



**PRESSURE
REGULATORS
FL SERIES**

**FL • MFL • BFL
FL-BP • MFL-BP • BFL-BP**



Pressure regulators

FL-MFL-BFL

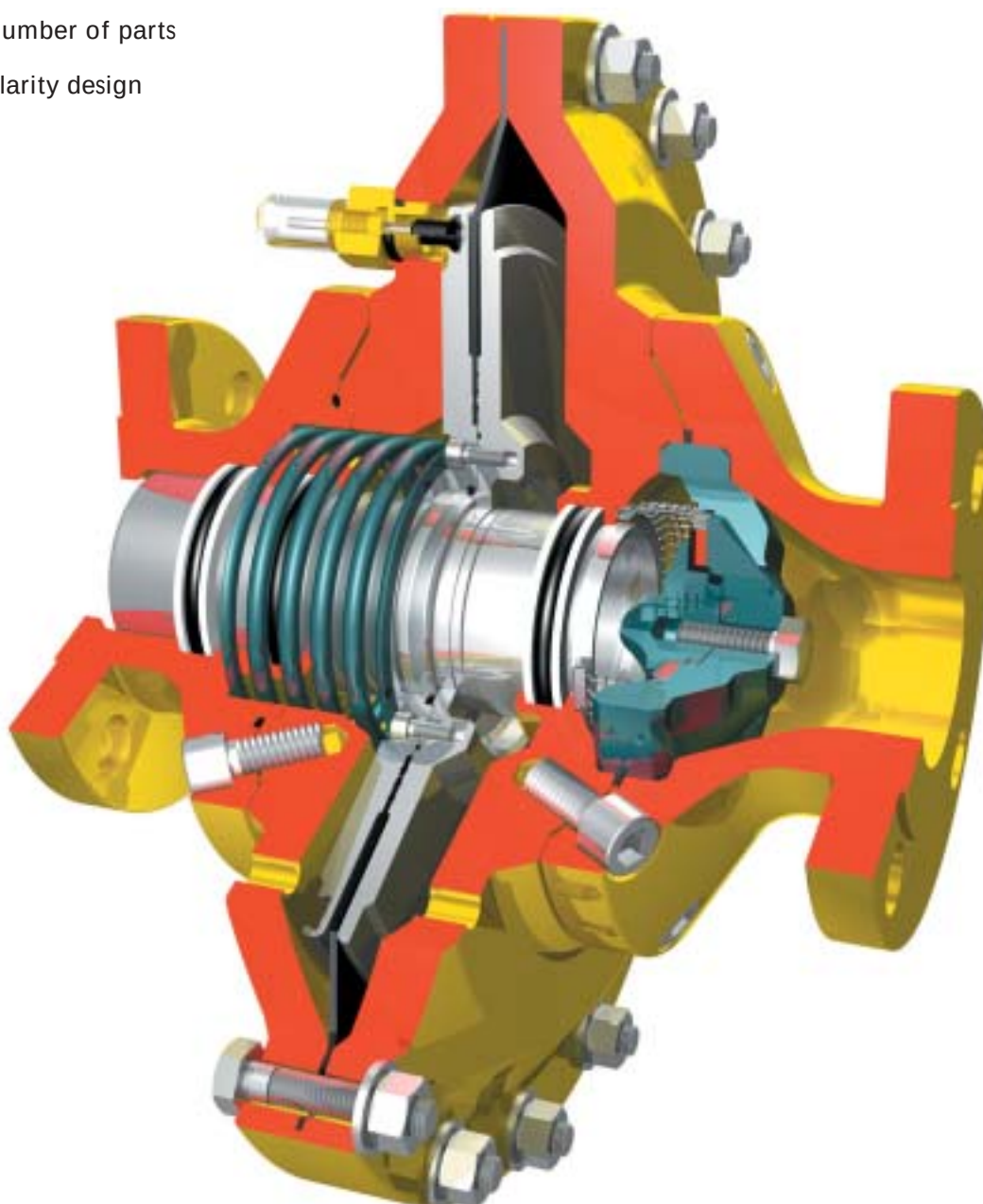


This series of axial flow appliances was designed to meet a wide range of applications.

Large appreciation from worldwide customers is guarantee of reliability and versatility of the product.

Main features of the product are as follow:

- Greater flow rates than “top entry” regulators
- Counterbalanced shutter
- Full strength diaphragm
- Low number of parts
- Modularity design





Configurations



FL Regulator



MFL Regulator + Monitor



BFL Regulator + Shut-off

Configurations	ID-ABBREVIATIONS					
	Low pressure PN 16/25 - ANSI 150			High pressure ANSI 300/600		
	Standard	Silenced		Standard	Silenced	
		SR	SRS		SR	SRS
Regulator	FL-BP	FL-BP-SR	FL-BP-SRS	FL	FL-SR	FL-SRS
Regulator + Monitor	MFL-BP	MFL-BP-SR	MFL-BP-SRS	MFL	MFL-SR	MFL-SRS
Regulator + Shut-off	BFL-BP	BFL-BP-SR	BFL-BP-SRS	BFL	BFL-SR	BFL-SRS

Note : SRS silenced solutions have a widened output flange.
Also available: version with widened output, but without a built-in silencer.



