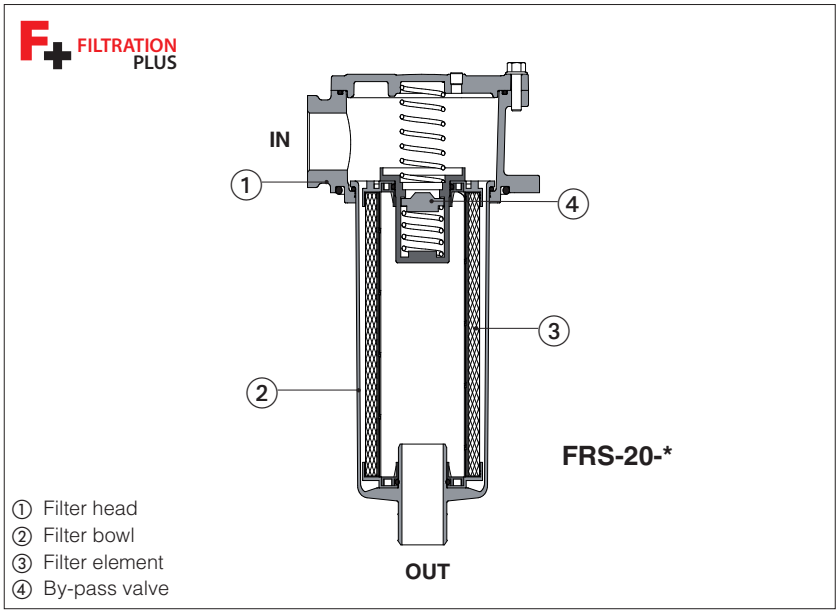
Return line filters, tank-top type FRS

Threaded ports



FRS

Return filters are designed to ensure cleanliness of fluid back to the tank from contamination collected downstream of the hydraulic circuit.

They are specific for installation on the top of the hydraulic tank.

- four head sizes
- ports size: G1/2" to G2"
  SAE-12 to SAE-32
- by-pass valve with cracking pressure 3 bar
- **Filtration Plus** microfiber filter elements ensure low pressure drop, high DHC and long lasting performance,
- filtration rating 7 - 12 - 27 µm(c) (βx (c) >1000, ISO 16889)
- cellulose filter elements with filtration rating 10 or 25 µm (βx (c) >2, ISO 16889)
- without or with electrical or visual clogging indicators

Max flow **750 l/min**

Max working pressure **8 bar**

1 MODEL CODE OF COMPLETE FILTERS

FRS	-	10	-	A	-	F10	-	00	-	R	-	W	**	/	*

FRS: Return line filter

Filter size (ports size):
10 = G1/2" ÷ G3/4" or SAE-12
20 = G1/2" ÷ G1¼" or SAE-16
30 = G1" ÷ G1½" or SAE-24
40 = G1¼" ÷ G2" or SAE-32

Filter length:		Max flow [l/min] **(1)** FRS-10	FRS-20	FRS-30	FRS-40
A	=	50	75	290	370
B	=	80	125	310	600
C	=	-	200	-	650
D	=	-	260	-	430 **(2)**
E	=	-	-	-	750

SN = only body, without filter element

F_+ microfibre filter element, βx(c) >1000 - ISO 16889:
F06 = 7 µm (c)
F10 = 12 µm (c)
F25 = 27 µm (c)

Cellulose filter element, βx (c) >2 - ISO 16889:
C10 = 10 µm (c)
C25 = 25 µm (c)

Series number: **-** = NBR, **PE** = FKM

Seals material:

Clogging indicator see sect. 12 **(4)**:
W = without, indicator port plugged with steel plug
E = electrical indicator **(5)**
V = visual indicator

By-pass:
R = by-pass valve with cracking pressure 3 bar

Ports size:

BSPP threaded:

FRS-10	FRS-20	FRS-30	FRS-40
00 = G 1/2"	**00** = G 1/2"	**02** = G 1"	**03** = G 1 1/4"
01 = G 3/4"	**01** = G 3/4"	**03** = G 1 1/4"	**04** = G 1 1/2"
	02 = G 1"	**04** = G 1 1/2"	**05** = G 2"
	03 = G 1 1/4"		

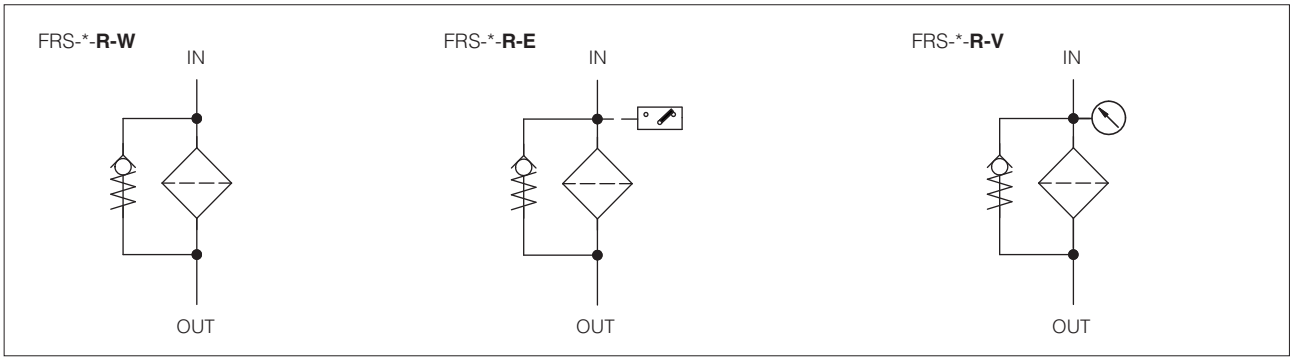
SAE J1926-1 threaded **(3)**:

FRS-10	FRS-20	FRS-30	FRS-40
41 = SAE-12	**42** = SAE-16	**44** = SAE-24	**45** = SAE-32

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

(1) Max flow rates are measured with: Δp 0,5 bar, filter element F25, largest port size, oil viscosity 32 mm²/s - see also section 6
In case of different conditions see section 9 for filter sizing
(2) Filters type FRS-40-D has the same length to FRS-40-B but it uses filter elements with smaller internal diameter
(3) Filters with SAE threaded ports are available on request
(4) The clogging indicator is supplied disassembled from the filter. The indicator port on filter head is factory plugged with steel plug
(5) Clogging indicator CIA-E/UL with cURus certification is 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)

