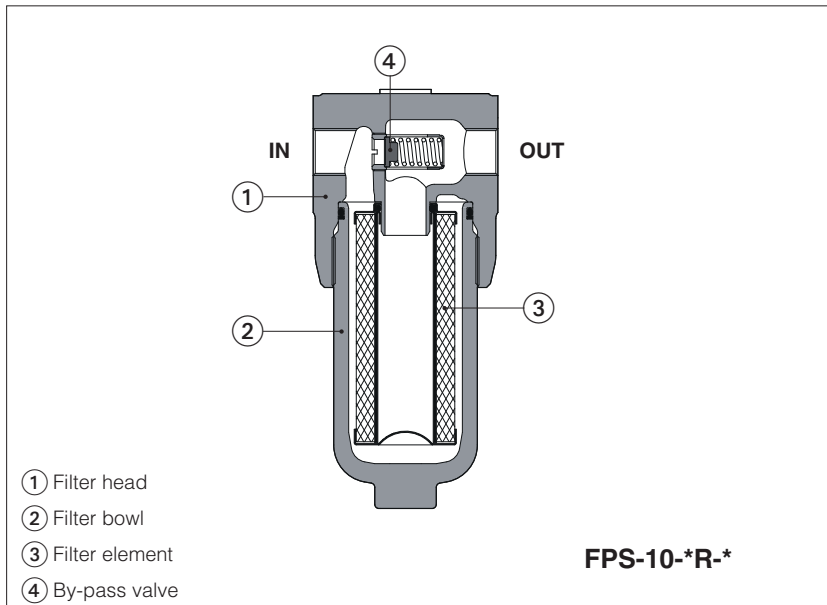


In line filters, high pressure type FPS

Threaded ports



- ① Filter head
- ② Filter bowl
- ③ Filter element
- ④ By-pass valve

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
- threaded port sizes:
G1/2" to G1 1/2"
SAE-16, SAE-20, SAE-24
- high efficiency microfiber elements.
Collapse pressure 21 bar for filters equipped with by-pass valve or 210 bar for filters without by-pass
- filtration rating 4,5 - 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 **440 l/min**

