A	B	A	B	A	B	C	A	B	C	D
Max flow (l/min) at Δp= 1 bar Filter with by-pass - <b>R</b> (see note)	<b>F03</b>	42	65	44	79	83	98	127	96	182	234	279
	<b>F06</b>	57	82	64	109	119	138	173	140	246	295	340
	<b>F10</b>	75	93	95	137	172	194	232	203	294	333	380
	<b>F20</b>	90	100	132	160	225	246	281	261	343	375	400
Max flow (l/min) at Δp= 1 bar Filter without by-pass - <b>N</b> (see note)	<b>F03</b>	35	51	36	55	66	78	103	76	133	211	237
	<b>F06</b>	55	65	61	76	95	111	142	102	207	249	306
	<b>F10</b>	64	89	75	126	145	165	202	176	265	314	350
	<b>F20</b>	85	98	116	154	204	226	263	232	328	369	380
Max operating pressure	[bar]	<b>250</b>										
Burst pressure	[bar]	<b>&gt; 750</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 10 for filter sizing

## 7 FILTER ELEMENTS

Material		Inorganic microfibre
Filtration rating as per ISO16889	<b>F03</b>	β <sub>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, HVL, HVLDP	DIN 51524
Flame resistant without water	FKM	HFDR, 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.

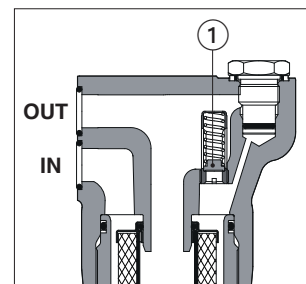
The by-pass valve allows the oil flow to by-pass the filter element in particular conditions:

- 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.

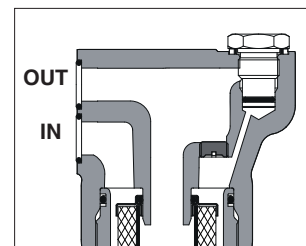
- it allows the free passage of the oil flow in case of completely clogged filter element ( $\Delta p > 6$  bar).

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.



FPB-\* -R



FPB-\* -N

### 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

## 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  $\Delta p$ :

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

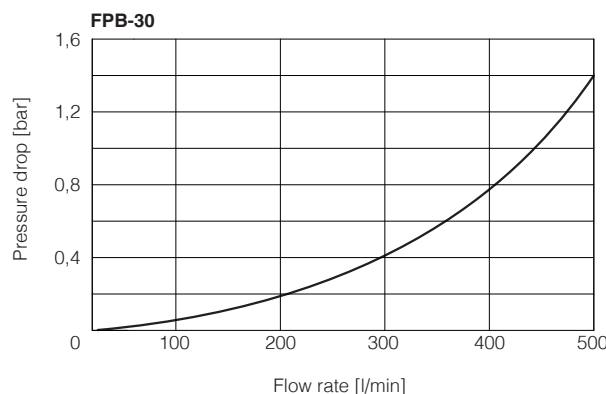
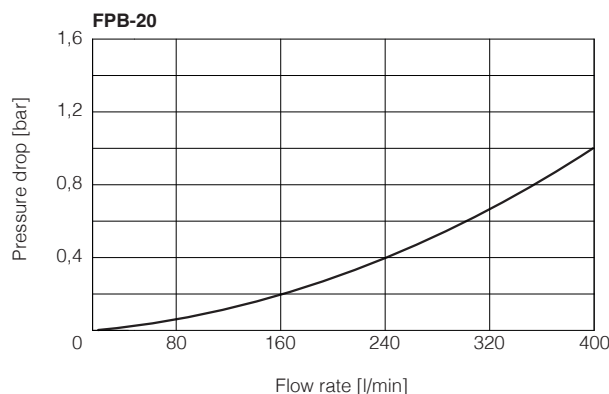
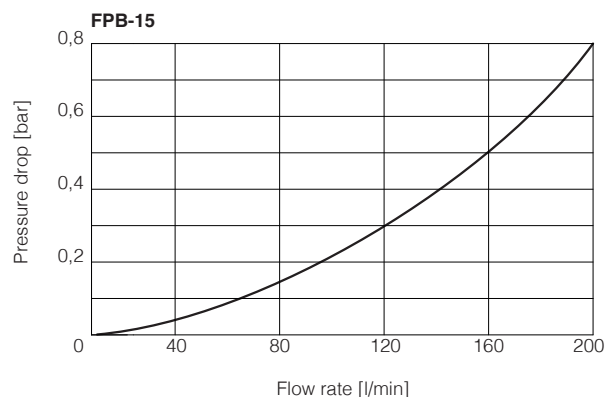
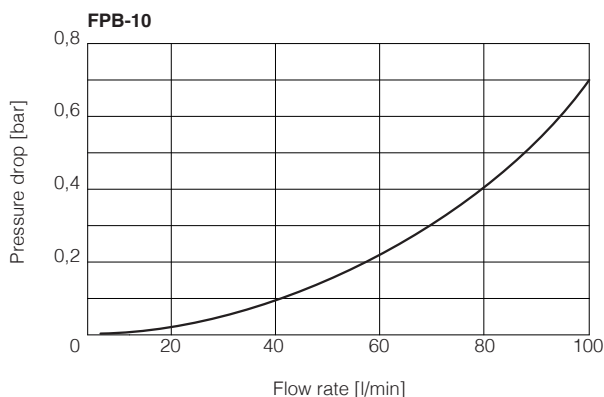
In the best conditions the total  $\Delta p$  should not exceed 1,0 bar

