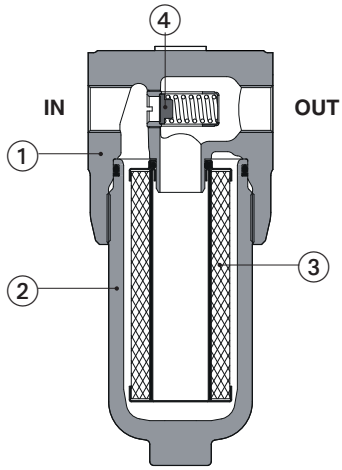
In line filters, high pressure type FPS

Threaded ports



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

FPS-10-*R-*

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

FPS	-	10	-	A	-	F10	-	01	-	R	-	*	-	W	*	/	*

FPS — In line filter, high pressure

Filter size (ports size):
10 = G1/2" ÷ G1" or SAE-16
20 = G1" ÷ G1 1/4" or SAE-20
30 = G1 1/4" ÷ G1 1/2" or SAE-24

Filter length:	Max flow [l/min] **(1)** FPS-10	FPS-20	FPS-30
A =	115	191	256
B =	137	205	361
C =	-	226	406
D =	-		450

Filter element:
SN = only body, without filter element
F+ microfibre filter element βx(c) >1000 - ISO 16889:
F03 = 5 µm (c) **F10** = 12 µm (c)
F06 = 7 µm (c) **F20** = 22 µm (c)
Filter element **F01** = 4 µm (c) available on request

Ports size:	FPS-10	FPS-20	FPS-30
BSPP threaded:	**00** = G 1/2" **01** = G 3/4" **02** = G 1"	**02** = G 1" **03** = G 1 1/4"	**03** = G 1 1/4" **04** = G 1 1/2"
SAE J1926-1 threaded:	FPS-10 **42** = SAE-16	FPS-20 **43** = SAE-20	FPS-30 **44** = SAE-24 (1 1/2")

Differential clogging indicator see sect. 14 **(2)**:
W = without, indicator port with plastic plug **(3)**
P = without, indicator port with steel plug
L = electrical indicator with LED
M = electrical indicator without LED
V = visual indicator
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)

Series number

Seals material:
- = NBR
PE = FKM

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

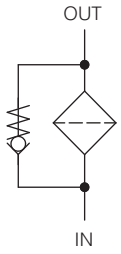
(2) The clogging indicator is supplied disassembled from the filter. The indicator port on filter head is plugged with plastic plug

(3) 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

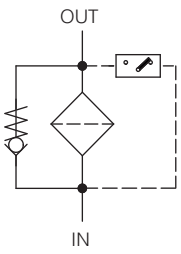
(4) Differential clogging indicator CID-E*-M/UL with cURus certification is available on request, see section 4
Differential thermostated indicator CID-T and differential electronic transmitter with output signal 4÷20 mA CID-Z are available on request, see section 4