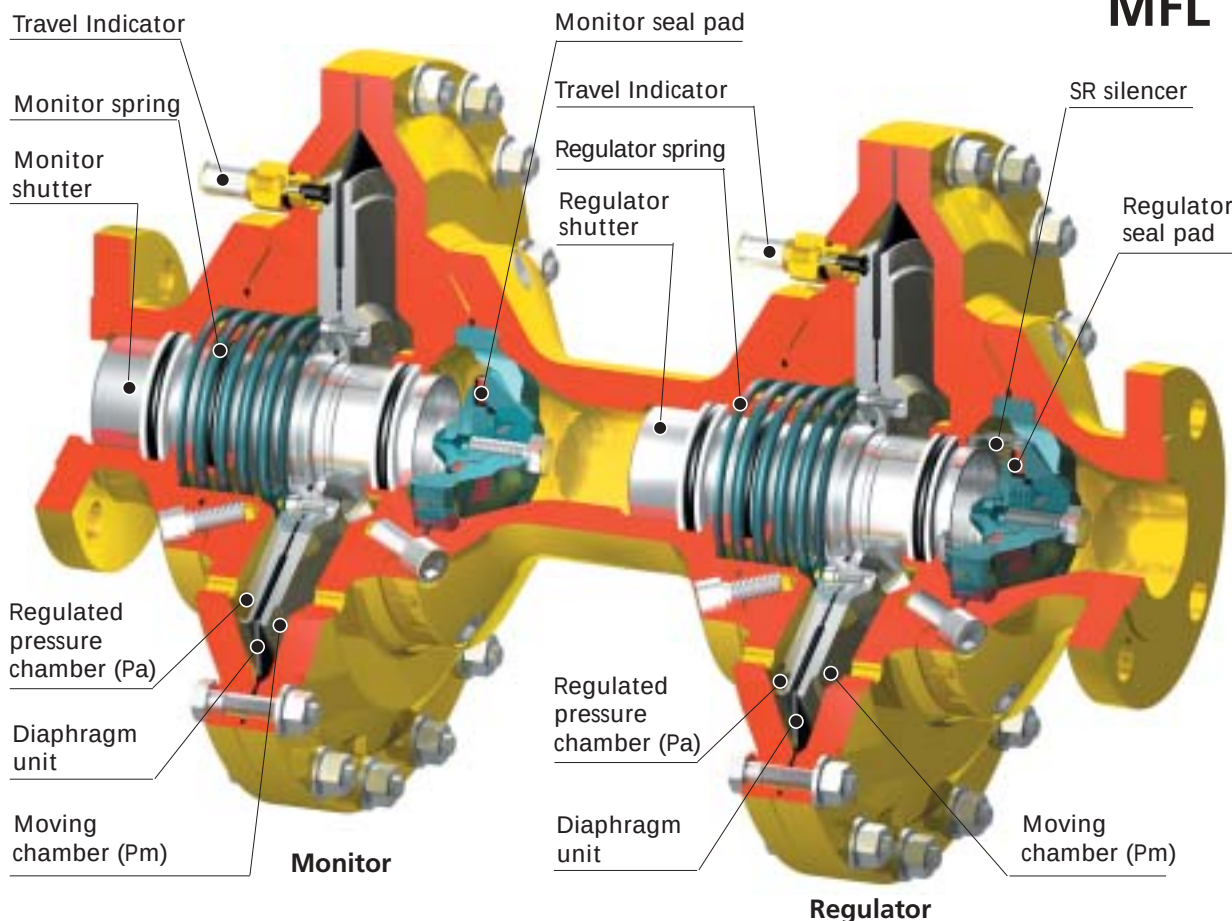
Pressure regulators

FL-MFL-BFL



Operation

MFL



HOW THE REGULATOR WORKS

The Diaphragm Unit (permanently connected to the shutter) divides the Regulator control head into two chambers.

One of the chambers is connected to regulated pressure (Pa), and the other to moving pressure (Pm) produced by the pilot according to pressure downstream. Due to lack of pressure, the regulator spring acts on the diaphragm unit and closes the shutter.

The shutter moves to its open position when the force produced by moving pressure acting on the diaphragm unit becomes greater than the force produced by downstream regulated pressure (Pa) added to the load of the regulator spring. The shutter stays idle when the two forces are equal under these conditions, downstream pressure is equal to the system's set value.

Any change in requested flow-rate produces a variation in downstream regulated pressure and the regulator controlled by the pilot opens or closes to deliver the requested flow-rate while keeping downstream pressure uniform.

HOW THE MONITOR WORKS

The Monitor or emergency regulator is used as a safety device in gas pressure reduction systems. The purpose of this device is to protect the system against possible overpressure, while keeping the reduction line in service.

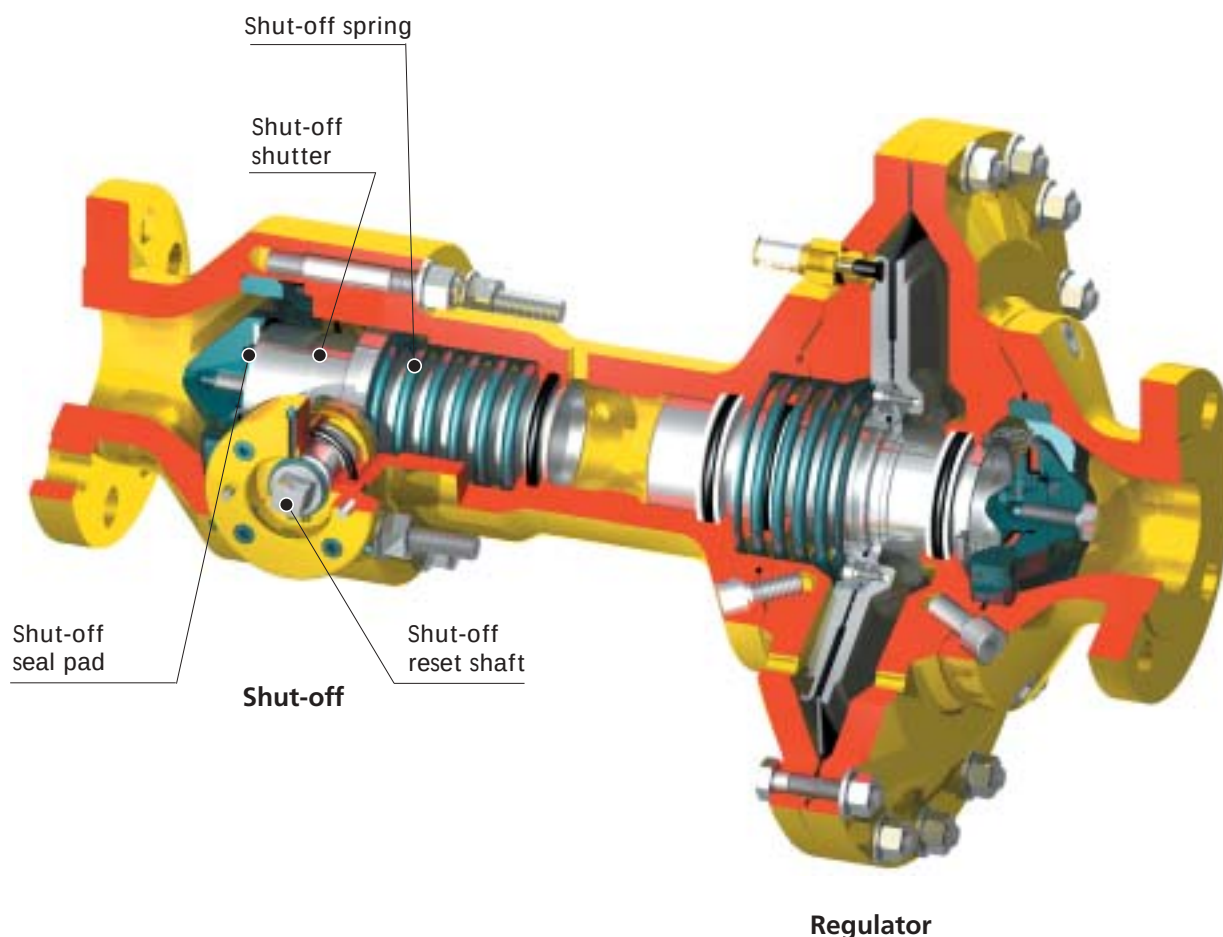
The monitor controls downstream pressure at the same point as the main regulator and is set a little higher than the latter.

Under normal duty, the monitor is fully open as it detects a pressure value lower than its set value. If, due to any regulator fault, downstream pressure increases, when it exceeds the tolerated level, the monitor comes into operation and adjusts pressure to its own set value.



Operation

BFL



HOW THE SHUT-OFF DEVICE WORKS

The shut-off device has a shutter and its own seat, and is provided with functions independent of the regulator/monitor.

The shutter can be opened by hand only, by rotating the shut-off reset shaft anti-clockwise.

To keep the shutter open, actuator-pilot series **OS/80X** or series **OS/80X-PN** is used both are designed to operate on maximum and minimum pressure, on maximum only, on minimum only.

When the system's downstream pressure is at normal operating value, the actuator-pilot remains set and prevents the shut-off reset shaft from turning by keeping the shut-off shutter open.