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/dm<sup>3</sup> and viscosity 32 mm<sup>2</sup>/s



## 10.2 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 FPB-10-B-F10-R at Q = 80 l/min and viscosity 46 mm<sup>2</sup>/s (filter element PSH-10-B-F10-R)

$\Delta p$  of filter head = 0,41 bar

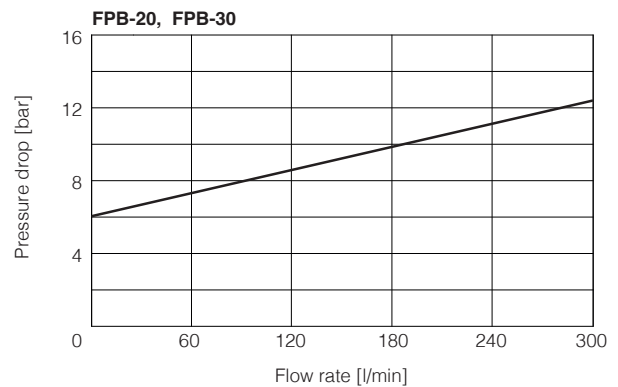
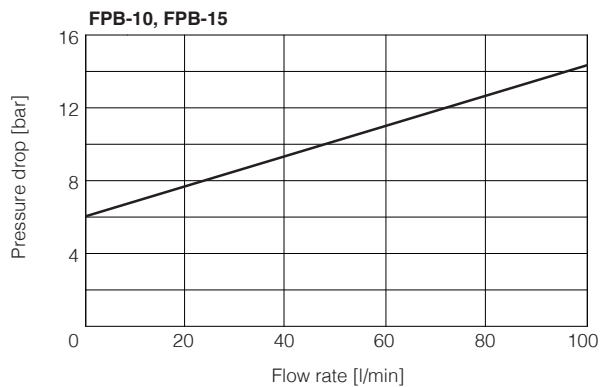
**Gr** = 4,42 mbar/(l/min)