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

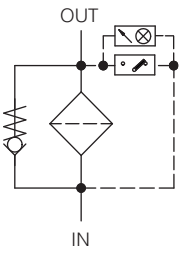
FPS-*-**R-W**



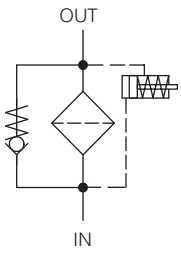
FPS-*-**R-M**



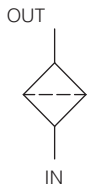
FPS-*-**R-L**



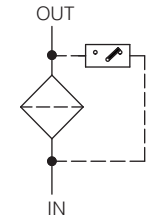
FPS-*-**R-V**



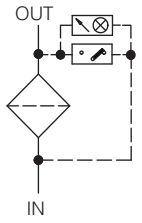
FPS-*-**N-W**



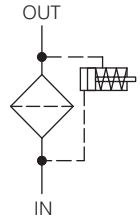
FPS-*-**N-M**



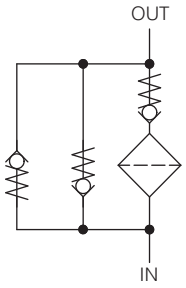
FPS-*-**N-L**



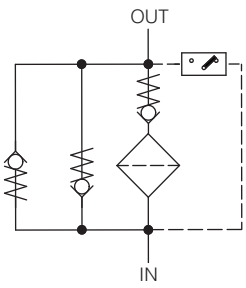
FPS-*-**N-V**



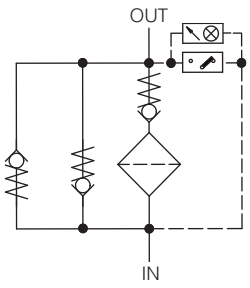
FPS-*-R-**AR**-W



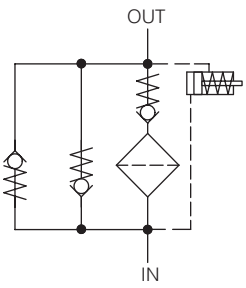
FPS-*-R-**AR**-M



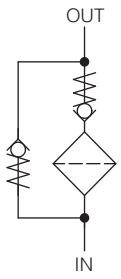
FPS-*-R-**AR**-L



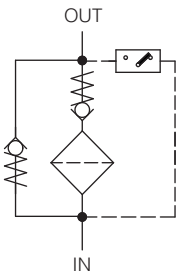
FPS-*-R-**AR**-V



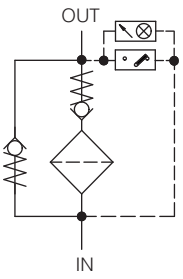
FPS-*-N-**AR**-W



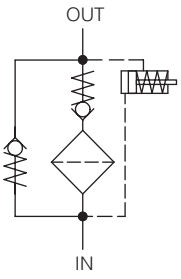
FPS-*-N-**AR**-M



FPS-*-N-**AR**-L



FPS-*-N-**AR**-V



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

PSH	-	**10**	-	**A**	-	**F10**	-	**R**	*****	/	*****

Spare filter element for in line filter type FPS

Filter element size:
10 = for FPS-10
20 = for FPS-20
30 = for FPS-30

Filter element length:

for FPS-10	for FPS-20	for FPS-30
A	**A**	**A**
B	**B**	**B**
	C	**C**
		D

Series number

Seals material:
- = NBR
PE = FKM

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

Microfibre filter element, βx(c) >1000 - ISO 16889:
F03 = 5 µm (c)
F06 = 7 µm (c)
F10 = 12 µm (c)
F20 = 22 µm (c)
Filter element **F01** = 4 µm (c) available on request

(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

CID	-	E	05	-	M	*	/	*

Spare differential clogging indicator for in line filter

Type of indicator:

E = electrical
V = visual
T = thermostated (available on request)
Z = electronic transmitter 4÷20 mA (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

Series number

Seals material:
- = NBR
PE = FKM

Optional LED - only for CID-E

L = with LED
M = without LED
M/UL = without LED, certified according to North American Standard cURus (available on request)

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		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 32mm²/s)

Filter size		FPS-10						FPS-20						FPS-30							
Ports size code		00		01		02, 42		02			03, 43			03				04, 44			
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		A	B	A	B	A	B	A	B	C	A	B	C	A	B	C	D	A	B	C	D
Max flow (l/min) at Δp= 1 bar Filter with by-pass **-R** (see note)	**F03**	36	56	40	62	43	73	73	84	105	80	93	118	88	164	213	259	91	172	226	277
	F06	48	69	53	79	61	98	100	112	135	112	127	154	127	225	277	330	132	239	297	356
	F10	63	79	72	92	86	120	135	148	170	154	170	195	183	275	321	380	193	295	347	414
	F20	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 **-N** (see note)	**F03**	31	43	34	48	36	53	60	70	88	65	76	98	71	120	191	215	74	125	202	228
	F06	47	55	52	61	58	71	83	94	116	91	105	131	93	187	228	290	97	197	242	311
	F10	54	75	60	87	70	111	117	130	153	133	149	176	158	245	298	343	166	260	321	372
	F20	72	85	82	99	103	131	154	166	187	177	192	215	210	315	367	380	223	340	400	414
Max operating pressure [bar]		**420**																			
Burst pressure [bar]		**> 1260**																			

Note: Max flow rates are measured with Δp= 1 bar and viscosity 32mm²/s. In case of different conditions see section 11 for filter sizing

7 FILTER ELEMENTS

Material		Inorganic microfibre
Filtration rating as per ISO16889	**F03**	$\beta_{4,5\mu m\,(c)} \geq 1000$
	F06	$\beta_{7\mu m\,(c)} \geq 1000$
	F10	$\beta_{12\mu m\,(c)} \geq 1000$
	F20	$\beta_{22\mu m\,(c)} \geq 1000$
Filter element collapse pressure	**R** = for filter with by-pass valve	21 bar
	N = for filter without by-pass valve	210 bar