PRS	-	10	-	A	-	F10	**	/	*

Spare filter element for return line filter type FRS

Filter element size:
10 = for FRS-10
20 = for FRS-20
30 = for FRS-30
40 = for FRS-40

Filter element length:

for FRS-10	for FRS-20	for FRS-30	for FRS-40
A	**A**	**A**	**A**
B	**B**	**B**	**B**
	C		**C**
	D		**D**
			E

Microfibre filter element, βx(c) >1000 - ISO 16889:
F06 = 7 µm (c)
F10 = 12 µm (c)
F25 = 27 µm (c)

Cellulose filter element, βx (c) >2 - ISO 16889:
C10 = 10 µm
C25 = 25 µm

Series number

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

(1) Select the filter element according to the model code reported on the filter nameplate, see section 17
(2) Filters with FKM seals are available on request
note: the spare filter element includes the by-pass valve

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

CIA	-	V	**

Clogging indicator for return line filter type FRS

Type of indicator:
E = Electrical - pressure switch, switching pressure 2 bar
E/UL = As type E, certified according to North American Standard cURus (available on request)
V = Visual - pressure gauge, range 0 ÷ 10 bar **(1)**

Series number

(1) Visual clogging indicator with rear side connection **CIA-V/P** 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	Aluminium alloy
	Filter bowl	Nylon PA6 reinforced
Fatigue strength		min. 1 x 10^6 cycles at 0 ÷ 8 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

FRS-10, FRS-20

Filter size		10				20															
Port size code		00		01, 41		00				01				02, 42				03			
Ports dimension		G1/2"		G3/4" SAE12		G1/2"				G3/4"				G1", SAE16				G1 1/4"			
Filter length		A	B	A	B	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Max flow (l/min) at Δp 0,5 bar **-see note-**	F06	14	36	15	38	32	50	66	82	35	57	79	100	35	58	93	133	36	62	93	135
	F10	30	54	31	58	48	65	83	100	52	77	103	125	53	78	138	195	56	90	140	200
	F25	48	73	50	80	58	79	96	110	67	97	123	141	67	100	189	240	75	125	200	260
	C10	70	87	76	97	75	88	102	110	90	111	132	146	92	115	216	263	113	160	225	277
	C25	75	94	92	105	90	105	114	120	115	138	152	163	118	144	288	300	168	243	305	300
Max operating pressure		8 bar																			
Direction of filtration		See the arrow on the filter head																			

FRS-30, FRS-40

Filter size		30						40													
Port size code		02		03		04		03					04					05, 45			
Ports dimension		G1"		G1 1/4"		G1 1/2" SAE24		G1 1/4"					G1 1/2"					G2", SAE32			
Filter length		A	B	A	B	A	B	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
Max flow (l/min) at Δp 0,5 bar **-see note-**	F06	180	190	175	185	180	190	203	286	310	233	430	208	300	330	240	460	210	310	338	245	500
	F10	250	260	250	270	270	280	314	429	492	353	540	329	478	565	374	607	340	500	594	387	640
	F25	265	275	280	293	290	310	340	495	525	386	590	358	570	611	412	708	370	600	650	430	750
	C10	280	290	311	315	326	330	365	515	546	401	606	387	597	642	430	732	400	630	679	446	780
	C25	330	355	380	390	400	409	473	594	640	495	648	513	714	782	540	790	536	750	800	564	800
Max operating pressure		8 bar																			
Direction of filtration		See the arrow on the filter head																			

Note: Max flow rates are measured with Δp= 0,5 bar and viscosity 32mm²/s. In case of different conditions see section 11
For a correct sizing of the filter, it is suggested not to exceed **750 l/min** to limit the maximum speed of the fluid in connecting pipes

7 FILTER ELEMENTS

Material		Inorganic microfibre FILTRATION PLUS	Cellulose
Filtration rating as per ISO16889	F06	$\beta_{06\mu m\,(c)} \geq 1000$	-
	F10	$\beta_{12\mu m\,(c)} \geq 1000$	-
	F25	$\beta_{27\mu m\,(c)} \geq 1000$	-
	C10	-	$\beta_{10\mu m\,(c)} \geq 2$
	C25	-	$\beta_{25\mu m\,(c)} \geq 2$

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

Seals, recommended fluid temperature	NBR seals (standard) = -25°C ÷ +100°C FKM seals (/PE option) = -25°C ÷ +100°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 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 filter bowl Δp plus the filter element Δp:

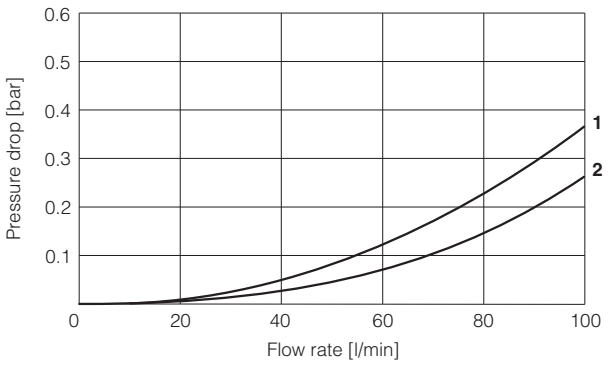
Total Δp = filter head Δp + filter bowl Δp + filter element Δp

In the best conditions the total Δp should not exceed 0,5 bar
See below sections to calculate the Δp of filter head and Δp of the filter element

9.1 Q/Δp DIAGRAMS OF FILTER HEAD + FILTER BOWL

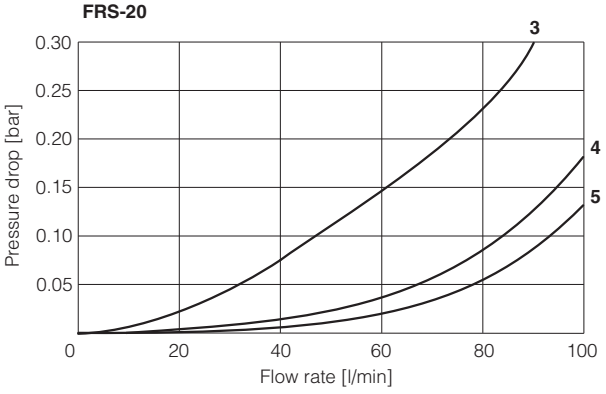
The pressure drop mainly depends on the ports size and fluid density
In the following diagrams are reported the Δp characteristics based on mineral oil with density 0,86 kg/dm³ and viscosity 32 mm²/s