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

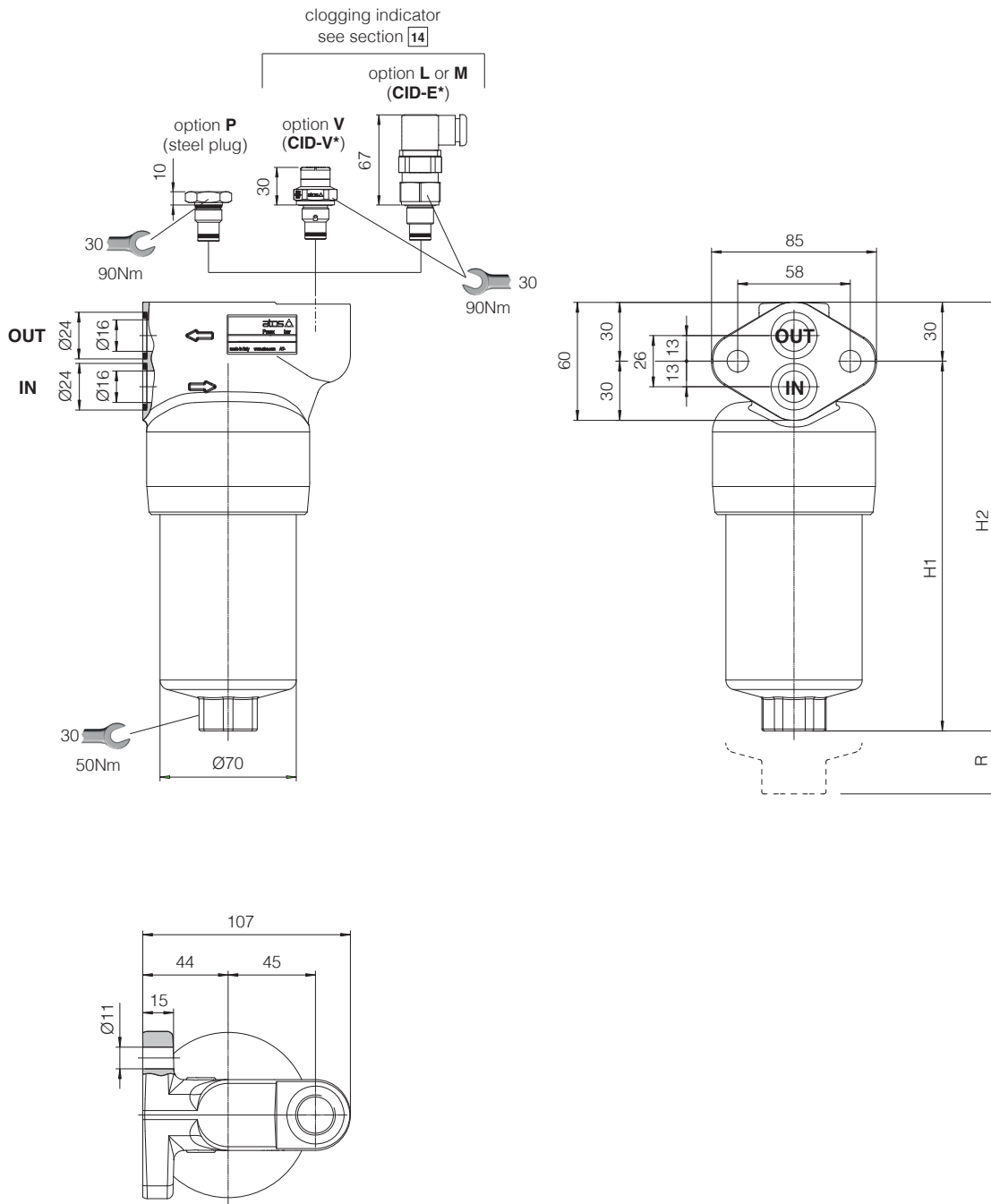
**Total  $\Delta p$  = 0,41 + 0,51 = 0,92 bar**