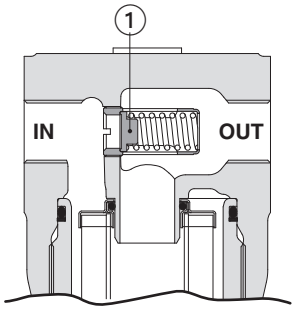
8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -30°C ÷ +100°C FKM seals (/PE option) = -25°C ÷ +120°C		
Recommended viscosity	15 ÷ 100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922

9 BY-PASS VALVE

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

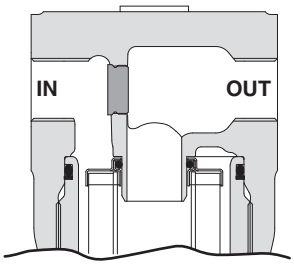
The filter with by-pass valve (1) is used in combination with filter elements PSH-*-R with collapse pressure 21 bar.
The by-pass valve allows the oil flow to by-pass the filter element in particular conditions:
- it protects the filter element from pressure peaks that could be generated, especially at 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 (Δp > 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 though 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

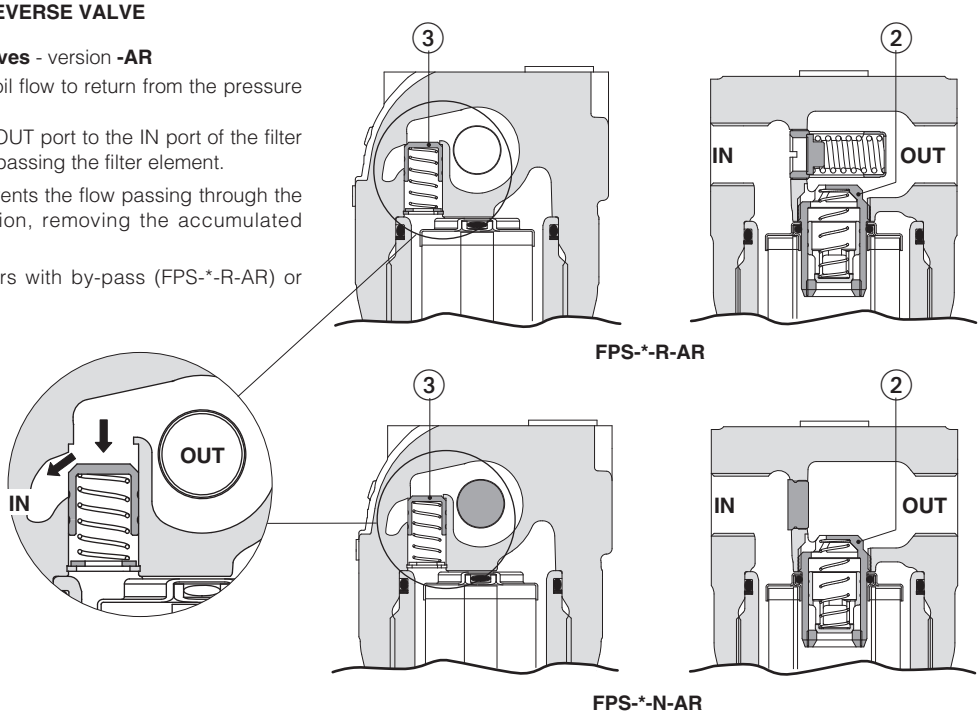
10 ANTI BACK-FLOW AND REVERSE VALVE

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 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:

Total Δp = filter head Δp + filter element Δp

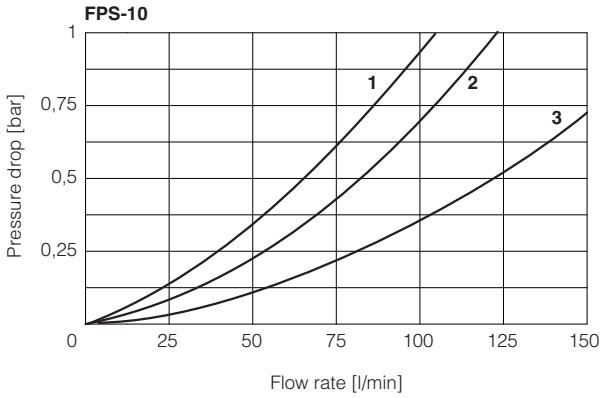
In the best conditions the total Δp should not exceed 1,0 bar
See below sections to calculate the Δp of filter head and Δp of the filter element

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/dm^3 and viscosity 30 mm^2/s