Max working pressure **420 bar**

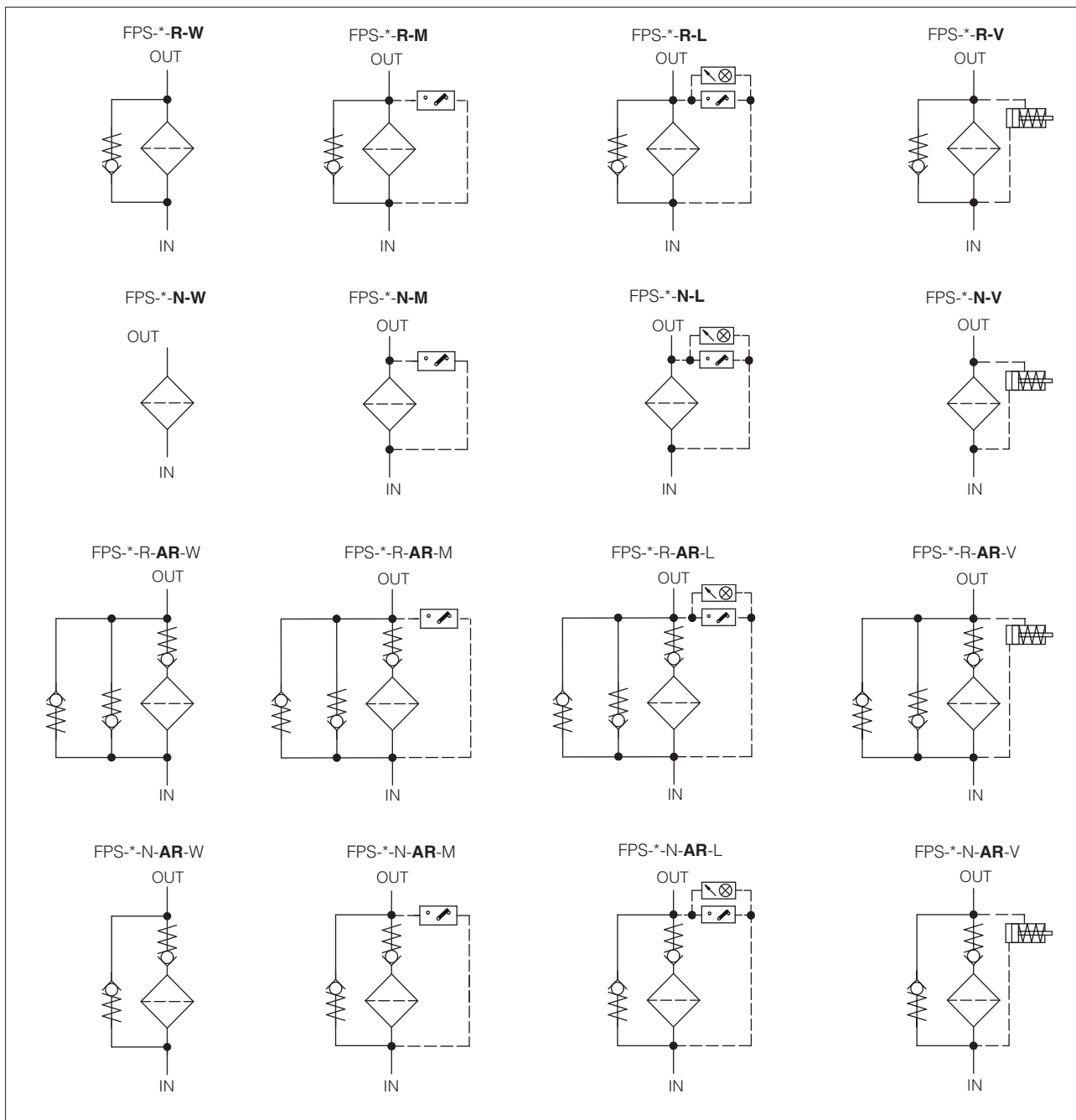
1 MODEL CODE OF COMPLETE FILTERS

FPS	-	10	-	A	-	F10	-	01	-	R	-	*	-	W	-	*	/	*	
In line filter, high pressure																		Series number	Seals material: - = NBR PE = FKM
Filter size:																			
10	= ports size 1/2" ÷ 1"																		
20	= ports size 1" ÷ 1 1/4"																		
30	= ports size 1 1/4" ÷ 1 1/2"																		
Filter length:																			
		FPS-10	FPS-20	FPS-30															
A		110	191	240															
B		133	205	349															
C		-	226	390															
D		-	-	440															
Filter element:																			
SN	= only body, without filter element																		
Microfibre filter element	βx(c) >1000 - ISO 16889:																		
F03	= 4,5 μm (c);																		
F10	= 12 μm (c);																		
F06	= 7 μm (c);																		
F20	= 22 μm (c)																		
Ports size:																			
		FPS-10	FPS-20	FPS-30															
BSPP		00 = G 1/2"	02 = G 1"	03 = G 1 1/4"															
threaded:		01 = G 3/4"	03 = G 1 1/4"	04 = G 1 1/2"															
		02 = G 1"																	
SAE J1926-1		FPS-10	FPS-20	FPS-30															
threaded:		42 = SAE-16 (1")	43 = SAE-20 (1 1/4")	44 = SAE-24 (1 1/2")															
Differential clogging indicator	see sect. 14:																		
W	= without, indicator port with plastic plug (2)																		
P	= without, indicator port with steel plug																		
L	= electrical indicator with LED (3)																		
M	= electrical indicator without LED (3)																		
V	= visual indicator (3)																		
	see also note (4)																		
Options	see sect. 10:																		
-	= none																		
AR	= anti-back flow valve and reverse valve																		
By-pass valve	see sect. 9:																		
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)																		

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 mm²/s - see also section 6
In case of different conditions see section 11 for filter sizing
- (2) The plastic plug (option W) is only intended 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 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)

PSH	-	10	-	A	-	F10	-	R	/	*
Spare filter element for in line filter type FPS								Series number		Seals material: - = NBR PE = FKM
<p>Filter element size: 10 = for FPS-10 20 = for FPS-20 30 = for FPS-30</p>										
<p>Filter element length: for FPS-10 for FPS-20 for FPS-30 A A A B B B C C D D</p>										
<p>Microfibre filter element, $\beta_{x(c)} > 1000$ - ISO 16889: F03 = 4,5 μm (c) F06 = 7 μm (c) F10 = 12 μm (c) F20 = 22 μm (c)</p>										

(1) Select the filter element according to the model code reported on the filter nameplate, see section 17.2

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

CID	-	E	05	-	M	*	/	*
Spare differential clogging indicator for in line filter						Series number		Seals material: - = NBR PE = FKM
Type of indicator: E = electrical V = visual T = thermostated (available on request) Z = electronic transmitter (available on request)								
Differential switching pressure (only for CID-E and CID-V): 05 = 5 bar for filters with by-pass valve 08 = 8 bar for filters without by-pass valve						Optional LED - only for CID-E 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	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 ⁶ 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 32mm²/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										
Filter length	A ÷ B	A ÷ B	A ÷ B	A ÷ B	A ÷ C	A ÷ C	A ÷ C	A ÷ D	A ÷ D	A ÷ D
Max flow (l/min) at Δp= 1 bar Filter with by-pass -R (see note)	F03	28÷45	30÷50	34÷56	55-82	59÷90	64÷200	66÷210		
	F06	48÷66	53÷75	60÷92	100÷135	112÷154	110÷284	113÷305		
	F10	60÷77	68÷89	80÷114	135÷170	154÷195	175÷342	183÷370		
	F20	75÷85	87÷99	110÷133	166÷196	191÷226	227÷323	240÷440		
Max flow (l/min) at Δp= 1 bar Filter without by-pass -N (see note)	F03	25-42	25÷46	29÷51	44÷67	47÷73	57÷167	58÷175		
	F06	35÷55	38÷68	41÷80	83÷116	91÷131	77÷228	80÷243		
	F10	55÷70	60÷81	71÷102	117÷153	133÷176	153÷267	160÷286		
	F20	69÷83	79÷96	98÷127	154÷187	177÷215	197÷372	208÷405		
Max operating pressure [bar]	420									
Burst pressure [bar]	> 1260									