#### 11 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

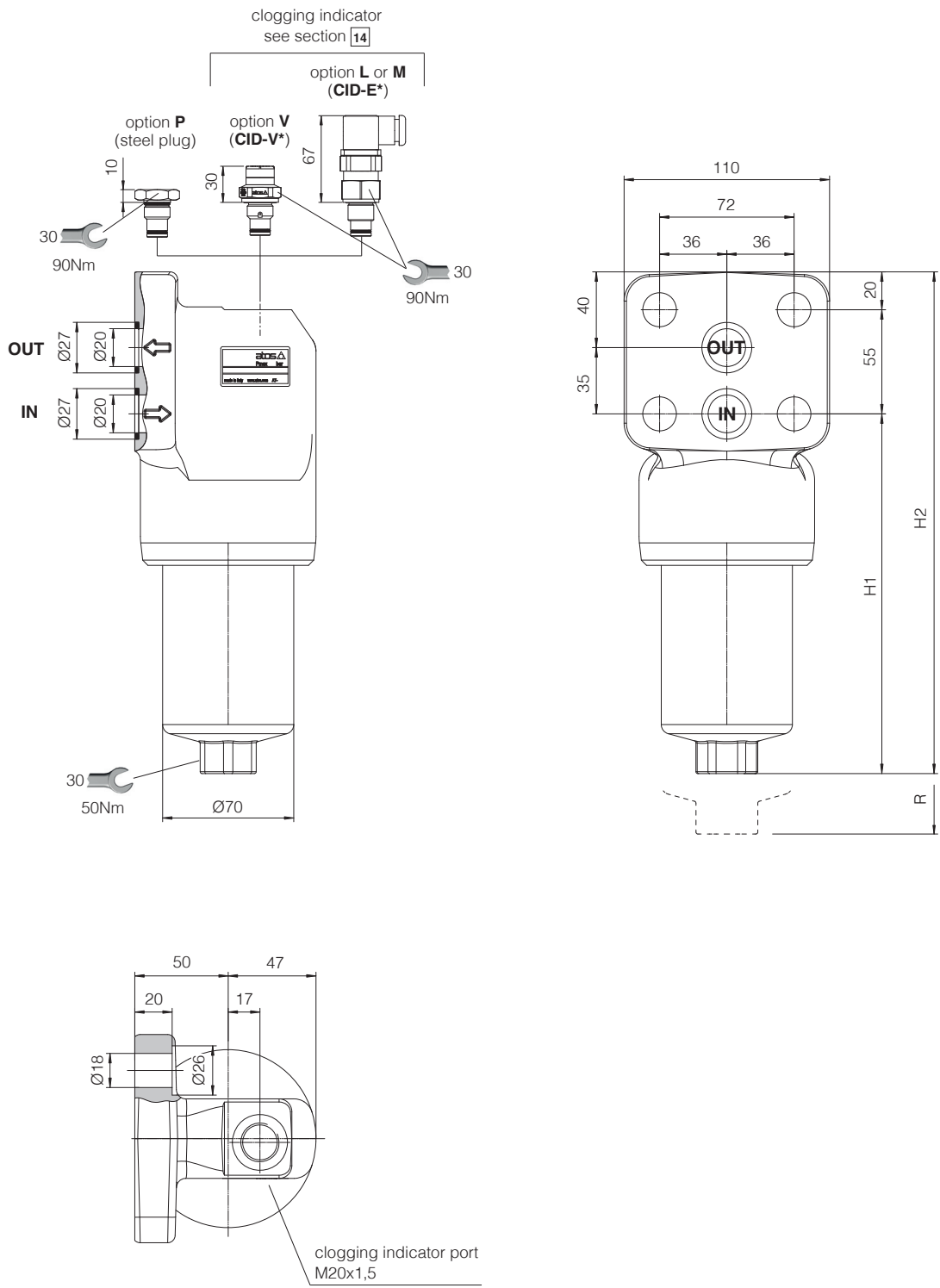


### FPB -10



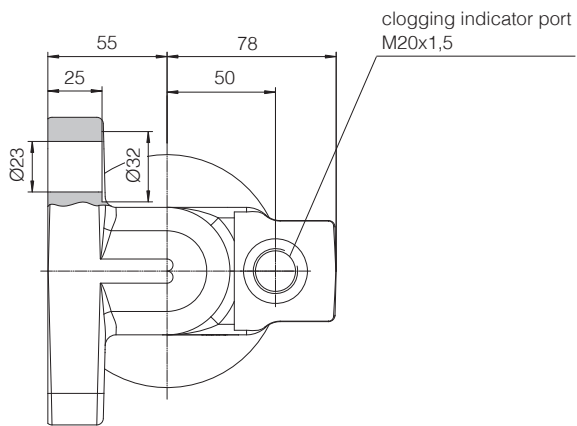