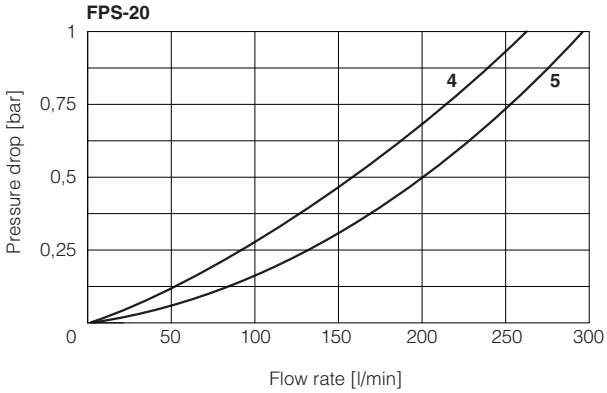
FPS-10

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)



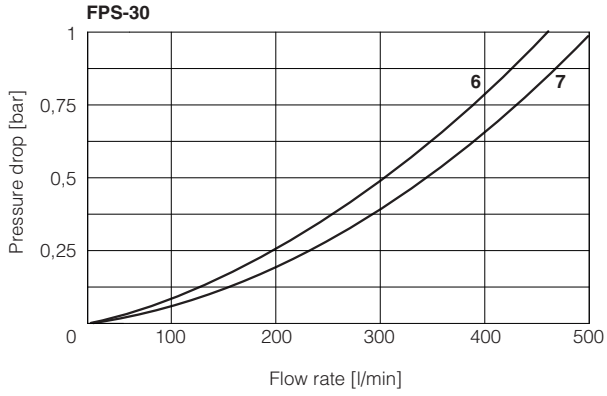
FPS-20

4 = FPS-20*** 02 (G 1")
5 = FPS-20*** 03 (G 1¼")
FPS-20*** 43 (SAE-20)



FPS-30

6 = FPS-30*** 03 (G 1¼")
7 = FPS-30*** 04 (G 1½")
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**	21.30	10.84	11.07	9.23	6.74	10.26	4.82	3.27	2.30
	F06	13.97	6.79	7.27	6.06	4.43	6.73	2.98	1.99	1.26
	F10	8.39	4.42	4.45	3.71	2.71	4.12	2.02	1.36	0.70
	F20	4.78	2.93	2.87	2.39	1.75	2.66	1.21	0.77	0.40
N for filter without bypass valve	**F03**	26.03	16.72	14.19	11.83	8.64	13.00	7.15	3.87	3.21
	F06	14.77	11.25	9.50	7.92	5.79	9.63	4.00	2.93	1.80
	F10	11.57	5.25	5.66	4.72	3.45	5.05	2.57	1.67	1.10
	F20	6.13	3.34	3.41	2.84	2.07	3.33	1.44	0.83	0.70

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)

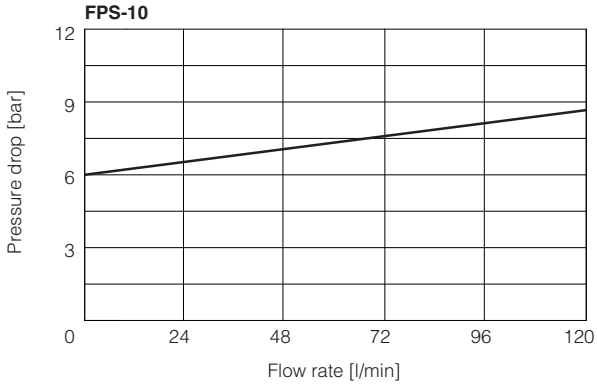
Δp of filter head = 0,24 bar
Gr = 4,42 mbar/(l/min)

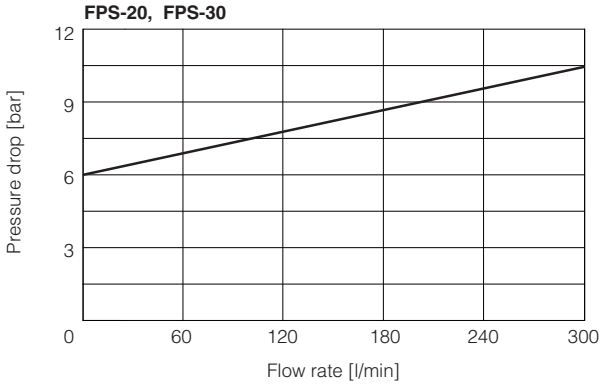
Filter element Δp = $80 \times \frac{4,42}{1000} \times \frac{46}{32} = 0,51$ bar