When downstream pressure varies beyond its set limits, the actuator-pilot releases the reset shaft and the shutter is closed by the thrust of the spring.



Features

Applications

FL series regulators are used in reduction, distribution and conveying stations of suitably filtered natural gas. They can also be used for air, propane, butane, LPG, city gas, nitrogen, carbon dioxide and hydrogen.

Technical features

Flange rating PN 16/25 - ANSI 150

Allowable pressure	PS	: up to 25 bar
Inlet pressure range	b_{pe}	: 0.2 to 25 bar
Set range	W_h	: 0.01 to 8 bar
Min.operating differential pres.	Δp_{min}	: 0.2 bar

Flange rating ANSI 300/600

Allowable pressure	PS	: up to 100 bar
Inlet pressure range	b_{pe}	: 1 to 100 bar
Set range	W_h	: 0.5 to 80 bar
Min.operating differential pres.	Δp_{min}	: 0.5 bar

Functional features

Accuracy class	AC	: up to $\pm 1\%$
Lock-up pressure class	SG	: up to + 5%
Class of lock-up pressure zone	SZ	: up to 5%

Shut-off device

Accuracy class	AG	: up to $\pm 1\%$
Response time	t_a	: ≤ 1 s

Flanged connections

Same Inlet and outlet : DN 25 - 40 - 50 - 65 - 80 - 100 - 150* - 200*
 Different Inlet and outlet : DN 25x100 - 40x150 - 50x150 - 65x200 - 80x250
 100x250 - 150x300*

Note: (*) These sizes are not available in MFL and BFL configurations
 DN 200 BP version is not available

Temperature

Standard version
 Working -10 °C +60 °C
 Ambient -20 °C +80 °C
 Low temperature version
 Working -20 °C +60 °C
 Ambient -30 °C +80 °C

Materials

Flanges and covers	• Carbon Steel
Diaphragms	• Fabric NBR+PVC/Nitrile rubber
Pads	• NBR Nitrile rubber



Calculation procedures

Symbols

Q = Natural gas flow rate in Stm^3/h

P1 = Absolute inlet pressure in bar

P2 = Absolute outlet pressure in bar

C_g = Flow rate coefficient

C1 = Body shape factor

d = Relative density of the gas

Flow coefficients

DN		FL-BP* FL*	FL-BP-SR* FL-SR*	FL-BP-SRS FL-SRS	MFL-BP* MFL*	MFL-BP-SR* MFL-SR*	MFL-BP-SRS MFL-SRS	BFL-BP* BFL*	BFL-BP-SR* BFL-SR*	BFL-BP-SRS BFL-SRS
25	Cg	550	530	470	440	430	400	430	420	370
	C1	29	29	31	30	30	32	30	30	32
40	Cg	1400	1350	1200	1130	1100	1020	1130	1110	970
	C1	28	28	30	29	29	31	29	29	31
50	Cg	2300	2200	1900	1850	1800	1600	1850	1800	1530
	C1	27	27	29	28	28	30	28	28	30
65	Cg	3500	3350	2900	2800	2700	2450	2850	2750	2360
	C1	29	29	31	30	30	32	30	30	32
80	Cg	5200	4950	4250	4100	4000	3550	4150	4050	3390
	C1	29	29	31	30	30	32	30	30	32
100	Cg	8300	8000	6600	6800	6600	5800	6900	6700	5490
	C1	27	27	29	28	28	30	28	28	30
150	Cg	17500	16800	14000	-	-	-	-	-	-
	C1	28	28	30	-	-	-	-	-	-
200	Cg	30600	-	-	-	-	-	-	-	-
	C1	30	-	-	-	-	-	-	-	-

*Values valid also for widened outlet version

Flow rate Q

Sub-critical state with $P2 > \frac{P1}{2}$

$$Q = 0,525 \cdot C_g \cdot P1 \cdot \sin \left(\frac{3417}{C1} \cdot \sqrt{\frac{P1-P2}{P1}} \right)^\circ$$

N.B. the sine argument is expressed in sexagesimal degree

Critical state with $P2 \leq \frac{P1}{2}$

$$Q = 0,525 \cdot C_g \cdot P1$$

For other gases with different densities, the flow rate calculated with the above formulas must be multiplied by the correction factor:

$$F = \sqrt{\frac{0,6}{d}}$$

Gas	Relative Density d	Factor F
Air	1	0,78
City gas	0,44	1,17
Butane	2,01	0,55
Propane	1,53	0,63
Nitrogen	0,97	0,79
Carbon dioxide	1,52	0,63
Hydrogen	0,07	2,93



Calculation procedures

DN Size Calculate the required C_g with the following formula:

Sub-critical state with $P_2 > \frac{P_1}{2}$

$$C_g = \frac{Q}{0,525 \cdot P_1 \cdot \sin \left(\frac{3417}{C_1} \cdot \sqrt{\frac{P_1 - P_2}{P_1}} \right)^\circ}$$

N.B. the sine argument is expressed in sexagesimal degree

Critical state with $P_2 \leq \frac{P_1}{2}$

$$C_g = \frac{Q}{0,525 \cdot P_1}$$

N.B. The above formulas apply to natural gas flow rate only. If the flow rate value (Q) refers to other gasses, divide it by the correction factor F (see table).

Select the diameter of the regulator with C_g higher than calculated value (see table). After finding the DN of the regulator, check that gas speed on the seat does not exceed 120 m/sec, using the following formula:

$$V = 345,92 \cdot \frac{Q}{DN^2} \cdot \frac{1 - 0,002 \cdot P_e}{1 + P_e}$$

V = Velocity (m/s)
 $345,92$ = Numerical constant
 Q = Flow rate under standard conditions (Stm³/h)
 DN = Regulator nominal diameter (mm)
 P_e = Inlet pressure in relative value (bar)



Reducing unit detail



Pilot

Configurations

The following pilots are used with BFL series regulator with built-in shut-off device:

- **OS/80X** series spring loaded pneumatic device
- **OS/80X-PN** series pneumatic device controlled by **PRX** series pilots

OS/80X

The OS/80X series pilot is supplied in different models according to set ranges required.

Technical features

Model	Servomotor body resistance (bar)	Overpressure set range W_{ho} (bar)		Underpressure set range W_{hu} (bar)	
		min.	max.	min.	max.
OS/80X-BP	5	0,03	2	0,01	0,60
OS/80X-BPA-D	20	0,03	2	0,01	0,60
OS/80X-MPA-D	100	0,50	5	0,25	4
OS/80X-APA-D	100	2	10	0,30	7
OS/84X	100	5	41	4	16
OS/88X	100	18	80	8	70

Materials OS/80X

Servomotor Body	OS/80X-BP	Aluminum
	OS/80X-BPA-D	Aluminum
	OS/80X-MPA-D	ASTM A 105 Steel
	OS/80X-APA-D	ASTM A 105 Steel
Diaphragm		Fabric NBR+PVC/Nitrile rubber
O-ring		NBR Rubber

Materials OS/84X OS/88X

Servomotor body	P-Cu Zn40 Pb2 UNI 5705-65 Brass
Lip seal	Teflon (PTFE)
O-ring	NBR Rubber



OS/80X-BP

OS/80X-PN

The OS/80X-PN series pilot is supplied in two models:

OS/80X-PN: Pressure range 0.5 ÷ 40 bar.