FRS-10



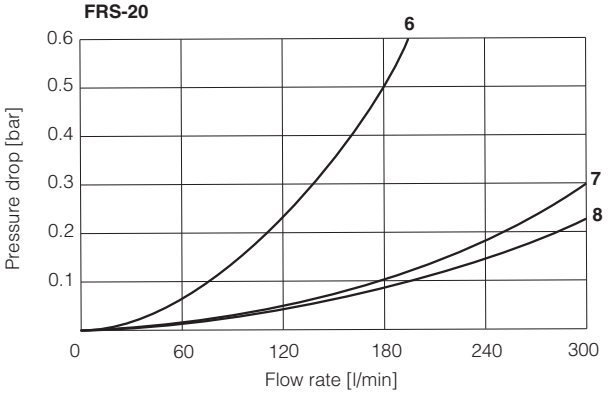
1 = FRS-10-*-00 (G 1/2")
2 = FRS-10-*-01 (G 3/4")
FRS-10-*-41 (SAE-12)

FRS-20



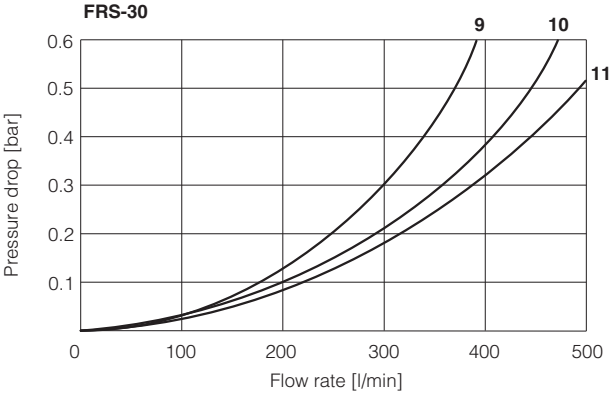
3 = FRS-20-*-00 (G 1/2")
4 = FRS-20-A-01 (G 3/4")
FRS-20-B-01 (G 3/4")
5 = FRS-20-A-02 (G 1")
FRS-20-B-02 (G 1")
FRS-20-A-42 (SAE-16)
FRS-20-B-42 (SAE-16)

FRS-20



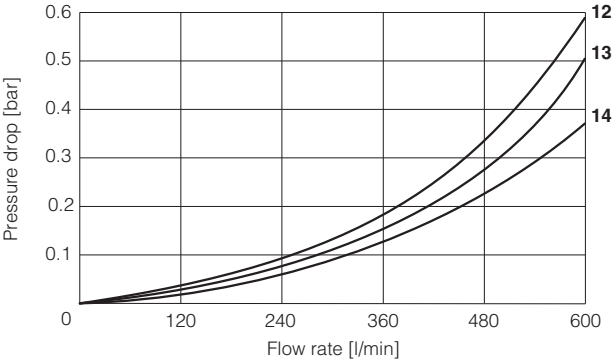
6 = FRS-20-C-01 (G 3/4")
FRS-20-D-01 (G 3/4")
8 = FRS-20-*-03 (G 1 1/4")
7 = FRS-20-C-02 (G 1")
FRS-20-D-02 (G 1")
FRS-20-C-42 (SAE-16)
FRS-20-D-42 (SAE-16)

FRS-30



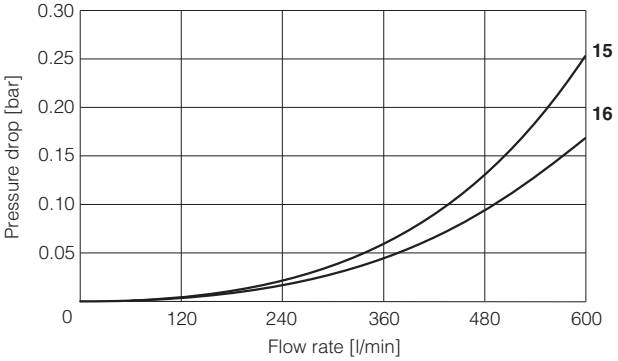
9 = FRS-30-*-02 (G 1")
10 = FRS-30-*-03 (G 1 1/4")
11 = FRS-30-*-04 (G 1 1/2")
FRS-30-*-44 (SAE-24)

FRS-40



12 = FRS-40-A-03 (G 1 1/4")
FRS-40-D-03 (G 1 1/4")
13 = FRS-40-A-04 (G 1 1/2")
FRS-40-D-04 (G 1 1/2")
14 = FRS-40-A-05 (G 2")
FRS-40-D-45 (G 2")
FRS-40-A-45 (SAE-32)
FRS-40-D-45 (SAE-32)

FRS-40



15 = FRS-40-B-04 (G 1 1/2")
FRS-40-C-04 (G 1 1/2")
FRS-40-E-04 (G 1 1/2")
16 = FRS-40-B-05 (G 2")
FRS-40-C-05 (G 2")
FRS-40-E-05 (G 2")
FRS-40-B-45 (SAE-32)
FRS-40-C-45 (SAE-32)
FRS-40-E-45 (SAE-32)

9.2 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 FRS filter elements

Filter element size	10		20				30		40				
Filter element length	A	B	A	B	C	D	A	B	A	B	C	D	E
Filtration rating	**Gc** Gradient coefficient												
F06	33.84	12.28	13.85	7.80	5.09	3.34	2.43	2.25	2.40	1.49	1.32	1.80	0.80
F10	15.68	7.32	8.65	5.27	3.19	1.94	1.31	1.21	1.11	0.74	0.52	0.88	0.43
F25	8.81	4.28	6.32	3.60	2.06	1.26	1.10	1.00	0.96	0.51	0.42	0.71	0.24
C10	4.83	2.74	4.09	2.70	1.64	1.06	0.85	0.83	0.82	0.45	0.36	0.64	0.20
C25	4.13	2.06	2.52	1.41	0.82	0.42	0.39	0.35	0.34	0.23	0.12	0.26	0.10

Examples:

1) calculation of Total Δp for filter type FRS-20-B-F10-02-R at Q = 50 l/min and viscosity 46 mm²/s (filter element PRS-20-B-F10)
   Δp of filter head + filter bowl = 0,03 bar
   Gc = 5,27 mbar/(l/min)

Filter element Δp = $50 \times \frac{5{,}27}{1000} \times \frac{46}{32} = 0{,}379$ bar

Total Δp = 0,03 + 0,379 = **0,40 bar**

2) calculation of Total Δp of filter type FRS-40-C-F25-05-R at Q = 500 l/min and viscosity 46 mm²/s (filter element PRS-40-C-F25)
   Δp of filter head + filter bowl = 0,13 bar
   Gc = 0,42 mbar/(l/min)