Total Δp = 0,24 + 0,51 = **0,75 bar**

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

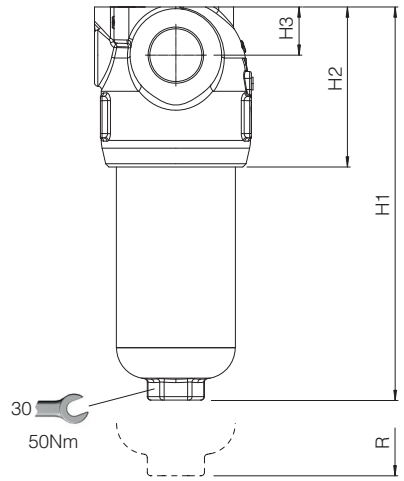
Q/Δp diagrams of flow through the by-pass valve

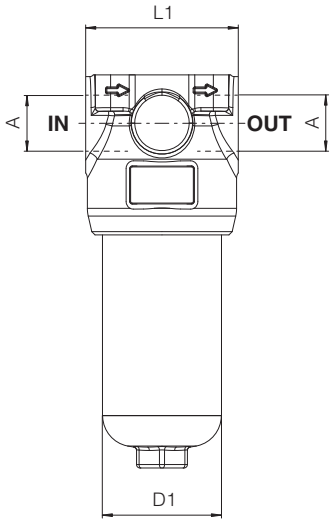


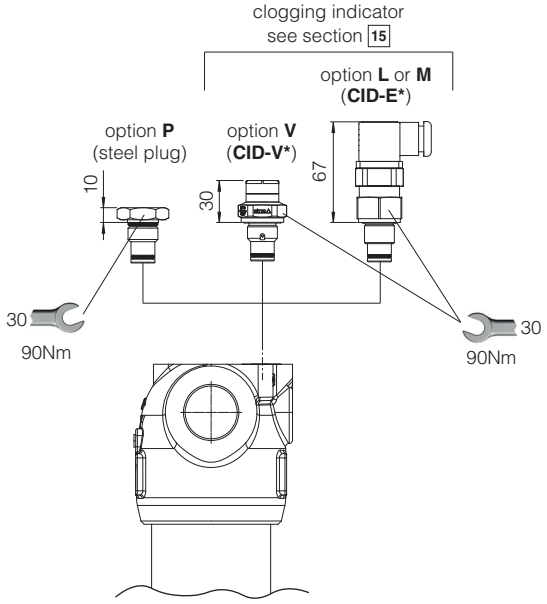


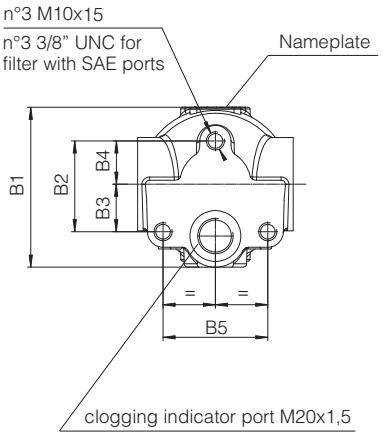
13 INSTALLATION DIMENSIONS OF FPS FILTERS [mm]