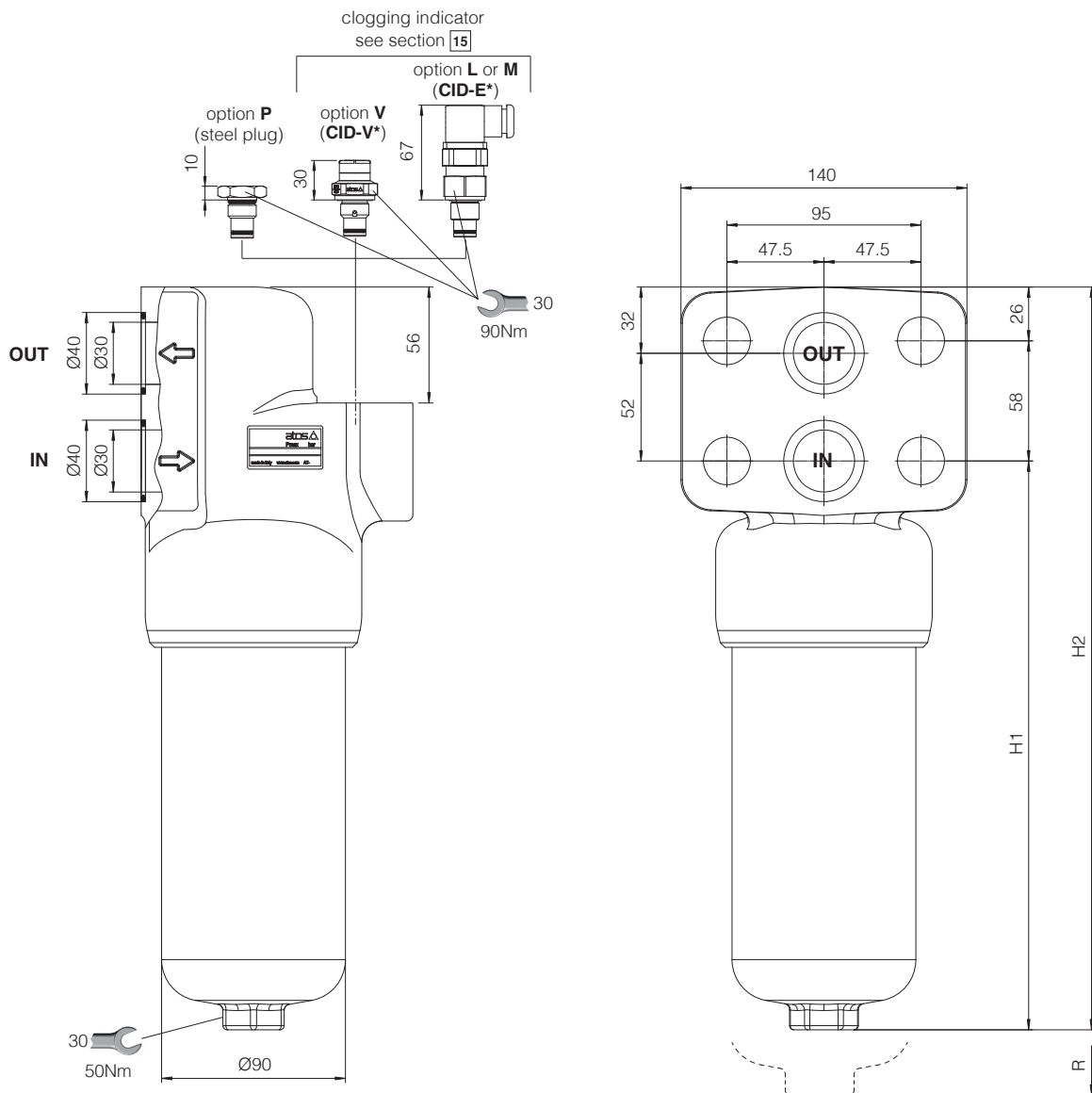
Code	H1	H2	R (element removal)	Mass (Kg)
FPB-10-A	188	226	110	3.8
FPB-10-B	281	319		4.9