Appliance made of an OS/80X-APA-D set at about 0.4 bar and a variable number of PRX/182 pilots for overpressure and PRX/181 for underpressure, as many as necessary to control different points of the installation.

OS/84X-PN: Pressure range 30 ÷ 80 bar.

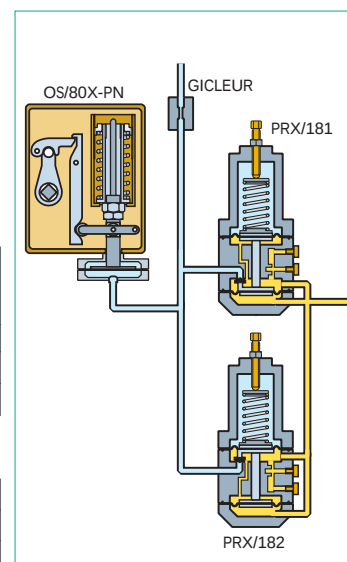
Appliance made of an OS/84X set at about 20 bar and a variable number of PRX-AP/182 pilots for overpressure and PRX-AP/181 for underpressure, as many as necessary to control different points of the installation.

Technical features

Model	Servomotor body resistance (bar)	Overpressure set range W_{ho} (bar)		Underpressure set range W_{hu} (bar)	
		min.	max.	min.	max.
OS/80X-PN	100	0,5	40	0,5	40
OS/84X-PN	100	30	80	30	80

Materials PRX/181/182 PRX-AP/181/182

Body	Cf9 S Mn Pb28 UNI 4838-80 Steel
Diaphragm	Fabric-finished NBR
O-ring	NBR Rubber





Pressure regulators

FL-MFL-BFL



Pilots

PS/ series



FL series regulators are equipped with the PS/ or PRX/ series pilots.

Use	Allowable pressure P_{zul} (bar)	Set range W_h (bar)	Body and covers material
Regulator or monitor			
PS/79-1	25	0,01 ÷ 0,5	Aluminium
PS/79-2	25	0,2 ÷ 3	

Attacchi filettati 1/4" NPT femmina



Use			Allowable pressure P_{zul} (bar)	Set range W_h (bar)	Body and covers material
Regulator or monitor	Operating monitor				
	Regulator	Monitor			
PS/79	PSO/79	REO/79	100	0,5 ÷ 40	Steel
PS/80	PSO/80	REO/80	100	1,5 ÷ 40	

1/4" NPT female threaded connections

All PS/ series pilots are supplied with a filter (5m filtering degree) and built-in pressure stabilizer, with the exception of pilots PSO/79 and PSO/80.

PRX/ series



Use			Allowable pressure P _{zul} (bar)	Set range W _h (bar)	Body and covers material
Regulator or monitor	Operating monitor				
	Regulator	Monitor			
PRX/120	PRX/120	PRX/125	100	1 ÷ 40	Steel
PRX-AP/120	PRX-AP/120	PRX-AP/125	100	30 ÷ 80	

1/4" NPT female threaded connections

The SA/2 pressure pre-reducer must be used with PRX/ series pilots.

SA/2



The pressure pre-reducer is equipped with a 5μ filtering degree filter and is suitable for heating.

Model	Allowable pressure P_{zul} (bar)	Supplied pressure	Body and covers material
SA/2	100	3 bar + Downstream press.	Steel

1/4" NPT female threaded connections

FU



When the pressure difference between upstream and downstream is below 10 bar, SA/2 can be used with the following FU filter:

Model	Allowable pressure P_{zul} (bar)	Filtering degree	Body and covers material
FU	100	5μ	Steel

1/4" NPT female threaded connections

Booster valves



Model	Material	Allowable pressure P_{zul} (bar)	Set range W_h (bar)
V/31-1	Alluminio	19	0,025 ÷ 0,55
PRX/131	Acciaio	100	0,5 ÷ 9