FPS -10





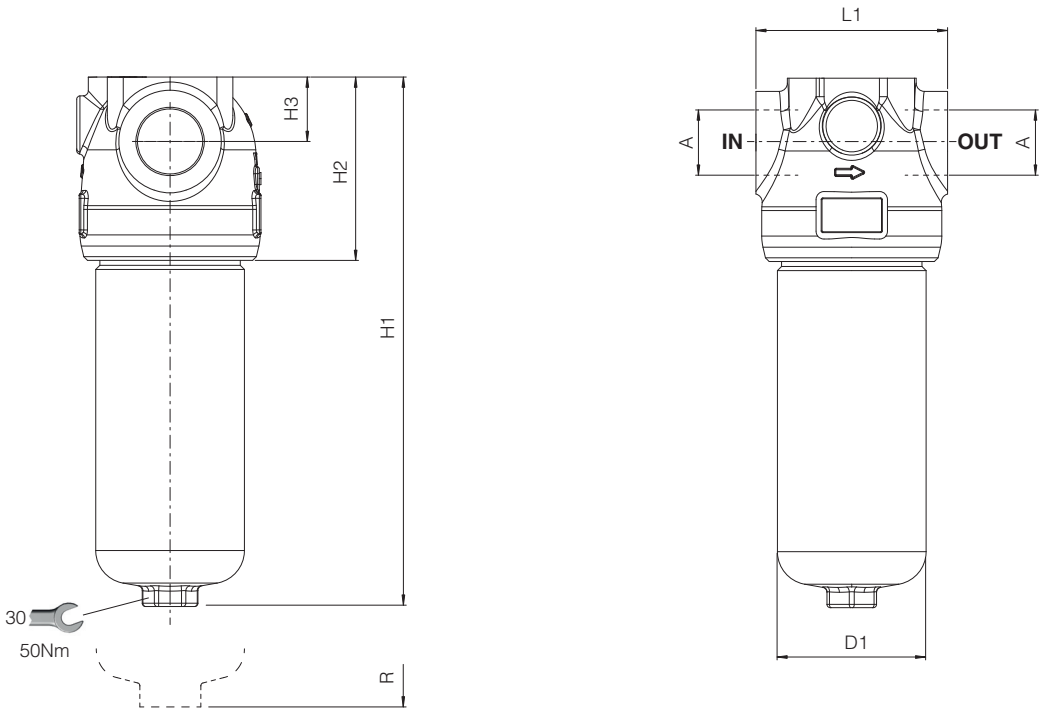


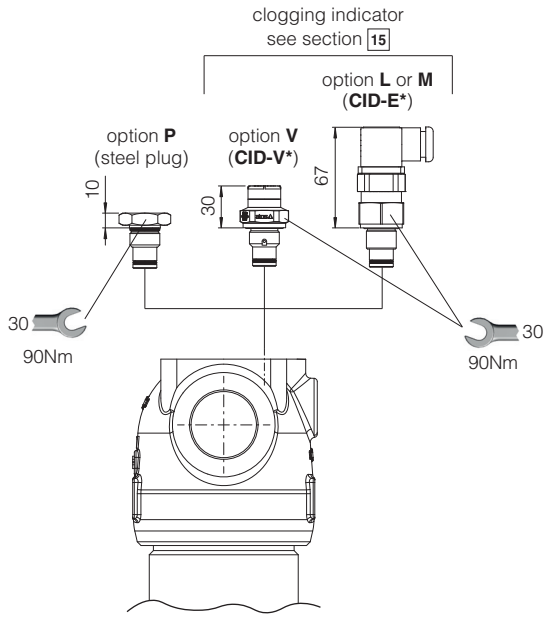


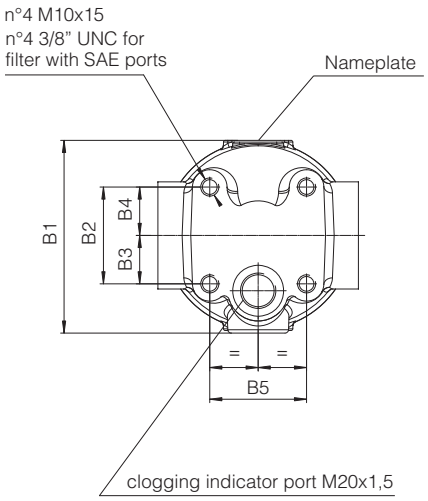
Code	A	B1	B2	B3	B4	B5	D1	H1	H2	H3	L1	R (element removal)	Mass (Kg)
FPS-10-A	1/2" BSPP 3/4" BSPP 1" BSPP SAE-16 **(1)**	93.5	52.5	27.5	25	60.6	70	203	93	28	90	110	4
FPS-10-B								296					5