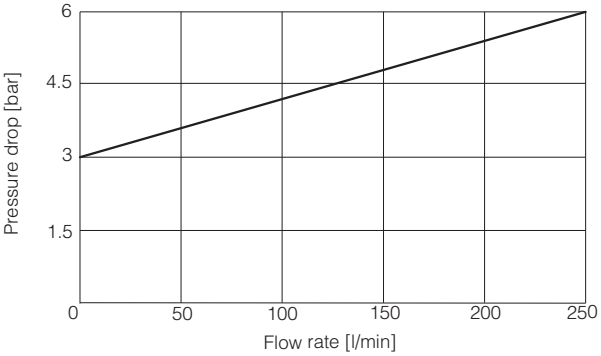
Filter element Δp = $500 \times \frac{0{,}42}{1000} \times \frac{46}{32} = 0{,}302$ bar

Total Δp = 0,13 + 0,302 = **0,43 bar**

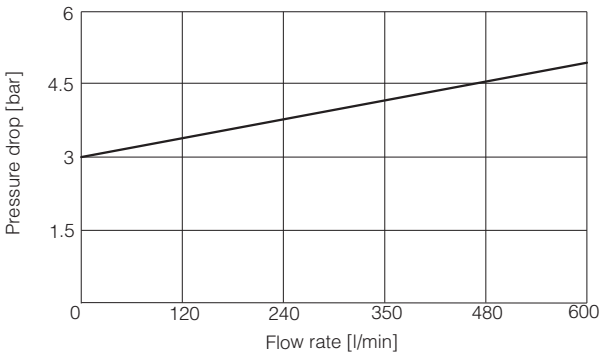
10 **BY -PASS VALVE** - based on mineral oil ISO VG46 at 50°C (viscosity = 32 mm²/s)