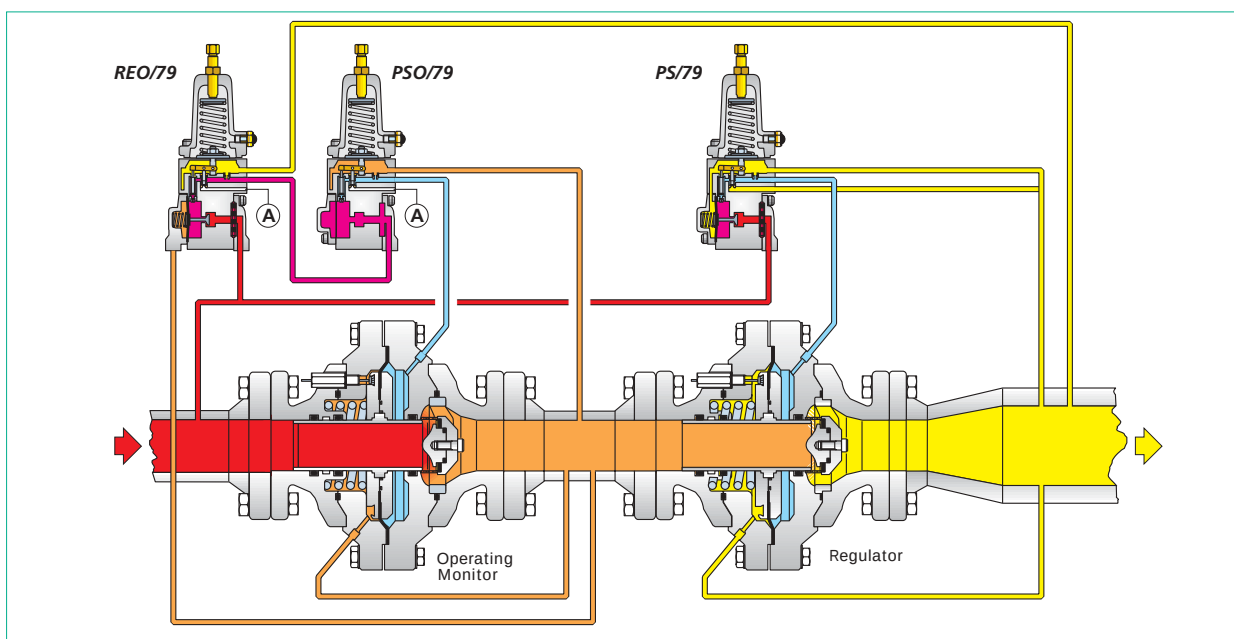
1/4" NPT female threaded connections



Operating monitor and booster valve

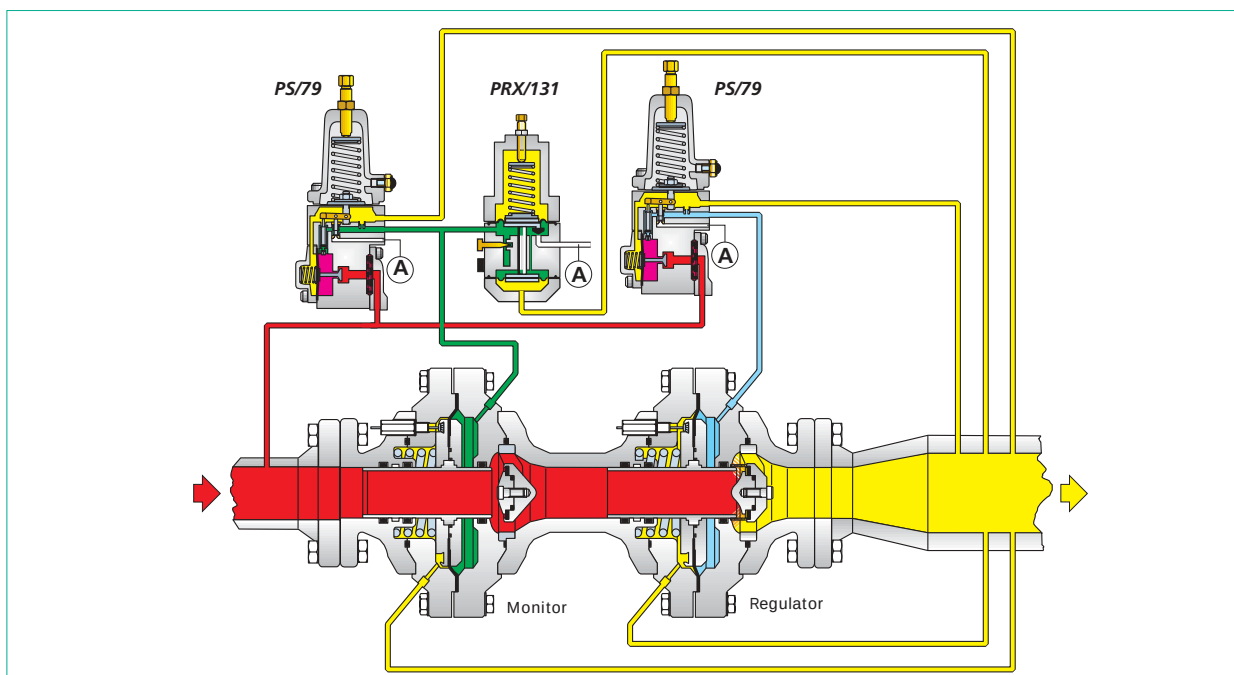
Operating Monitor

The “operating monitor” has two functions: under normal duty, it reduces pressure in the intermediate section between the two regulators, but, if the main regulator fails, it comes into operation as an emergency regulator.



Booster Valve

The booster valve is fitted on the monitor-regulator system which branches off from the monitor drive pressure circuit, so that the monitor operates more quickly.



Red Inlet pressure

Orange Intermediate pressure

Blue Regulator moving pressure

Green Monitor moving pressure

Pink Stabilized pressure

Yellow Outlet pressure

(A) Downstream or to the atmosphere



Pressure regulators

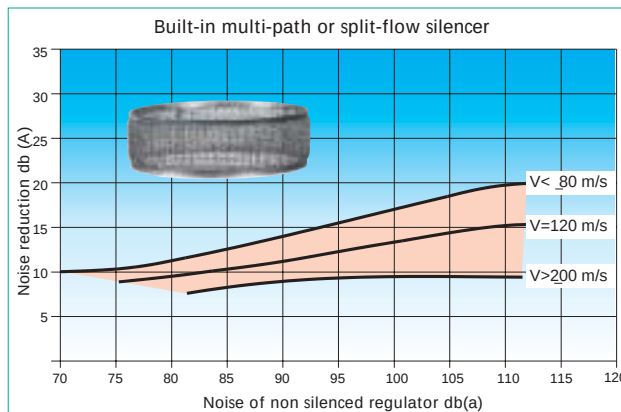
FL-MFL-BFL



Silencer

SR This silencer is fitted near the regulator shutter and is highly efficient up to a theoretical speed of 80 m/s calculated at the outlet flange.

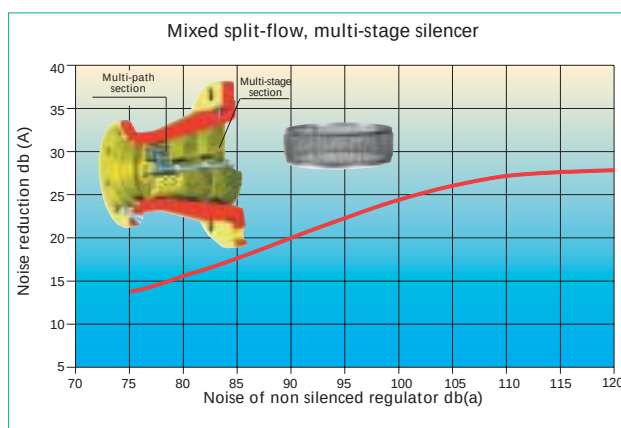
Beyond this speed could be necessary to act on the noise generated by the expansion cone usually installed downstream of the regulator.



SRS The SRS silencer consists of an SR silencer plus a widened outlet flange in which a second silencer is fitted.

The second silencer has an initial multi-path section and a second multi-stage section.

This silencer is highly efficient under all operating conditions, is not limited by the theoretical speed on the regulator outlet flange.



STP Habitually used downstream of SRS silencers but can also be combined with the SR silencer.

Overall reduction in noise level is the sum of the reduction produced by SR or SRS plus the STP induced reduction.

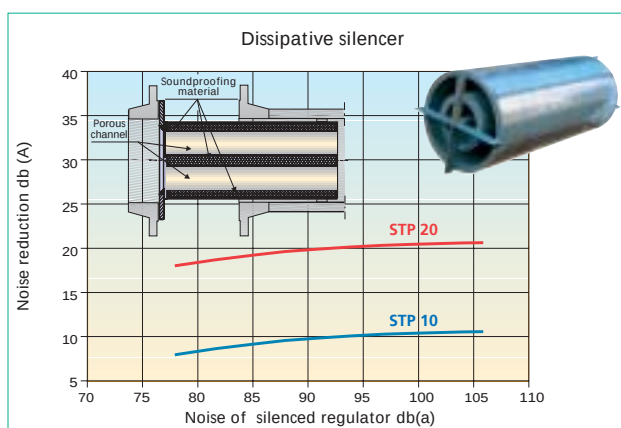
The STP silencer consists of one or more porous channels clad with soundproofing material.

Sound penetrates inside the soundproofing layer and is transformed into heat by friction.

The silencer is fitted in the pipe and is secured with two flanges.

Two types of silencers are supplied:

- STP10 10 dB(A) attenuation, with length of approximately 1 m
- STP20 20 dB(A) attenuation, with length of approximately 2 m





Accessories

Proportional travel transmitter

In order to communicate the valve position, a potentiometer-type straightaway position transmitter is used connected to the regulator travel indicator. Thanks to this transducer, it is possible to know accurately the valve position and thus have correct information on the regulator operating condition.

It is supplied in two models:

- PA1/25 suitable for DN 25 ÷ 65
- PA1/50 suitable for DN 80 ÷ 150

This transducer features a single element as foreseen by EN 50020 standards and can thus be used in hazardous area.

Single element transducers, if fitted in intrinsic safety circuits, should be protected through suitable safety barriers anyway.