Note: Max flow rates are measured with min and max filter length. In case of different conditions see section 11 for filter sizing

7 FILTER ELEMENTS

Material		Inorganic microfibre
Filtration rating as per ISO16889	F03	$\beta_{4,5\mu\text{m}(c)} \geq 1000$
	F06	$\beta_{7\mu\text{m}(c)} \geq 1000$
	F10	$\beta_{12\mu\text{m}(c)} \geq 1000$
	F20	$\beta_{22\mu\text{m}(c)} \geq 1000$
Filter element collapse pressure	R = for filter with by-pass valve	21 bar
	N = 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 ² /s - max allowed range 2.8 ÷ 500 mm ² /s		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
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

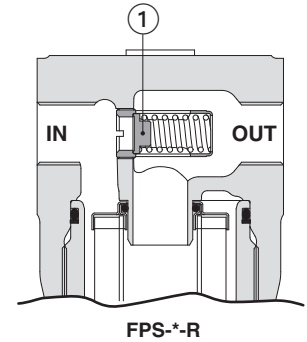
Filter with by-pass valve - version -R

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).

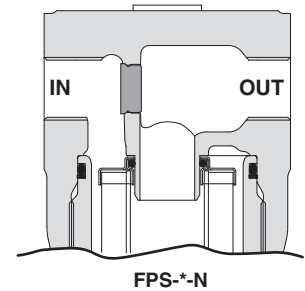
This situation should be carefully avoided, by means of a scheduled maintenance, otherwise the contaminated oil will pass to the clean side of the filter and then it will circulate in the hydraulic system. The filter element must be replaced before the clogging condition, at this purpose the use of a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



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 ANTI BACK-FLOW AND REVERSE VALVE

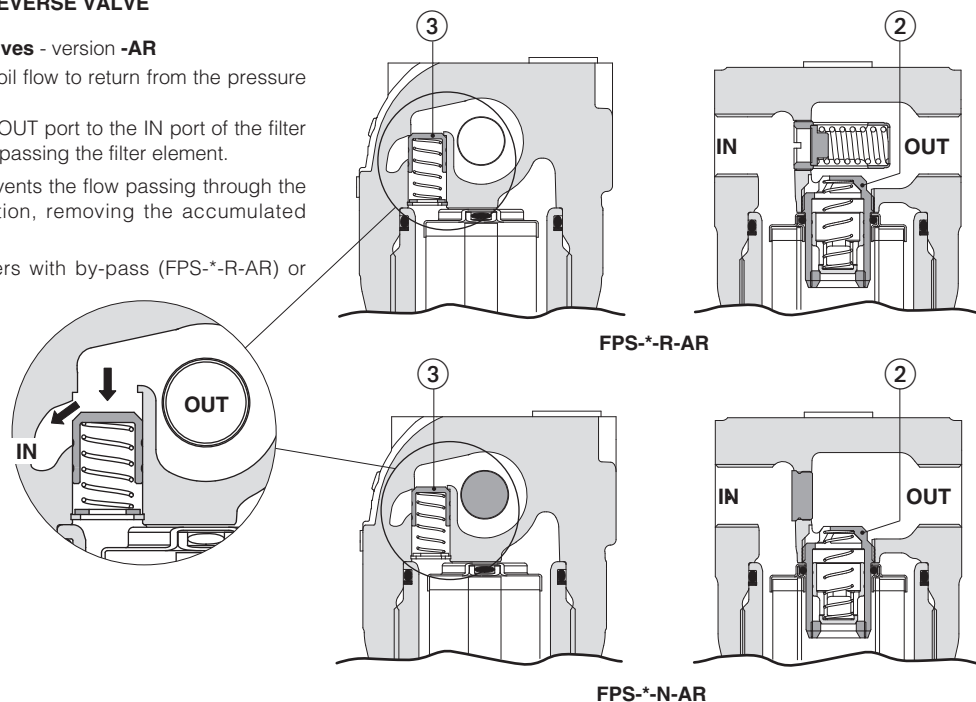
Anti-back flow and Reverse valves - version -AR

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)



11 FILTERS SIZING

For the filter sizing it is necessary to consider the Total Δp at the maximum flow at which the filter must work.