# FPB -15



Code	H1	H2	R (element removal)	Mass (Kg)
FPB-15-A	190	265	110	6
FPB-15-B	283	358		7.1

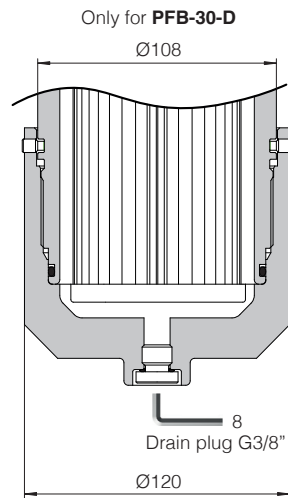
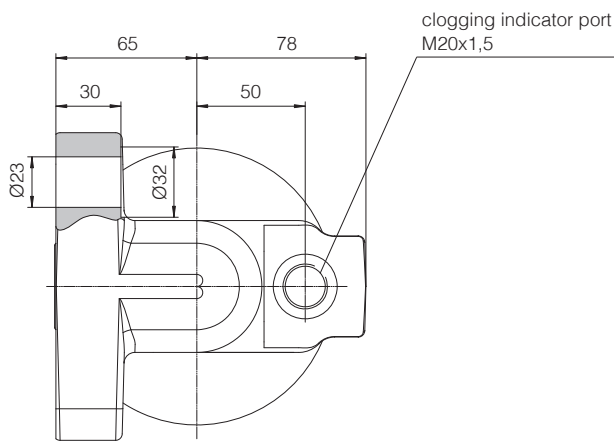
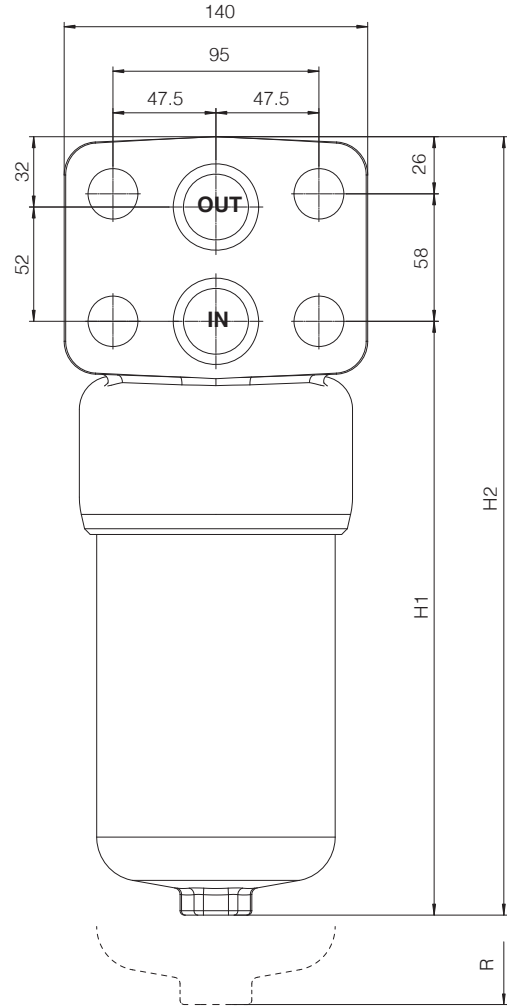
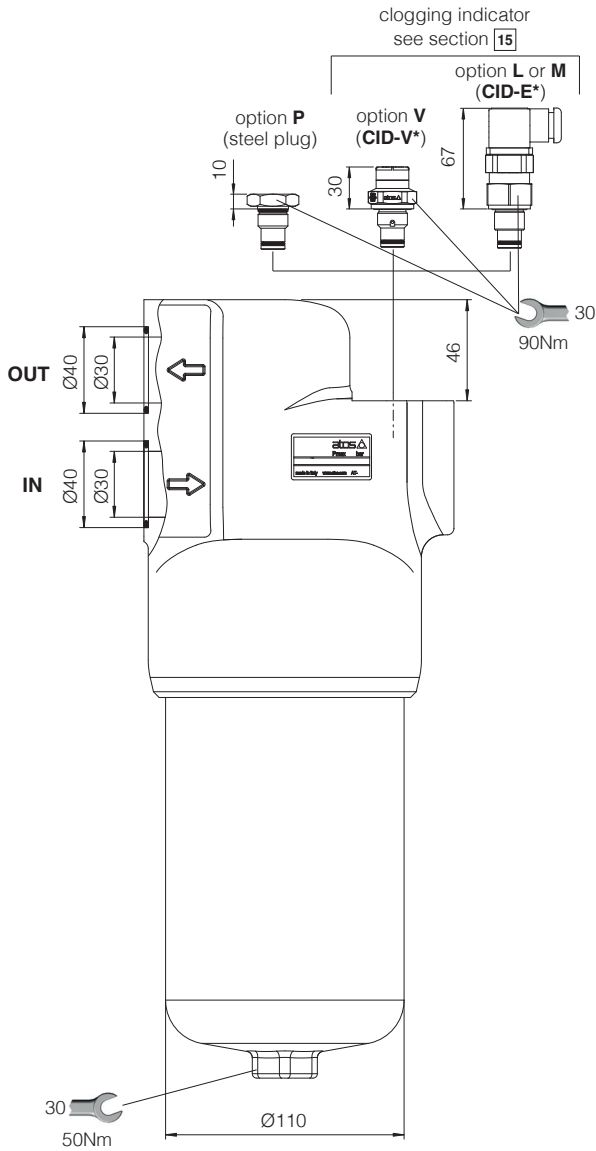
# FPB -20