Q/Δp diagrams of flow trough the by pass valve

FRS-10
FRS-20

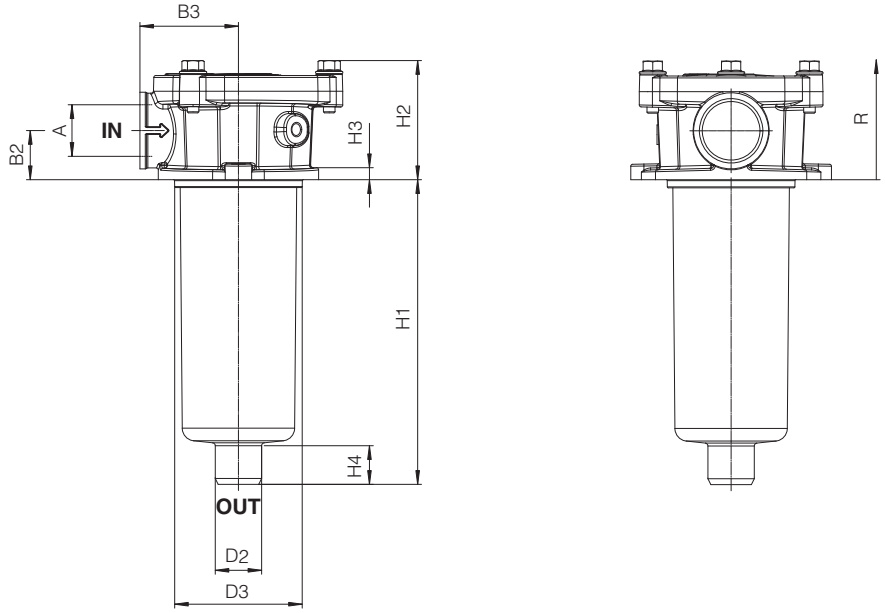


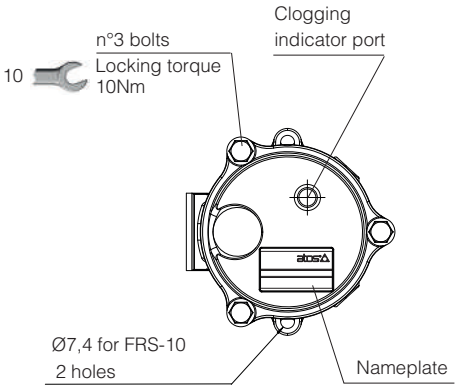
FRS-30
FRS-40

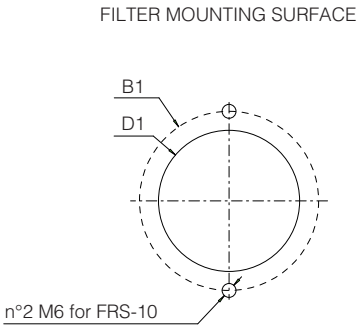


11 INSTALLATION DIMENSIONS OF FRS FILTERS [mm]

FRS-10



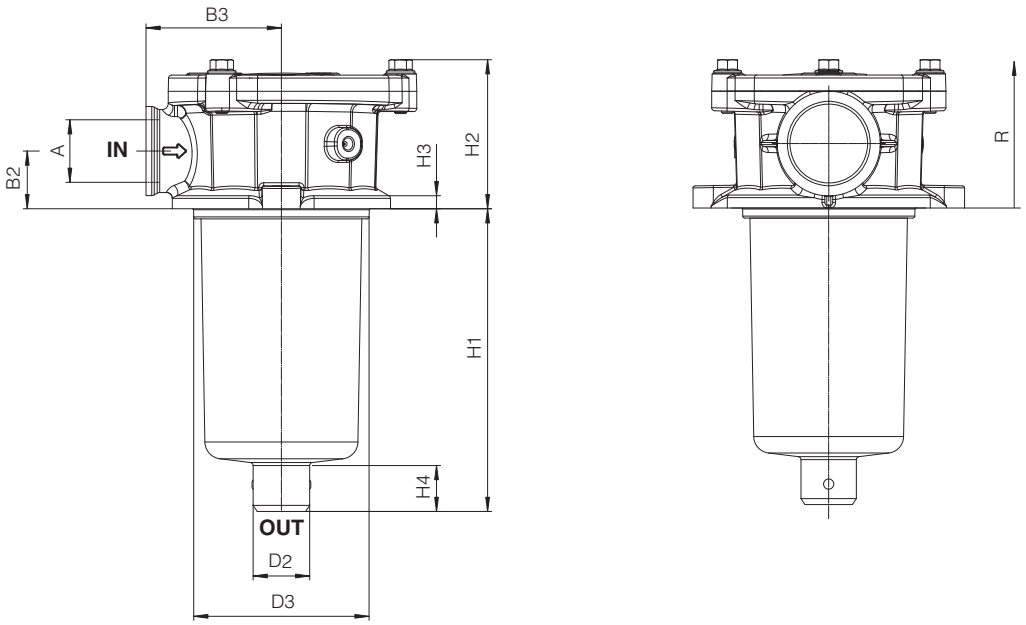


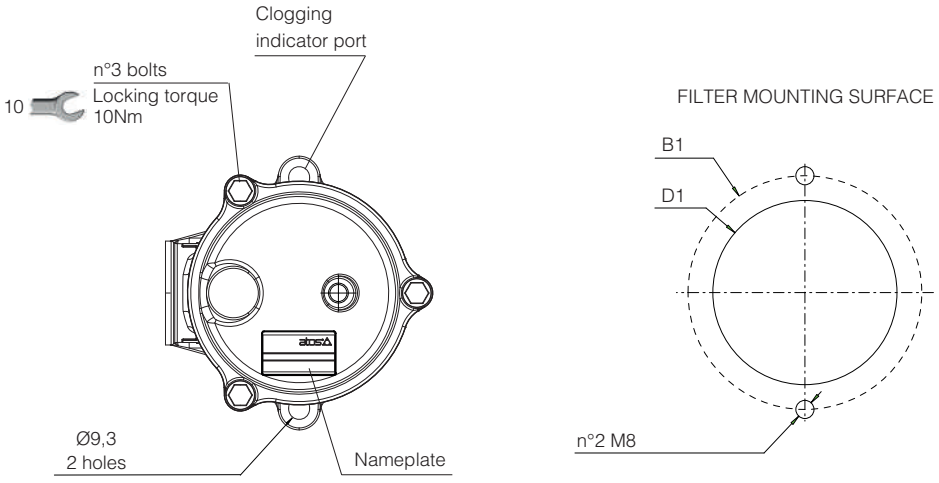


Code	A	B1	B2	B3	D1	D2	D3	H1	H2	H3	H4	R (element removal)	Mass (Kg)
FRS-10-A	1/2" BSPP 3/4" BSPP SAE-12	89	25	51	67,5	24	67	85	60	8	22	150	0,45
FRS-10-B								158				220	0,60

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

FRS-20

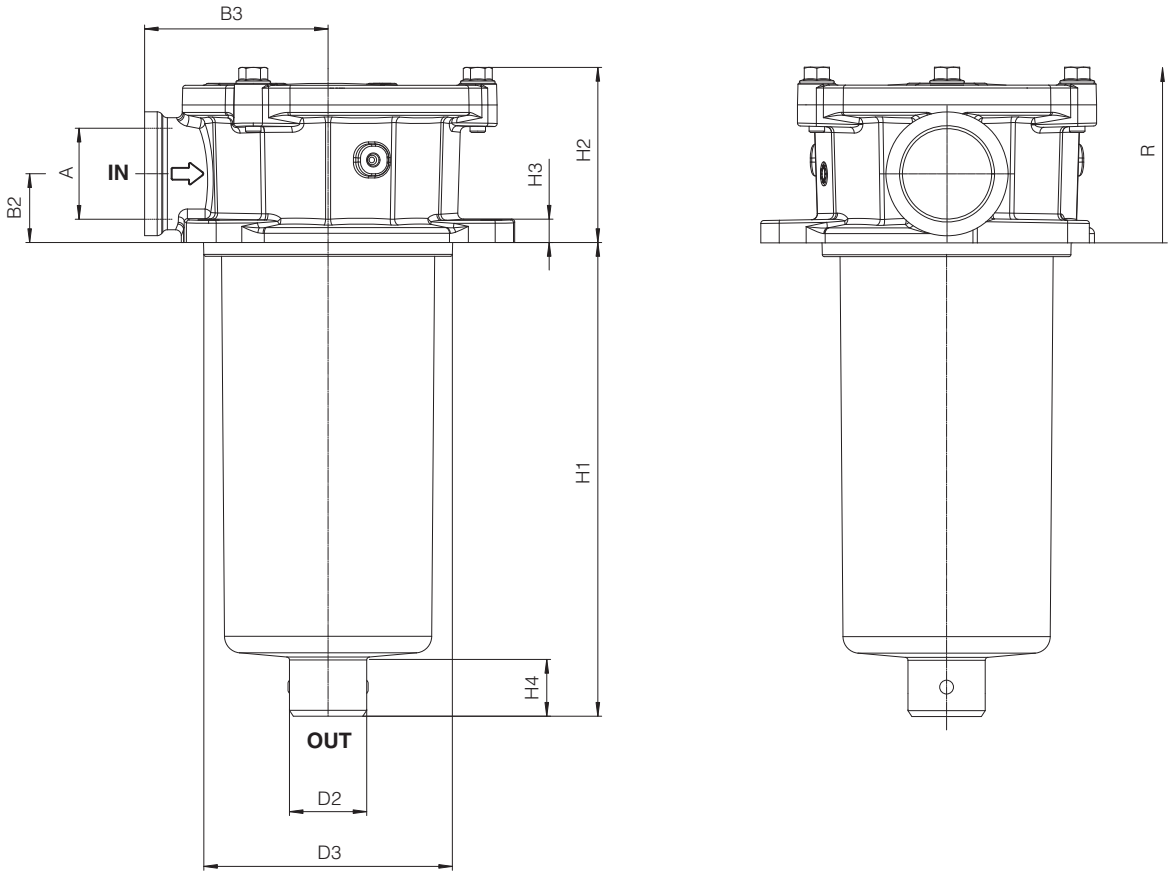


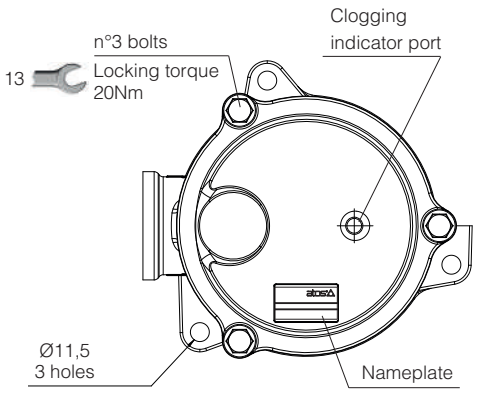


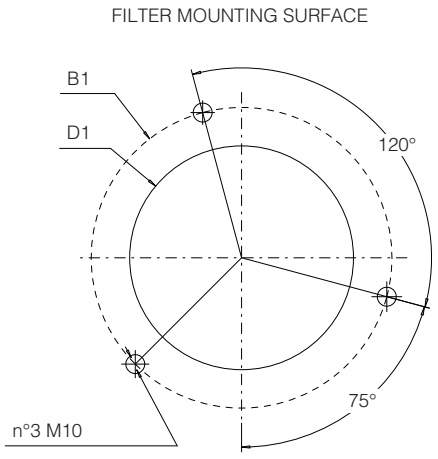
Code	A	B1	B2	B3	D1	D2	D3	H1	H2	H3	H4	R (element removal)	Mass (Kg)
FRS-20-A	1/2" BSPP 3/4" BSPP 1" BSPP 1 1/4" BSPP SAE-16 **(1)**	115	28,5 **(2)**	67	88,5	40	87	95	73	11	24	170	0,80
FRS-20-B								140				220	0,90
FRS-20-C			32 **(3)**					221				295	1,10
FRS-20-D								325				400	1,30