The Total Δp is given by the sum of filter head Δp plus the filter element Δp :

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

In the best conditions the total Δp should not exceed 1,0 bar

See below sections to calculate the Δp of filter head and Δp of the filter element

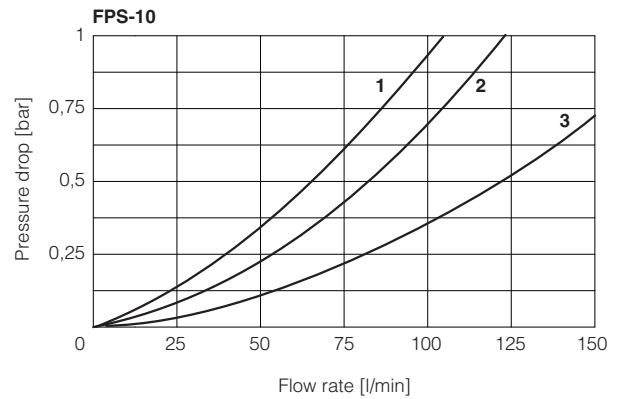
11.1 Q/ Δp DIAGRAMS OF FILTER HEAD

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

In the following diagrams are reported the Δp characteristics of filter head based on mineral oil with density 0,86 kg/dm³ and viscosity 30 mm²/s

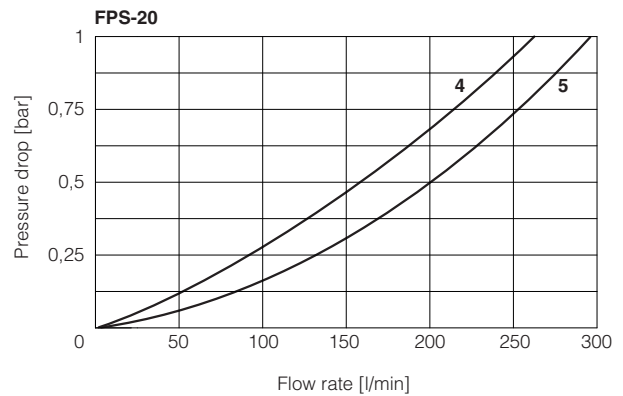
FPS-10

- 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)



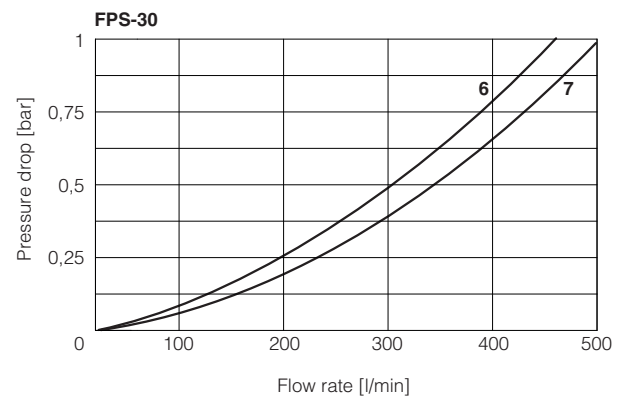
FPS-20

- 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 Δp

The pressure drop through the filter depends to:

- size of filter element
- filtration rating
- fluid viscosity

The Δp 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 (mm²/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								
R for filter with bypass valve	F03	27.75	15.25	15.82	13.19	9.63	14	7.13	4.7	3.62
	F06	15.12	7.58	7.27	6.06	4.43	8.03	3.37	2.2	1.89
	F10	9.37	4.91	4.45	3.71	2.71	4.43	2.33	1.5	1.12
	F20	5.31	3.25	2.87	2.39	1.75	2.95	1.34	0.92	0.44
N for filter without bypass valve	F03	32.2	17.32	20.27	16.90	12.35	16.48	8.13	5.5	4.71
	F06	22.38	9.41	9.50	7.92	5.79	11.88	4.18	3.28	2.91
	F10	11.2	6.27	5.66	4.72	3.45	5.27	3.45	2.36	2.15
	F20	6.81	3.71	3.41	2.84	2.07	3.70	1.60	0.86	0.78

Example:

Calculation of Total Δp for filter type FPS-10-B-F10-02-R at Q = 80 l/min and viscosity 46 mm²/s (filter element PSH-10-B-F10-R)

Dp of filter head + filter bowl = 0,24 bar

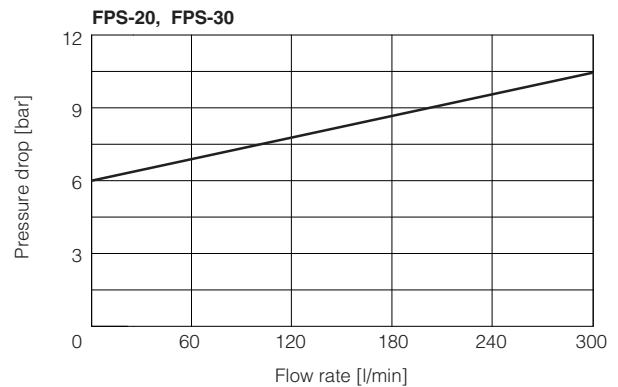
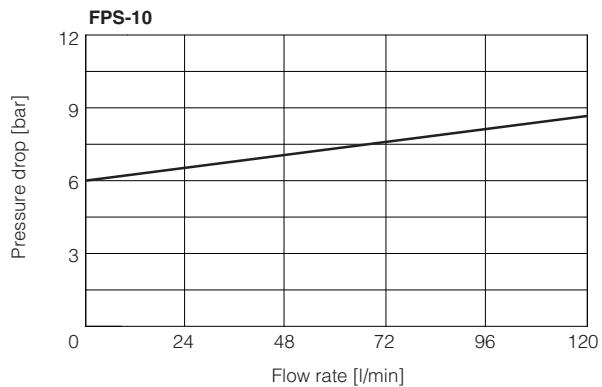
Gc = 4,91 mbar/(l/min)