(1) SAE-16 thread size 1" 5/16-12-UN-2B

FPS -20



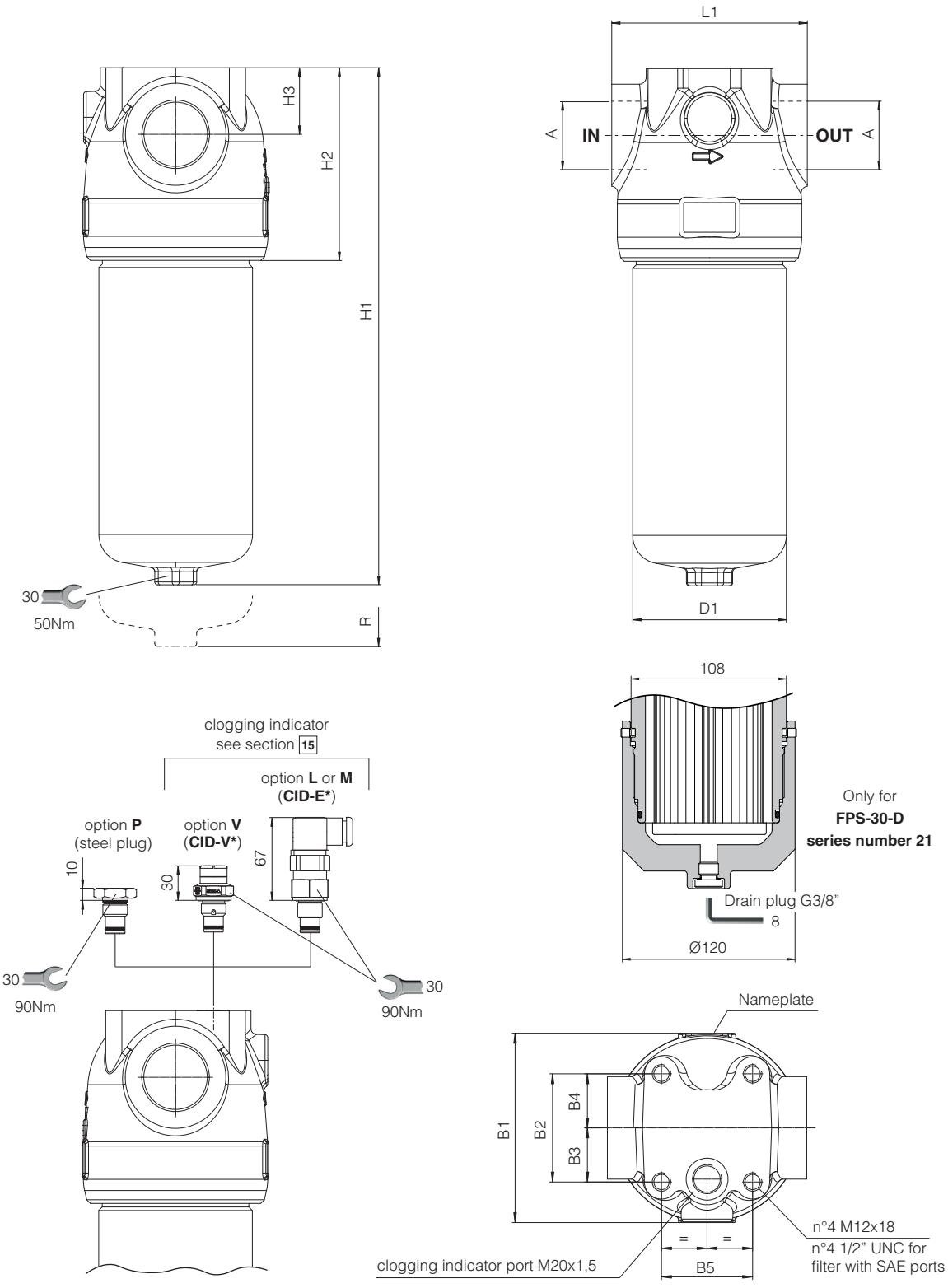




Code	A	B1	B2	B3	B4	B5	D1	H1	H2	H3	L1	R (element removal)	Mass (Kg)
FPS-20-A	1" BSPP 1 1/4" BSPP SAE-20 **(1)**	111.5	56	28	28	56	90	261	111	39	116	120	7.4
FPS-20-B								320					8.5
FPS-20-C								390					9.9

(1) SAE-20 thread size 1" 5/8-12-UN-2B

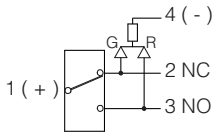
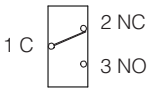
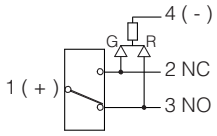
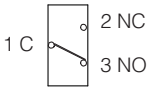
FPS -30



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 **(1)**	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

(1) SAE-24 thread size 1" 7/8-12-UN-2B

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 VDC ± 10%		-
	CID-E05-M, CID-E08-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)	-
Protection degree to DIN EN 60529		IP65 with mating connector		-
Switching scheme		**CID-*-L**	**CID-*-M**	
	clean filter element			GREEN
	clogged filter element			RED