(1) SAE-16 thread size 1" 5/16-12-UN-2B
(2) For port size 1/2", 3/4", 1" and SAE-16
(3) For port size 1 1/4"

FRS-30



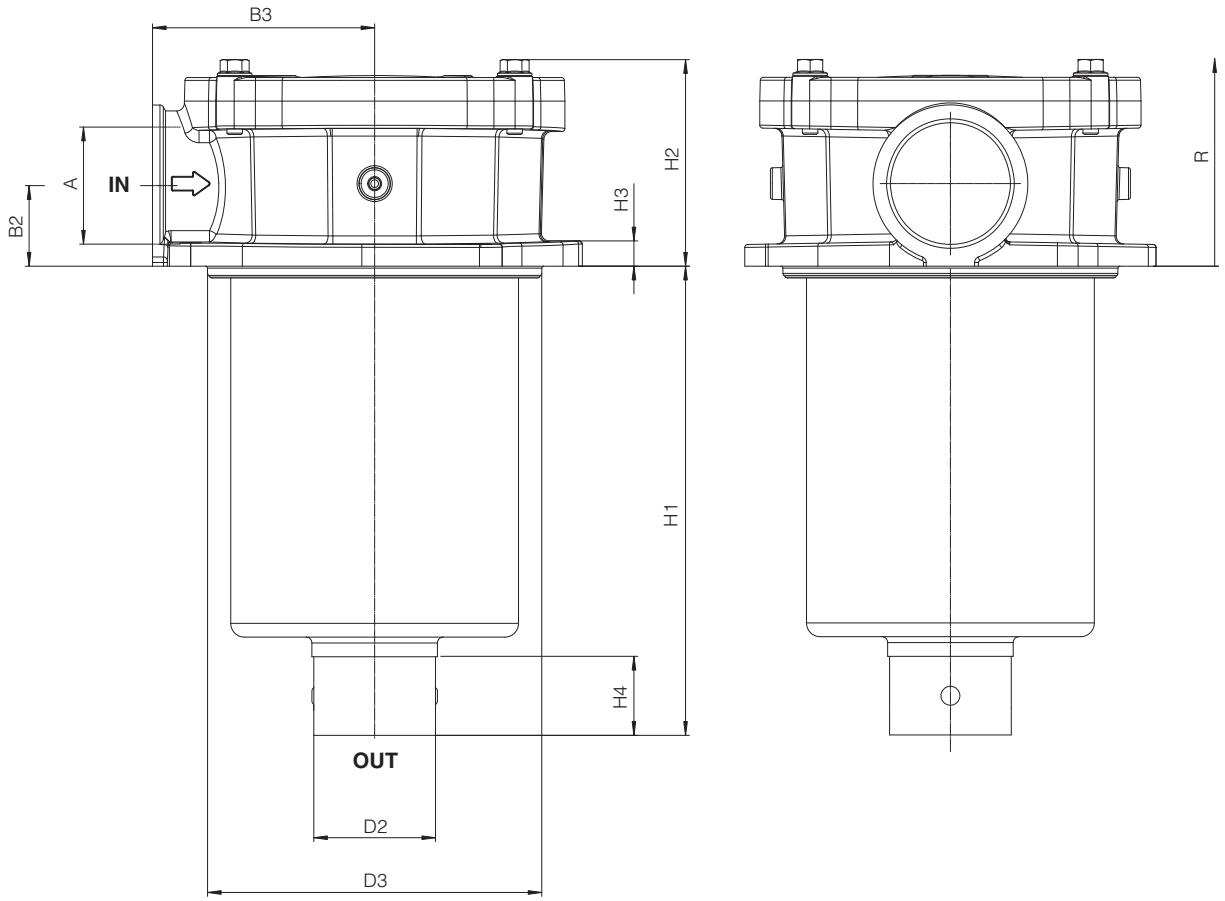


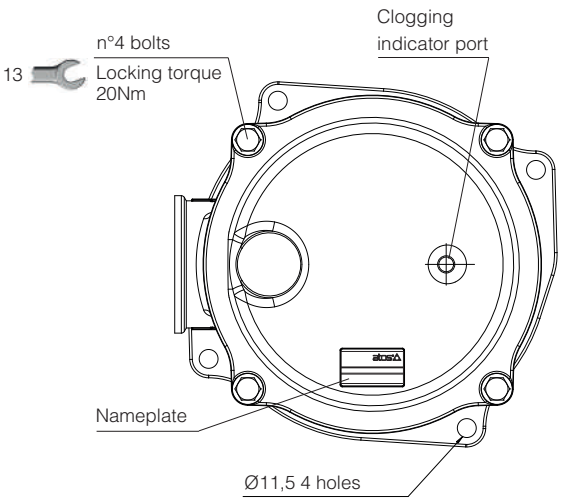


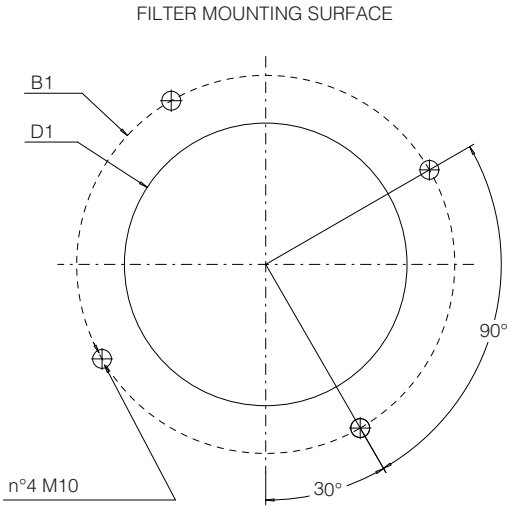
Code	A	B1	B2	B3	D1	D2	D3	H1	H2	H3	H4	R (element removal)	Mass (Kg)
FRS-30-A	1" BSPP 1 1/4" BSPP 1 1/2" BSPP SAE-24 **(1)**	175	35	95	130	40	129	226	90	11	30	320	2,10
FRS-30-B								256				360	2,40