$$\text{Filter element } \Delta p = 80 \times \frac{4,91}{1000} \times \frac{46}{32} = 0,60 \text{ bar}$$

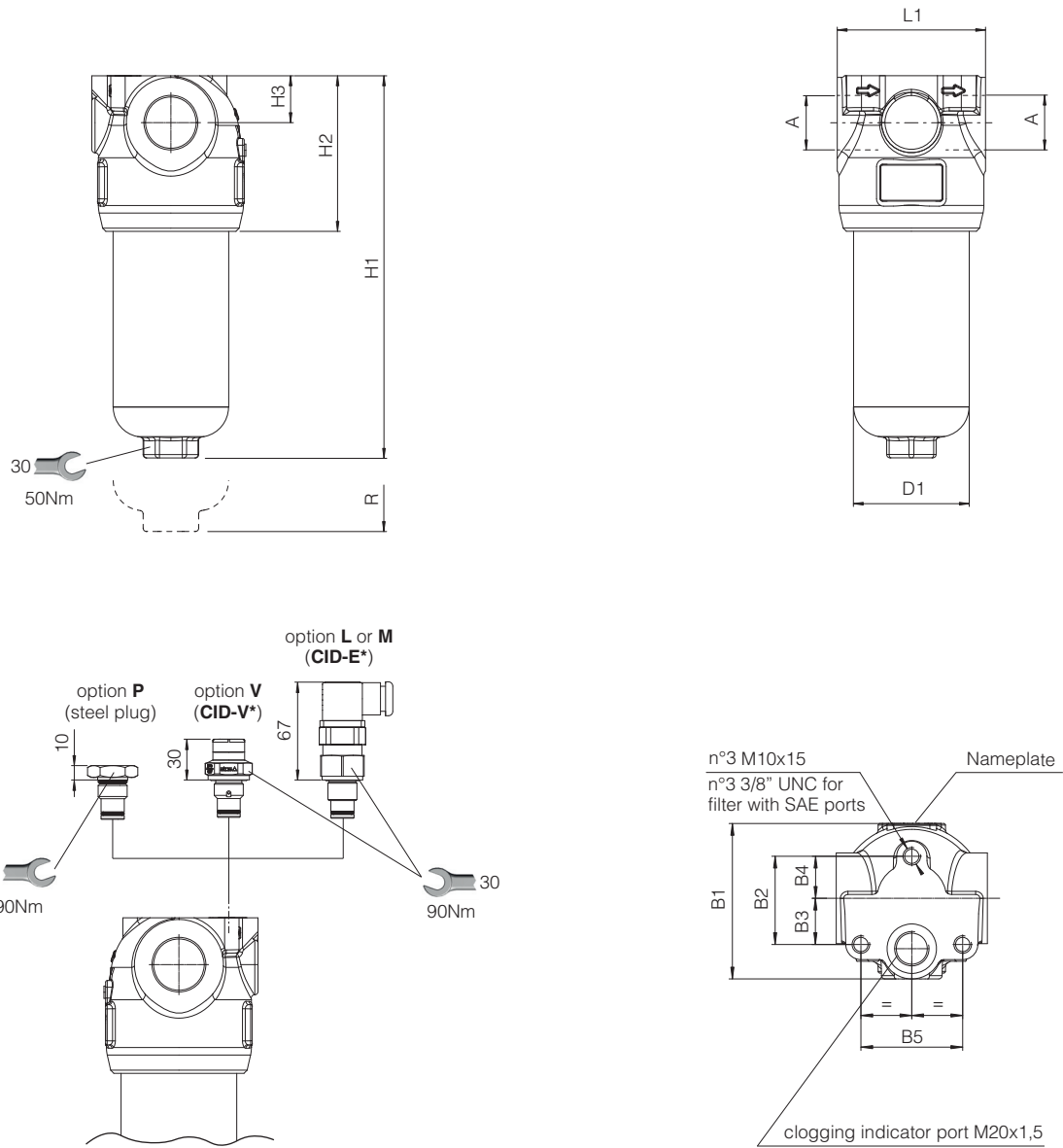
Total Δp = 0,24 + 0,60 = 0,84 bar

12 BY-PASS VALVE - based on mineral