Code	H1	H2	R (element removal)	Mass (Kg)
FPB-20-A	240	324	120	9.8
FPB-20-B	299	383		11
FPB-20-C	369	453		12.3



# FPB -30

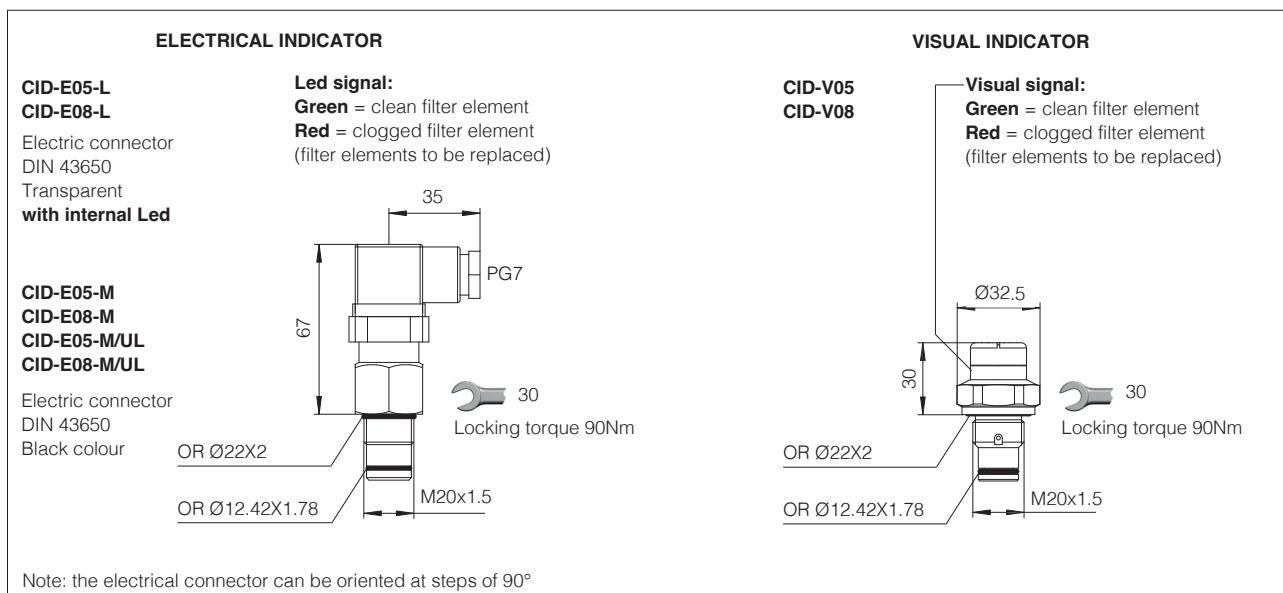


Code	H1	H2	R (element removal)	Mass (Kg)
FPB-30-A	202	287	130	12.2
FPB-30-B	295	380		14.8
FPB-30-C	415	500		18
FPB-30-D	514	599		20.8