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

FRS-40







Code	A	B1	B2	B3	D1	D2	D3	H1	H2	H3	H4	R (element removal)	Mass (Kg)
FRS-40-A	1 1/4" BSPP 1 1/2" BSPP 2" BSPP SAE-32 **(2)**	220	42	115	175	65	174	170	105	11	37	270	3,20
FRS-40-B								223				330	3,60
FRS-40-C								273				380	4,20
FRS-40-D **(1)**								223				330	3,60
FRS-40-E								423				530	4,00

(1) Filter type FRS-40-D has the same length of FRS-40-B but it uses filter elements with smaller internal diameter

(2) SAE-32 thread size 2" 1/2-12-UN-2B

12 ACCESSORIES - to be ordered separately

Following accessories can be assembled on return filters type FRS-20, FRS-30 and FRS-40 (not available for FRS-10) to avoid the foam or air/oil emulsion inside the tank caused by the return flow.

The discharge ending pipes **DSC-END-*** are used to extend the outlet port of the FRS filters below the oil level in the tank.
They are available with length 250 (200 mm for FRS-40) and 500 mm

The diffusers **DIFF-FRS** are used in case of high flow rates to evenly distribute the return flow inside the tank.
They can be mounted directly on the filter bowl or using the connecting pipes **CONN-END-***, available with lengths of 250 (200 for FRS-40) and 500 mm.

MODEL CODE OF DISCHARGE ENDING PIPES (1)

DSC-END	-	250	FRS-20/30
Discharge ending pipe		**Pipe length** for **FRS-20** and **FRS-30**: 250 = 250 mm 500 = 500 mm **Pipe length** for **FRS-40**: 200 = 200 mm 500 = 500 mm	**Filter type**: FRS-20/30 = for FRS-20 and FRS-30 FRS-40 = for FRS-40

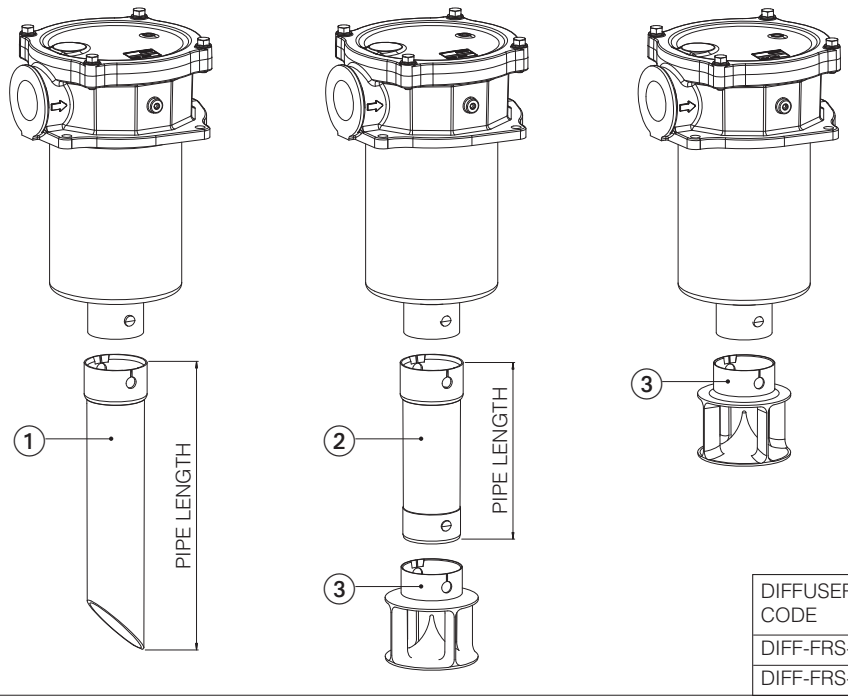
MODEL CODE OF CONNECTING ENDING PIPES (2)

CONN-END	-	250	FRS-20/30
Connecting ending pipe		**Pipe length** for **FRS-20** and **FRS-30**: 250 = 250 mm **Pipe length** for **FRS-40**: 200 = 200 mm (for FRS-40) 500 = 500 mm (for FRS-40)	**Filter type**: FRS-20/30 = for FRS-20 and FRS-30 FRS-40 = for FRS-40

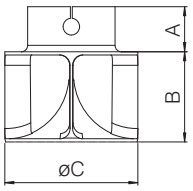
MODEL CODE OF DIFFUSERS (3)

DIFF	-	FRS-20/30
Diffuser		**Filter type**: FRS-20/30 = for FRS-20 and FRS-30 FRS-40 = for FRS-40