oil ISO VG46 at 50°C (viscosity = 32 mm²/s)

Q/ Δp diagrams of flow through the by-pass valve

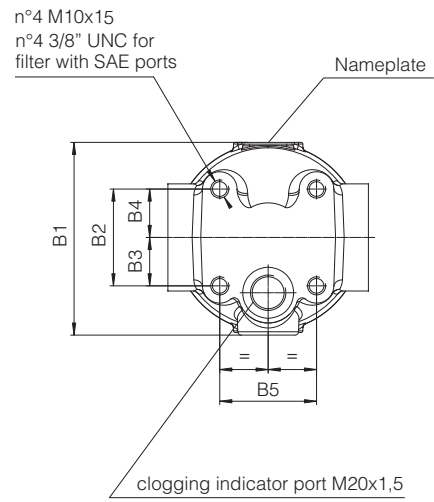
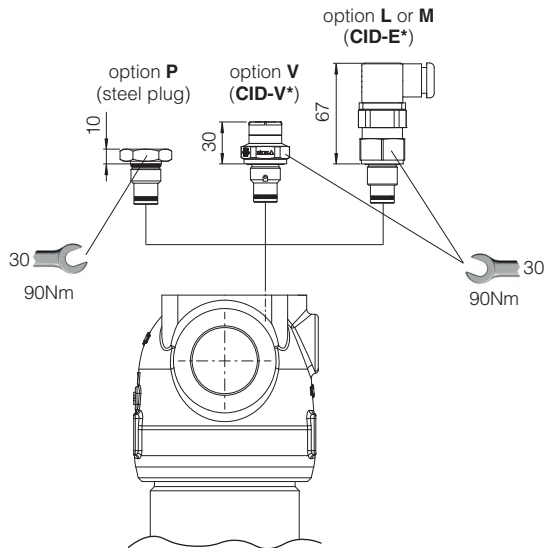
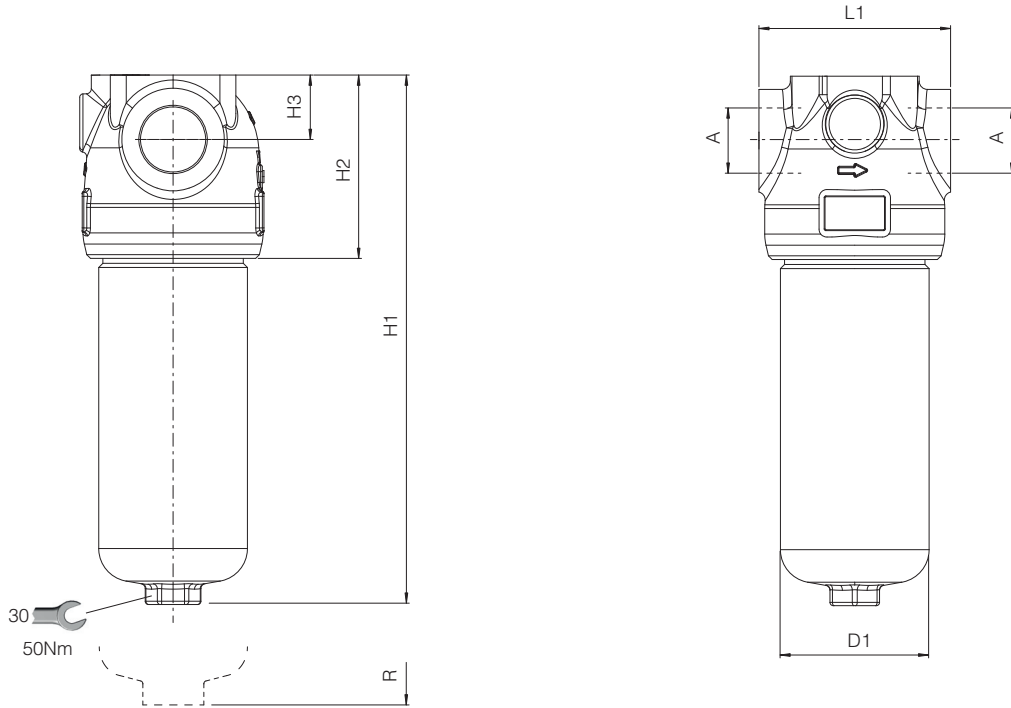