PA1 Model		25	50
Useful electrical travel	mm	26	51
Resistance	Ω	1	5
Resolution	mm	infinite	
Suggested current	μA	<1	
Max. current	mA	≤ 10	
Max. voltage	V	25	60
Working temperature	$^{\circ}C$	-30 $^{\circ}C$ +100 $^{\circ}C$	

Proximity switch

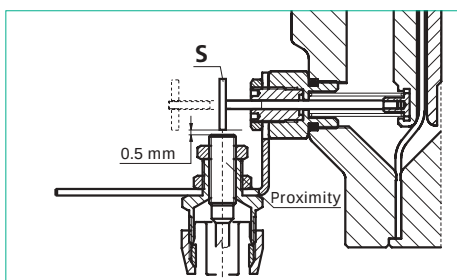
In order to send the shut-off or the regulator/monitor opening/closing signal, a proximity switch suitable for installation in hazardous area is used.

The use of this switch foresees the application of an intrinsic safety separation barrier which should be installed in safe area.

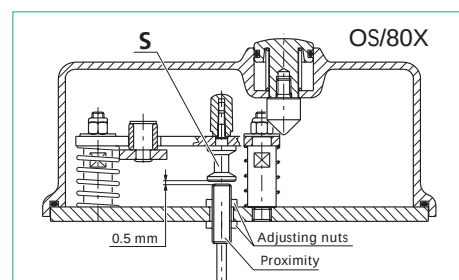
The distance between the proximity switch and the barrier should be calculated according to the type of gas and installation electrical specifications.

The proximity switch should be positioned at about 0.5 mm from the stem (S). The adjustment is made by means of adjusting nuts.

On request it is possible to supply the pilot in the version with two proximity switches in order to indicate extreme positions of valve opening/closing.



Regulator/Monitor installation



Pilot installation



Pressure regulators

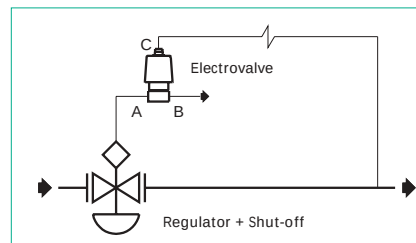
FL-MFL-BFL



Accessories

Electrovalve for remote controlled closure

The OS/80X and the OS/80X-PN equipped with a shut-off device for minimum pressure, can be equipped with a 3-way valve with explosion-proof construction to permit remote-controlled closure.



IT/3V three-way valve for setting control (P_e max 50 bar)

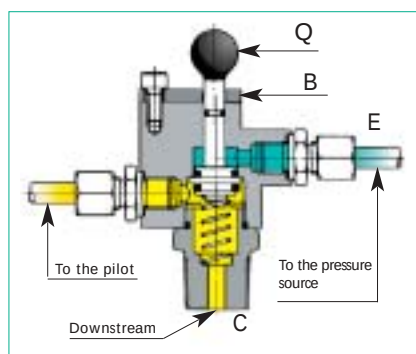
It allows the OS/80X operation and setting control, without having to change the regulator setting.

The valve is installed on the OS/80X control line and it must be connected to a suitable pressure source that is capable of reaching the settings of the OS/80X.

The IT/3V three-way valve is of the spring-return type and it is equipped with a safety lock plate (B) on the control knob (Q).

When the plate (B) is pivoted, pressure on the knob (Q) makes it possible to put the sensitive member into communication with a pressure source, thus making it possible to perform operation and setting tests.

Upon completion of the procedures, releasing the knob will reset normal running conditions. The safety lock plate on the knob prevents accidental maneuvers.

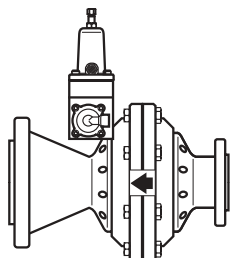


MIF/65 Underground module

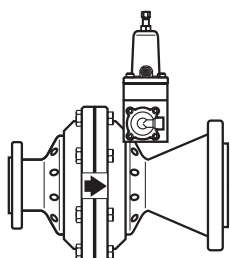


Installation

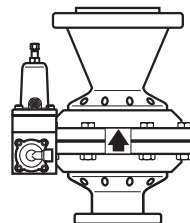
FL • FL-SR • FL-SRS • FL with widened outlet



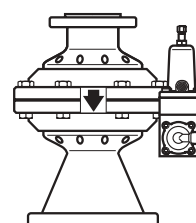
Horizontal installation
Right to Left



Horizontal installation
Left to Right

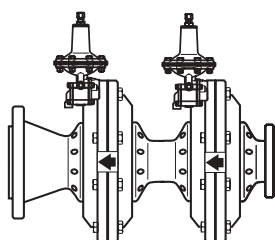


Vertical installation
Upword

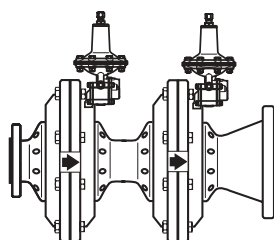


Vertical installation
Downword

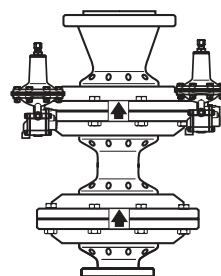
MFL • MFL-SR • MFL-SRS • MFL with widened outlet



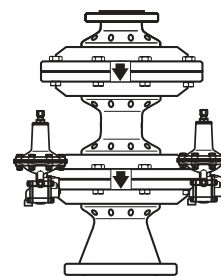
Horizontal installation
Right to Left



Horizontal installation
Left to Right

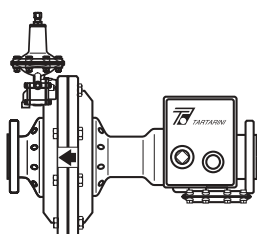


Vertical installation
Upword

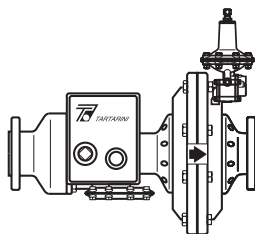


Vertical installation
Downword

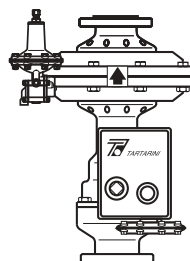
BFL • BFL-SR • BFL-SRS • BFL with widened outlet



