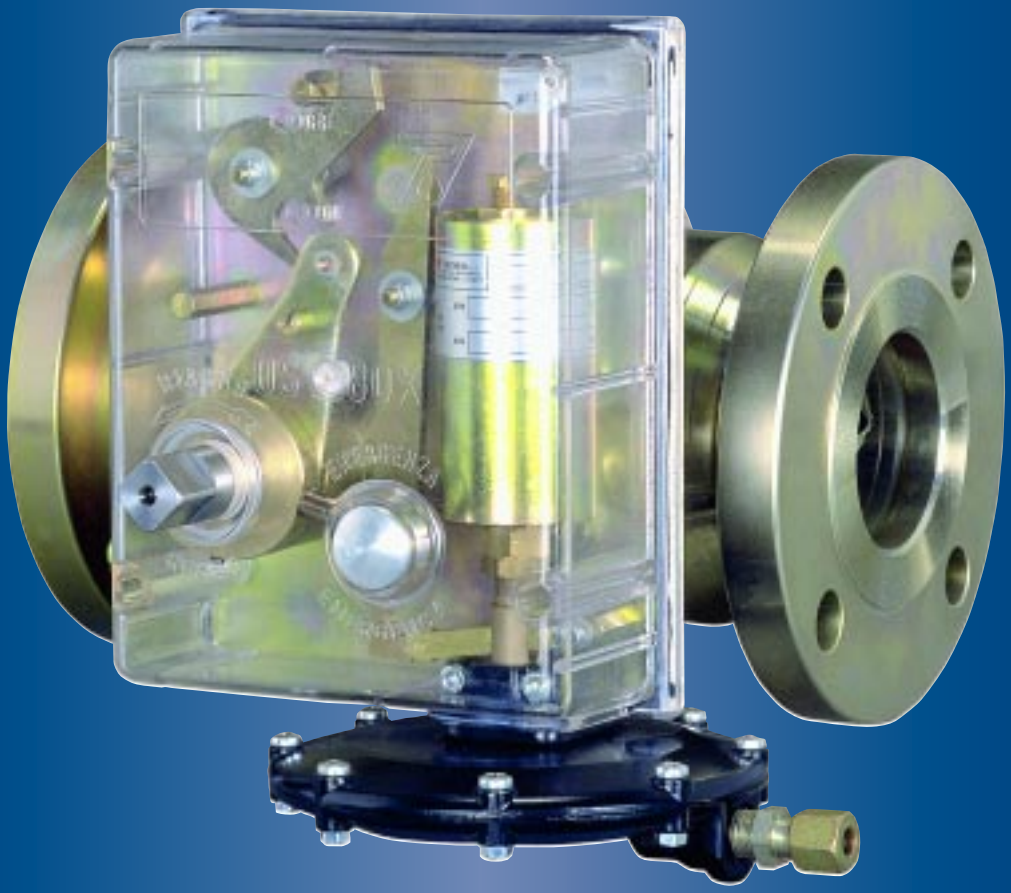
TARTARINI

BM5 series Slam shut valves



EMERSON™
Process Management

Slam shut valves

BM5 series slam shut valve is an automatic shut-off appliance suitable for installation as safety device in regulating stations and gas distribution piping.
The slam shut valve has the task to quickly shut off the gas flow when the pressure in control point(s) reaches a fixed set value.
Advantages to our customers coming from the use of BM5 series slam shut valves are summarized below.
The valve is sleeve-type and as a consequence does not need any external by-pass to facilitate the opening of the valve itself.
The valve re-opening can be made only through a manual operation.

- Axial flow.
- Flanged connections.
- Sleeve valve.
- Protected seal pad.
- Possible to fit in all positions.
- Pressure control in one or more points of the installation.
- Starting up following overpressure and/or underpressure.
- Push-button manual emergency release.
- Manual reset through rotation of the reset shaft only.

Operation

BM5 series slam shut valve is essentially made of an axial flow valve and a pilot allowing to keep the valve open.
The valve body features a sleeve valve (O) sliding axially and as a consequence no by-pass is needed for its opening even in the presence of pressurized gas.

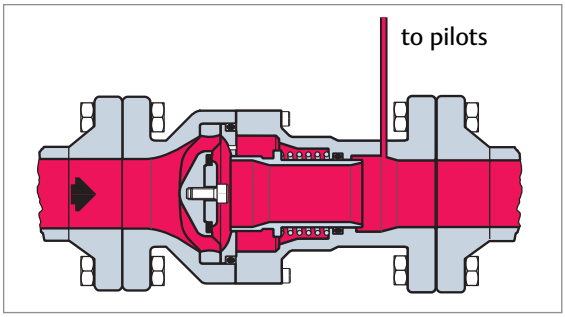
The valve opening can be made only manually by turning the eccentric shaft (A) anticlockwise.
The seal pad is not hit by the gas flow since it is protected by the pad holder (P) and as a consequence is not affected by any possible dirt present in the gas.