FPS -10



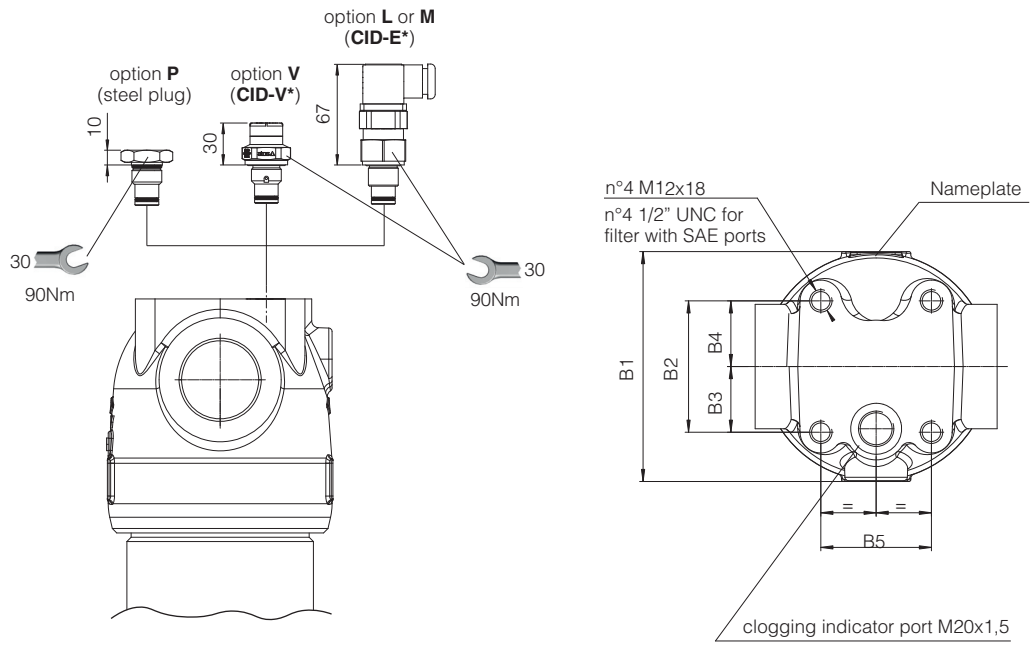
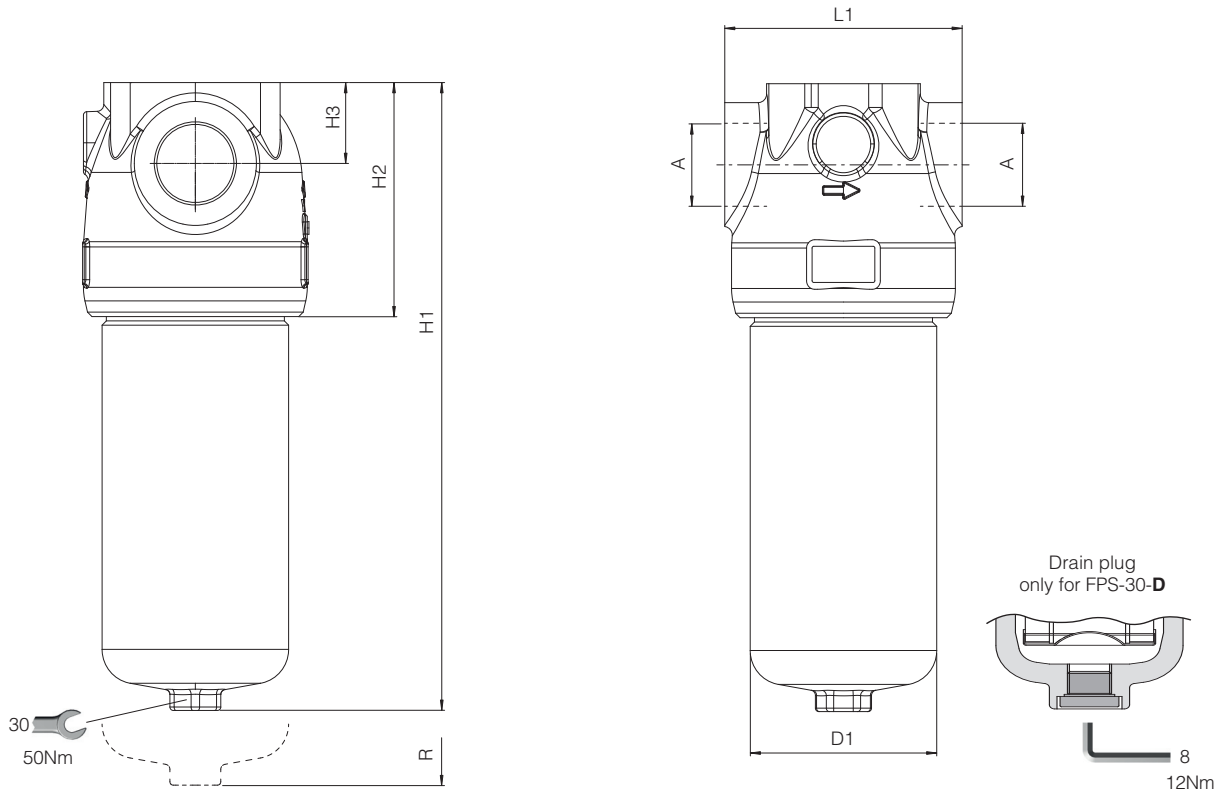
Code	A	B1	B2	B3	B4	B5	D1	H1	H2	H3	L1	R (element removal)	Mass (Kg)
FPS-10-A	1/2" BSPP 3/4" BSPP 1" BSPP SAE-16	93.5	52.5	27.5	25	60.6	70	203	93	28	90	110	4
FPS-10-B								296					5