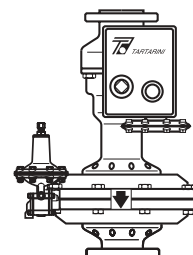
Horizontal installation
Right to Left



Horizontal installation
Left to Right



Vertical installation
Upword

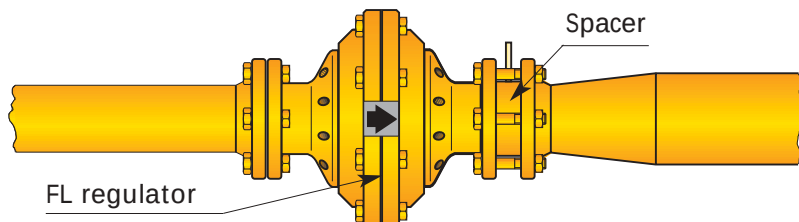


Vertical installation
Downword

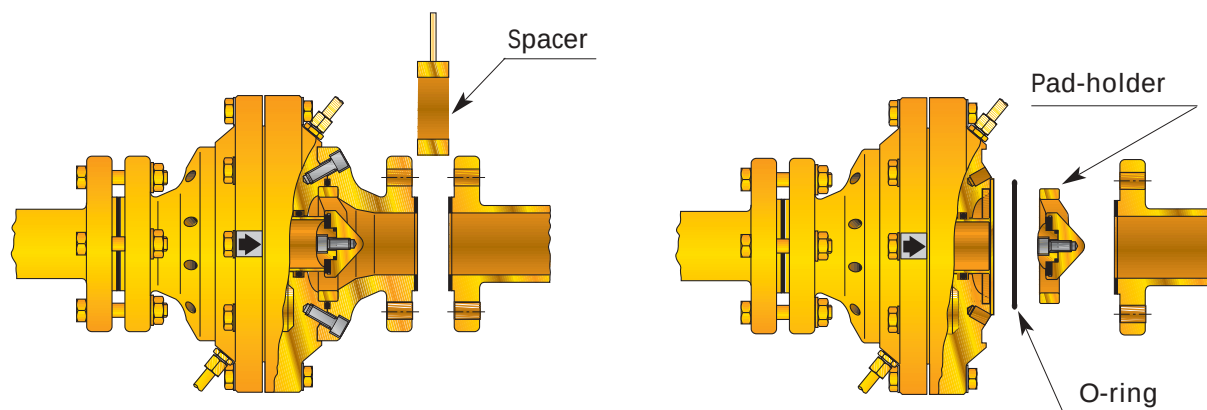


Maintenance

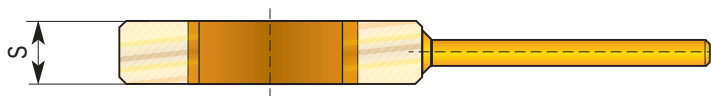
During the maintenance operations the pad is easily accessible and, unlike in other regulators, there is no need to remove the regulator from the line or to disassemble the diaphragm in order to replace the pad.



A special spacer has been installed downstream of the regulator so that, once the spacer is removed, the outlet flange can also be easily removed for ready access to the pad-holder.



Spacer overall dimensions



DN is referred to the outlet flange of the regulators

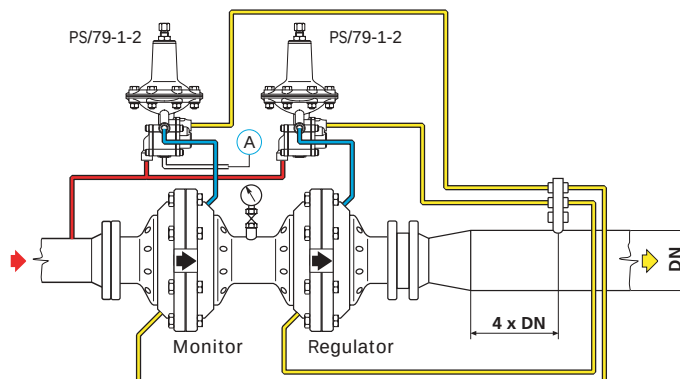
DN	S
25	30
40	40
50	50
65	60
80	60
100	60
150	80
200	100
*250	100

*only on request

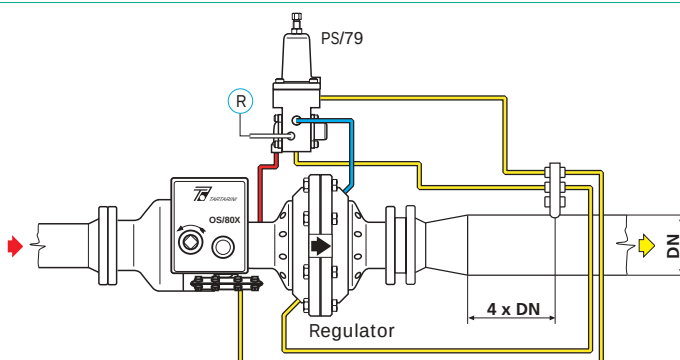


Examples of connection

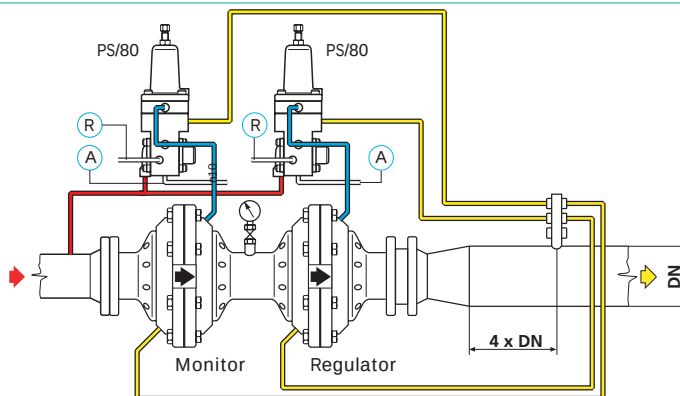
PS/79-1
PS/79-2 series



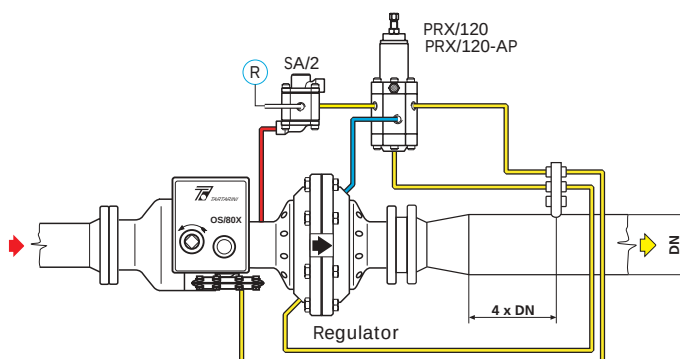
PS/79 series



PS/80 series



PRX series



■ Inlet pressure
■ Moving pressure
■ Outlet pressure

Ⓐ Downstream or to the atmosphere
Ⓡ To the heating system



Pressure regulators

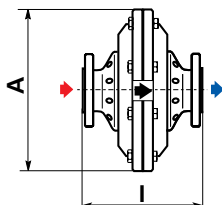
FL-MFL-BFL



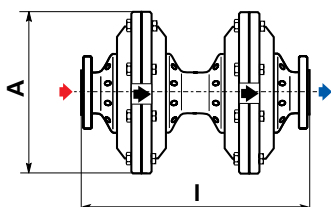
Overall dimensions (mm) and Weights (Kg)