15 DIMENSIONS OF DIFFERENTIAL CLOGGING INDICATORS

ELECTRICAL INDICATOR

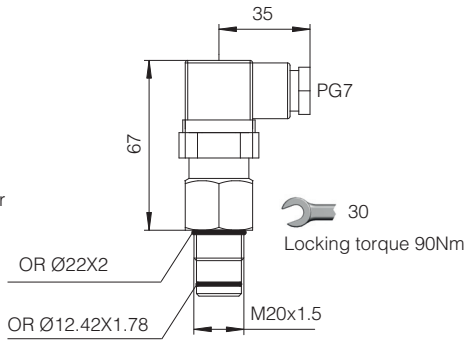
CID-E05-L
CID-E08-L

Electric connector
DIN 43650
Transparent
with internal Led

CID-E05-M
CID-E08-M
CID-E05-M/UL
CID-E08-M/UL

Electric connector
DIN 43650
Black colour

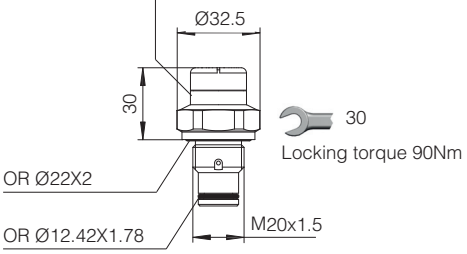
Led signal:
Green = clean filter element
Red = clogged filter element
(filter elements to be replaced)



VISUAL INDICATOR

CID-V05
CID-V08

Visual signal:
Green = clean filter element
Red = clogged filter element
(filter elements to be replaced)



Note: the electrical connector can be oriented at steps of 90°

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.

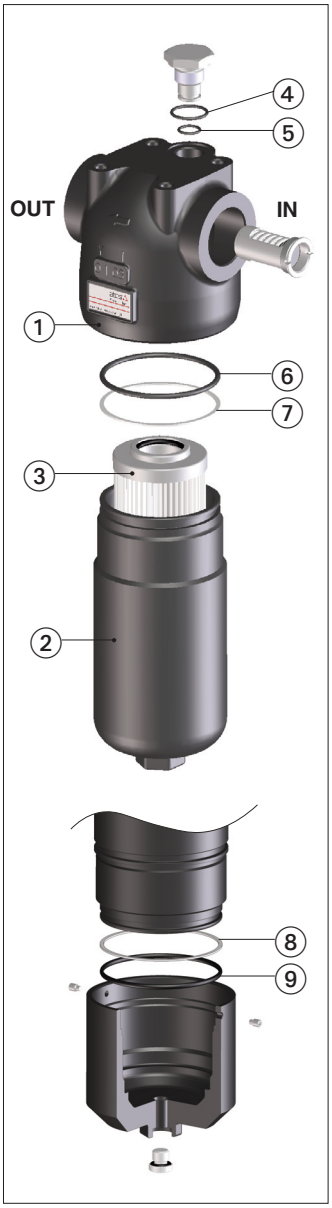
For filters ordered with clogging indicator:
- remove the plastic plug from the indicator port on the filter head
- install the clogging indicator and lock it at the specified torque

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

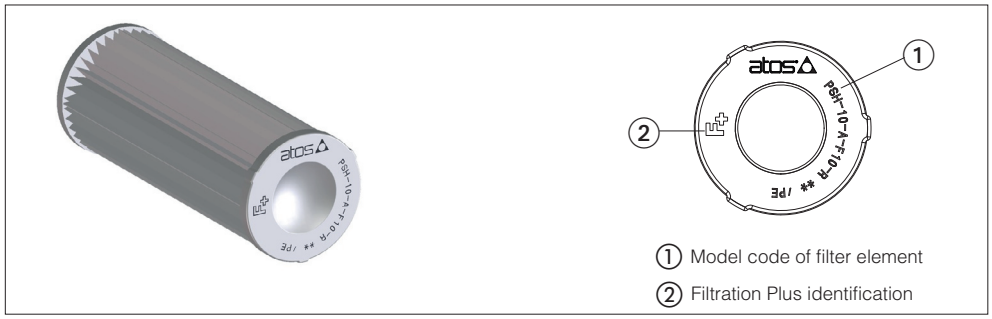
Filter type	Seal kit code (NBR)	Seal kit code (FKM)	Seal kit composition
FPS-10	GUARN FPS-10	GUARN FPS-10 /PE	④+⑤+⑥+⑦
FPS-20	GUARN FPS-20	GUARN FPS-20 /PE	④+⑤+⑥+⑦
FPS-30	GUARN FPS-30	GUARN FPS-30 /PE	④+⑤+⑥+⑦+⑧+⑨ **(1)**

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

18 FILTER IDENTIFICATION NAMEPLATE

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

18.1 IDENTIFICATION OF FILTER ELEMENT



① Model code of filter element
② Filtration Plus identification

19 RELATED DOCUMENTATION

LF010	Fluid contamination
LF020	Filtration guidelines