DISCHARGE ENDING PIPE **CONNECTING ENDING PIPE** **DIFFUSER**

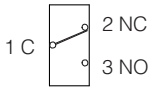


DIFFUSER DIMENSIONS

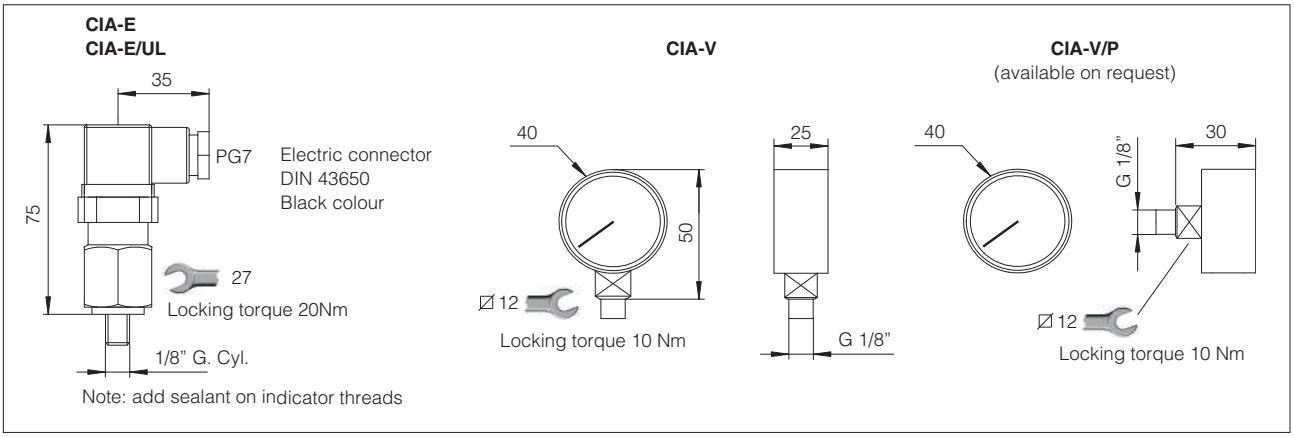


DIFFUSER CODE	DIMENSIONS		
	A	B	C
DIFF-FRS-20, DIFF-FRS-30	30	45	75
DIFF-FRS-40	35	70	105

13 CHARACTERISTICS OF CLOGGING INDICATORS

Model code	CIA-E electrical		CIA-V visual
Switching pressure	2 bar		green sector = 0 ÷ 3 bar red sector = 3 ÷ 10 bar
Switching tolerance at 20°C	± 10% of switching pressure		-
Electric connection	Electric plug connection as per DIN 43650 with cable gland type PG7		-
Power supply	14 V_{DC} ÷ 30 V_{DC}	125 V_{AC} ÷ 250 V_{AC}	
Max current - resistive (inductive)	4 A (3 A) ÷ 3 A (2 A)	5 A (3 A) ÷ 3 A (2 A)	
Fluid temperature	-25°C ÷ +100°C		-25°C ÷ +100°C
Protection degree according to DIN 40050	IP65 with mating connector		-
Hydraulic connection	G1/8" BSP		G1/8" BSP
Duty factor	100%		100%
Mass (Kg)	0,16		0,04
Electric scheme / Hydraulic symbol	 The electric scheme shows the switch position in case of clean filter element		

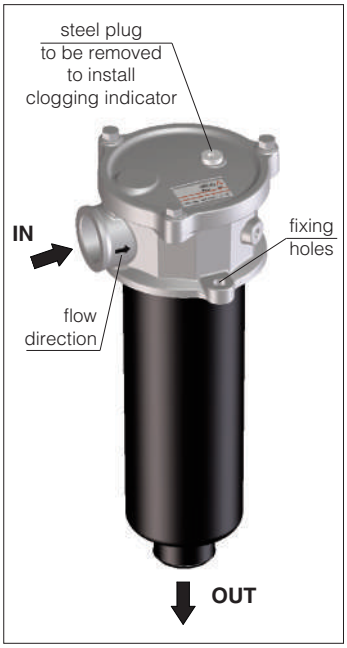
14 DIMENSIONS OF CLOGGING INDICATORS



15 INSTALLATION AND COMMISSIONING

Verify that the tank flange with the filter mounting surface is clean and free of scratches.
Install the filter on the tank cover using the fixing holes on the filter head.
Connect the IN port of the filter to the system return pipe.
The OUT port of the filter must end under the oil level to avoid foam or air/oil emulsion inside the tank.
At this purpose specific accessories as connecting pipes, discharge ending pipes ad flow diffusers can be fit on the filter OUT port see section 12
Make sure that there is enough space above the filter, for the replacement of the filter element, see dimension "R" at section 11
Never run the system without the filter element.

For filters ordered with clogging indicator, code E or V:
• remove the steel 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.

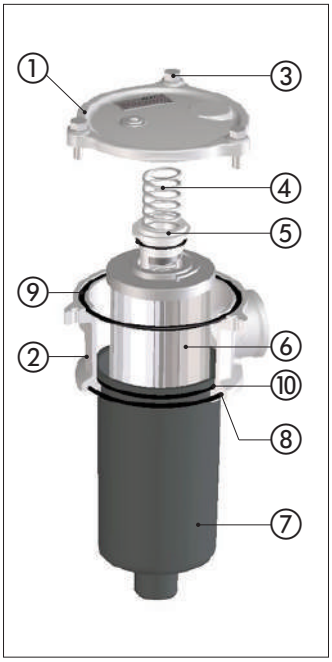


16 MAINTENANCE

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 17

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

- switch-off the system and make sure that there is no residual pressure in the filter line (i.e. pressurized tank); the filter has no pressure bleeding device
- pay attention to the fluid and filter surface temperature. Always use suitable gloves an protection glasses
- remove the cover ① from the filter head ② by releasing the bolts ③
- remove the spring ④ and the bowl ⑦
- remove the dirty filter element ⑥ pulling it upward carefully
- clean the bowl ⑦
- install the bowl ⑦ after having checked the good condition of the seal ⑧
- insert the new filter element over the spigot in the filter bowl; the filter element includes the by-pass valve ⑤
- install the spring ④
- mount the cover and lock the relevant bolts ③ after having checked the good condition of the seal ⑨



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
FRS-10	GUARN FRS-10	GUARN FRS-10 /PE	⑧+⑨+⑩
FRS-20	GUARN FRS-20	GUARN FRS-20 /PE	⑧+⑨+⑩
FRS-30	GUARN FRS-30	GUARN FRS-30 /PE	⑧+⑨+⑩
FRS-40	GUARN FRS-40	GUARN FRS-40 /PE	⑧+⑨+⑩

16.2 SPARE SPRING ④

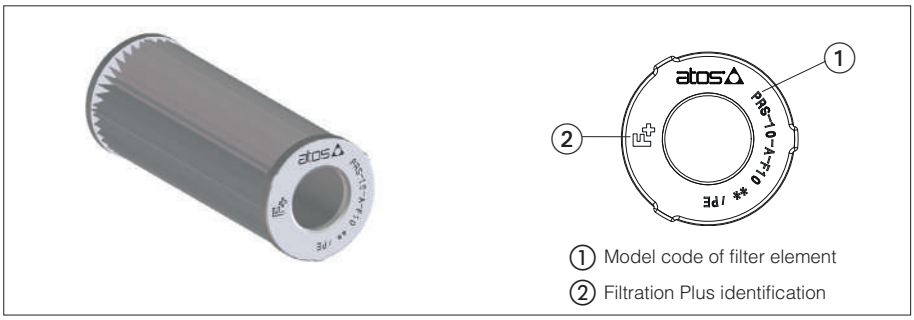
Filter type	Seal kit code
FRS-10	MO-1246
FRS-20	MO-1247
FRS-30	MO-1248
FRS-40	MO-1249

17 FILTER IDENTIFICATION NAMEPLATE



① Model code of complete filter
② Model code of filter element
③ Filter matrix code

17.1 IDENTIFICATION OF FILTER ELEMENT



① Model code of filter element
② Filtration Plus identification

18 RELATED DOCUMENTATION

LF010	Fluid contamination
LF020	Filtration guidelines