Standard and SR

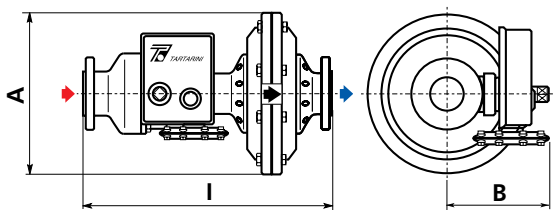
FL-BP



MFL-BP

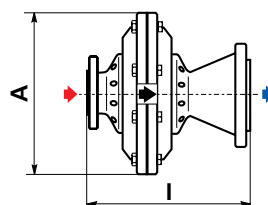


BFL-BP

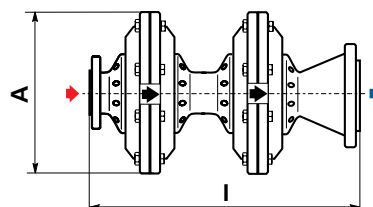


Widened outlet and SRS

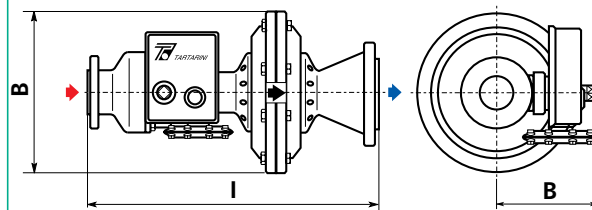
FL-BP



MFL-BP



BFL-BP



DN	Face to Face - I			Dimensions	
	PN 16 - ANSI 150			A	B
	FL-BP	MFL-BP	BFL-BP		
25	184	360	355	285	199
40	222	424	410	306	206
50	254	510	485	335	213
65	276	542	530	370	227
80	298	564	560	400	245
100	352	675	670	450	269
150	451	-	-	590	-

DN	Face to Face - I			Dimensions	
	PN 16 - ANSI 150			A	B
	FL-BP	MFL-BP	BFL-BP		
25x100	290	466	461	285	199
40x150	350	552	538	306	206
50x150	380	636	611	335	213
65x200	420	686	674	370	227
80x250	470	736	732	400	245
100x250	525	848	843	450	269
150x300	630	-	-	590	-

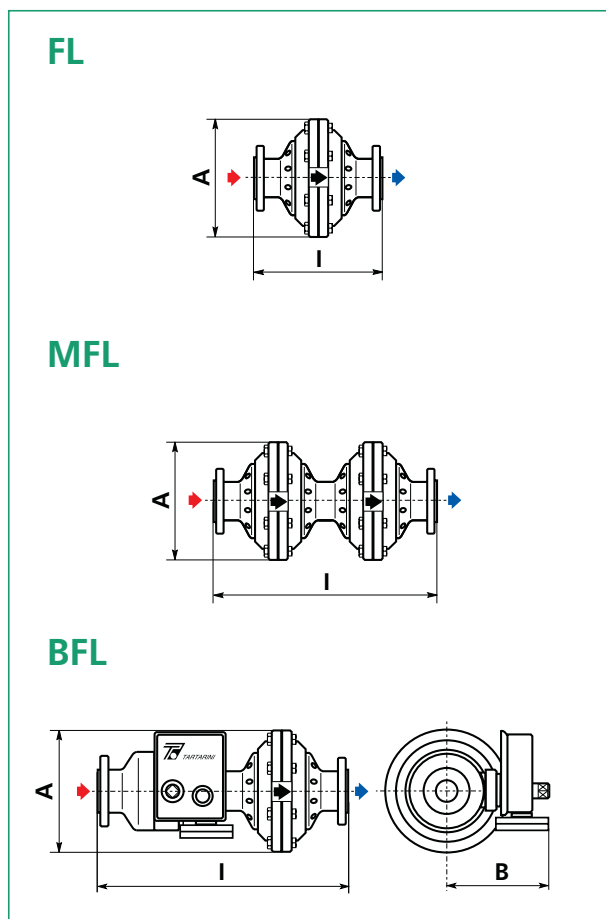
Standard and SR Weights			
DN	PN 16 - ANSI 150		
	FL-BP	MFL-BP	BFL-BP
25	24	48	38
40	37	77	50
50	48	97	60
65	68	140	100
80	83	168	132
100	105	239	197
150	255	-	-

Widened outlet and SRS Weights			
DN	PN 16 - ANSI 150		
	FL-BP	MFL-BP	BFL-BP
25x100	30	54	44
40x150	47	87	60
50x150	58	107	70
65x200	90	162	122
80x250	128	213	177
100x250	150	284	242
150x300	380	-	-



Overall dimensions (mm) and Weights (Kg)

Standard and SR

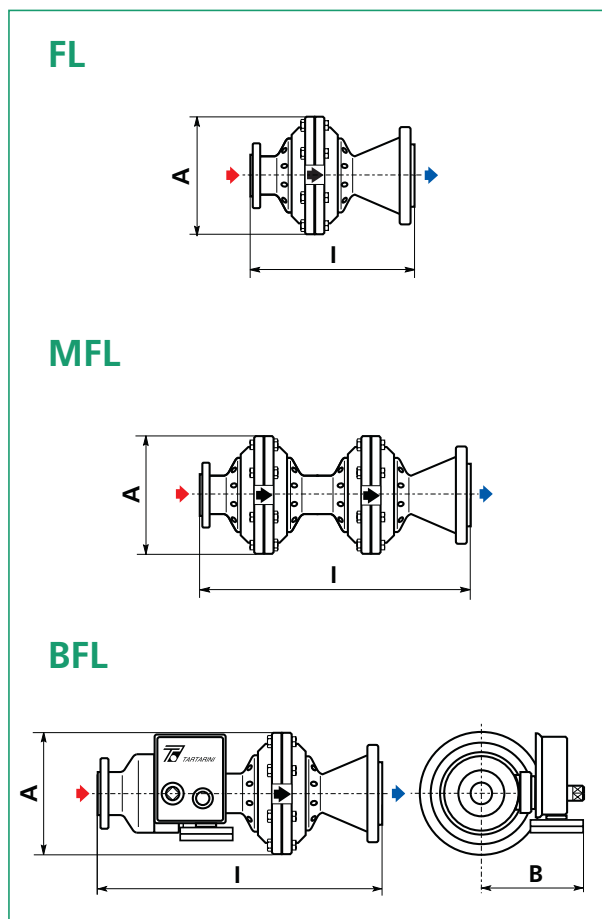


DN	Face to Face - I			Dimensions	
	ANSI 300 - ANSI 600			A	B
	FL	MFL	BFL		
25	210	385	390	225	199
40	251	450	445	265	206
50	286	535	515	287	213
65	311	574	560	355	227
80	337	600	600	400	245
100	394	720	710	480	269
150	508	-	-	610	-
200*	610	-	-	653	-

*ANSI 300 I = 568

Standard and SR Weights			
DN	ANSI 300 - ANSI 600		
	FL	MFL	BFL
25	31	73	49
40	47	96	71
50	60	113	90
65	88	174	129
80	148	296	208
100	201	364	297
150	480	-	-
200	620	-	-

Widened outlet and SRS



DN	Face to Face - I			Dimensions	
	ANSI 300 - ANSI 600			A	B
	FL	MFL	BFL		
25x100	300	475	480	225	199
40x150	370	569	564	265	206
50x150	400	649	629	287	213
65x200	440	703	689	355	227
80x250	500	763	763	400	245
100x250	525	851	841	480	269
150x300	660	-	-	610	-

Widened outlet and SRS Weights			
DN	ANSI 300 - ANSI 600		
	FL	MFL	BFL
25x100	45	87	63
40x150	74	123	98
50x150	87	140	117
65x200	135	220	176
80x250	233	380	293
100x250	286	450	382
150x300	600	-	-