**13 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	clean filter element	<p><b>CID-*L</b></p>	<p><b>CID-*M</b></p> <p>GREEN</p>
	clogged filter element	<p><b>CID-*L</b></p>	<p><b>CID-*M</b></p> <p>RED</p>

**14 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

## 15 INSTALLATION AND COMMISSIONING

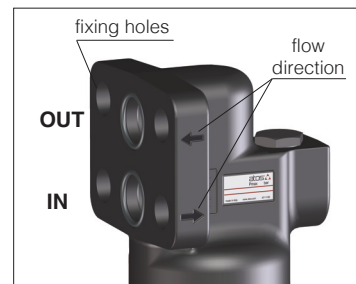
The max operating pressure of the system must not exceed the max working pressure of the filter (350 bar).

During the filter installation, pay attention to respect the flow direction, shown by the arrows on the filter head.

The filter should be preferably mounted with the bowl downward.

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 thermostated clogging indicator CID-T can be used.



## 16 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 (only for PFB-30-D has a drain plug G1/4" at the bottom of the blow)
- 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.

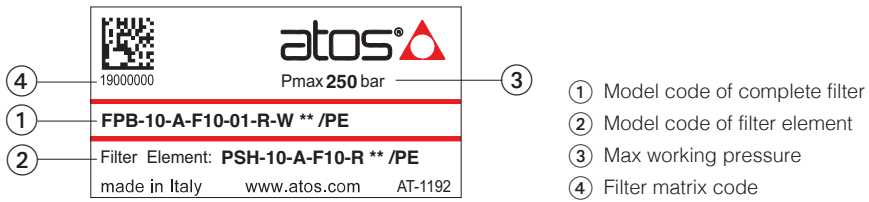
### 16.1 SEALS KIT

Filter type	Seal kit code (NBR)	Seal kit code (FKM)	Seal kit composition
FPB-10	GUARN FPB-10	GUARN FPB-10 /PE	④+⑤+⑥+⑦
FPB-15	GUARN FPB-15	GUARN FPB-15 /PE	④+⑤+⑥+⑦
FPB-20	GUARN FPB-20	GUARN FPB-20 /PE	④+⑤+⑥+⑦
FPB-30	GUARN FPB-30	GUARN FPB-30 /PE	④+⑤+⑥+⑦+⑧+⑨+⑩

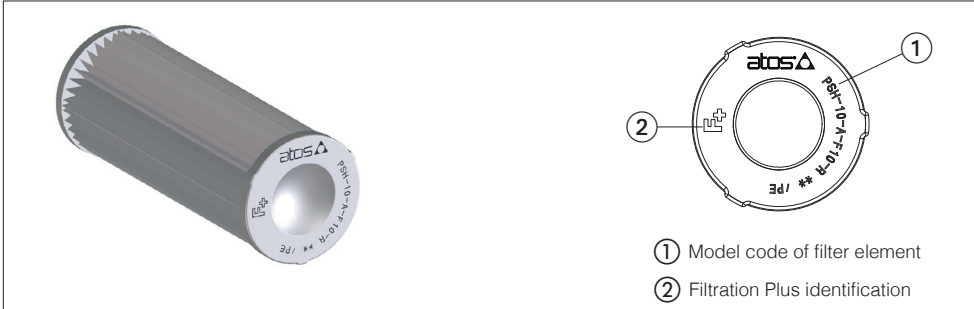
(1) Seals (8) and (9) are supplied in seal kit but used only for FPB-30-D



## 17 FILTER IDENTIFICATION NAMEPLATE



### 17.1 IDENTIFICATION OF FILTER ELEMENT



## 18 RELATED DOCUMENTATION

- LF010 Fluid contamination
- LF020 Filtration guidelines