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

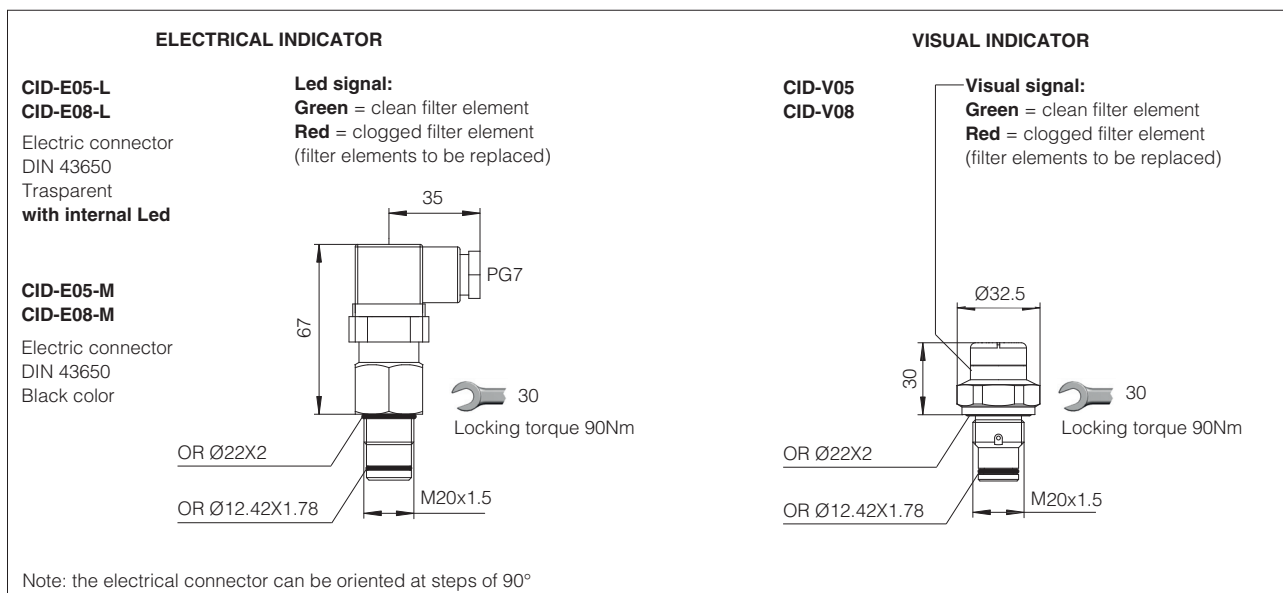


Code	A	B1	B2	B3	B4	B5	D1	H1	H2	H3	L1	R (element removal)	Mass (Kg)
FPS-30-A	1 1/4" BSPP 1 1/2 BSPP SAE-24	133.5	76	38	38	64	110	240.5	136	47	140	130	10.5
FPS-30-B								333.5					13
FPS-30-C								453.5					16.4
FPS-30-D								552.5					19

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 ⁶ 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 _{DC} ± 10%		-
	CID-E05-M, CID-E08-M	14 V _{DC} ÷ 30 V _{DC}	125 V _{AC} ÷ 250 V _{AC}	-
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>CID-*L</p>	<p>CID-*M</p>	GREEN
	clogged filter element			RED

15 DIMENSIONS OF DIFFERENTIAL CLOGGING INDICATORS



NOTE: Differential thermostated indicator CID-T and differential electronic transmitter 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.
 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.

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.



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.

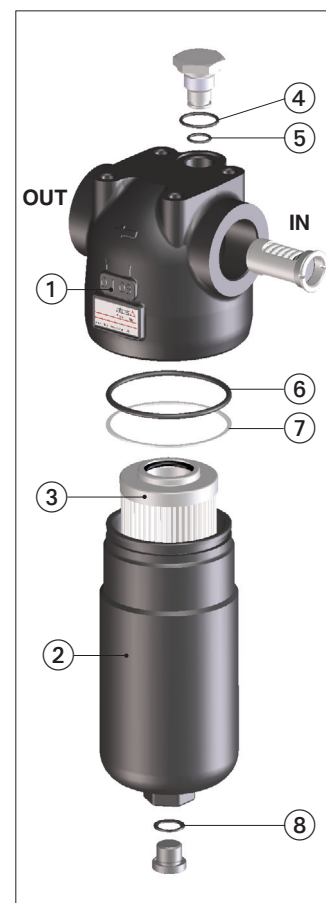
Select the new filter element according to the model code reported on the filter nameplate, see section 17.2

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, 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.



17.1 SEALS KIT

Filter type	Seal kit code	Seal kit composition
FPS-10	GUARN FPS-10	④+⑤+⑥+⑦
FPS-20	GUARN FPS-20	④+⑤+⑥+⑦
FPS-30	GUARN FPS-30	④+⑤+⑥+⑦+⑧

17.2 FILTER IDENTIFICATION NAMEPLATE



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

18 RELATED DOCUMENTATION

LF010	Fluid contamination
LF020	Filtration guidelines