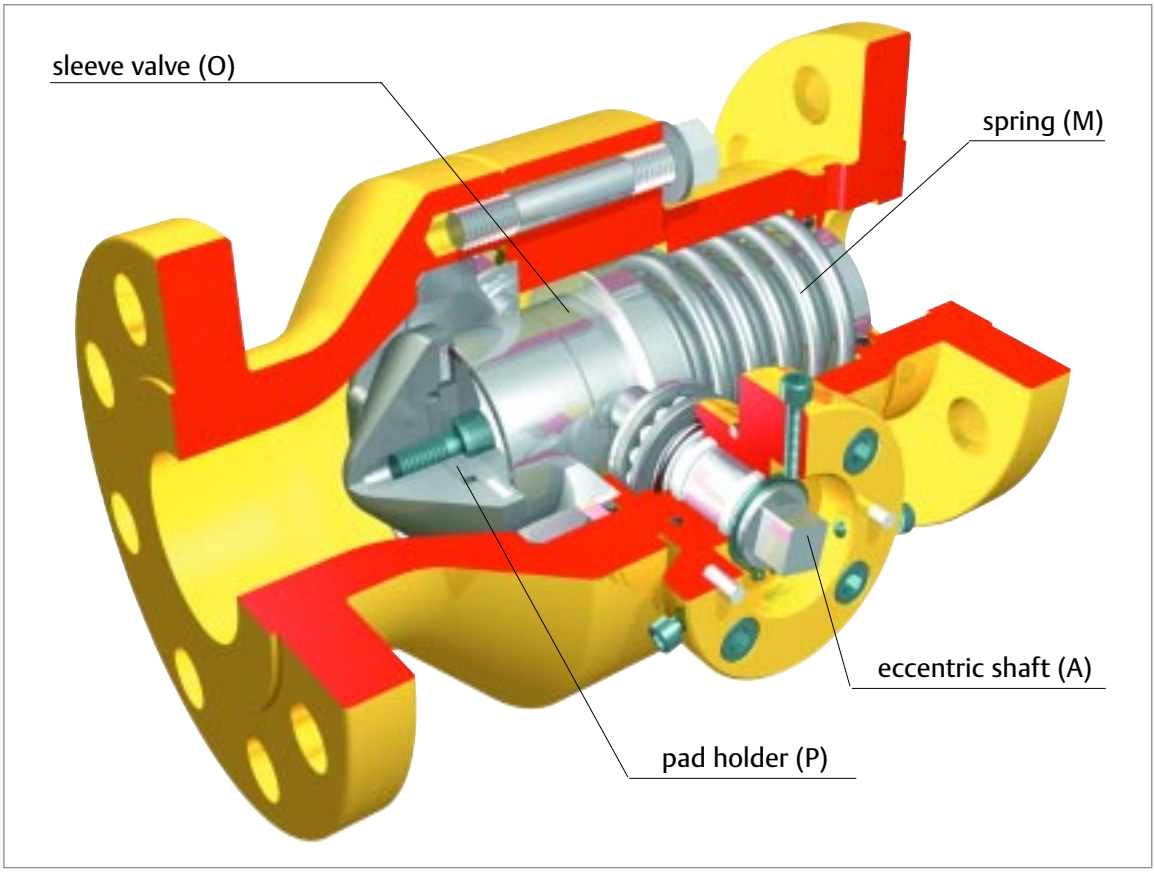
When the controlled pressure is within set values of the pilot, this remains set and prevents the rotation of the eccentric shaft (A).

When this pressure varies beyond setting limits, the pilot releases the eccentric shaft and the valve (O) is brought to its closing position following the spring (M) thrust.

The pilot is provided with a manual release push-button to quickly close the slam shut valve in case of emergency or during maintenance/checking operations.

Should the valve be used with pilot-operated pressure regulators, the supply to pilots should be taken downstream of the slam shut valve.
For this purpose, BM5 valves feature a threaded hole to be used for supply to pilots; the hole is normally kept closed by a dowel.
The supply to pilots can be made through a standard joint or through the suitable stud supplied on request.





Features

Application

BM5 slam shut valve is used in natural gas regulating installations and air, propane, butane, LPG, city gas, nitrogen, carbon dioxide, hydrogen regulating or distribution installations.

Construction features

Nominal diameters available (mm); DN: 25 - 40 - 50 - 65 - 80 - 100 - 150.

PN 16, PN 25, (UNI 2282) and ANSI 150, ANSI 300, ANSI 600 (ASME/ANSI B16.5) flanged connections.
Flanges are normally supplied with step.

ANSI flange coupling surfaces are finished with semicircular profile phonographic groove.

UNI flange coupling surfaces are finished with three semicircular profile concentric grooves.

On request, they can be both supplied with smooth finish.

Technical features

Pressure bar		PN 16	PN 25	ANSI 150	ANSI 300	ANSI 600
Allowable pressure	PS	16	25	20	50	100
Design pressure	P_d	16	25	20	50	100
Hydraulic test		24	37.5	30	75	150
Permissible inlet pressure	$P_{e,max}$	16	25	19	50	100
Inlet pressure range	b_{pe}	0 ÷ 16	0 ÷ 25	0 ÷ 19	0 ÷ 50	0 ÷ 100
Overpressure set range	W_{ho}	0.03 ÷ 16	0.03 ÷ 25	0.03 ÷ 19	0.03 ÷ 50	0.03 ÷ 80
Underpressure set range	W_{hu}	0.01 ÷ 16	0.01 ÷ 25	0.01 ÷ 19	0.01 ÷ 50	0.01 ÷ 80
Accuracy class	AG	up to 1				
Response time	t_a	≤ 1 s				

Temperature

Standard type and sour gases type
- working temperature - 10 °C + 60 °C
- ambient temperature - 20 °C + 80 °C

Low temperature type
- working temperature - 20 °C + 60 °C
- ambient temperature - 30 °C + 80 °C

Materials

Half-bodies	• Steel
Valve	• Steel
O-Ring	• NBR rubber
Pad	• NBR rubber
Pad holder	• Steel

Calculation procedures

The following formulas refer to normal operating conditions in a **sub-critical state** with: $P2 > \frac{P1}{2}$

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
Δp = Power loss in bar
d = Relative density of the gas

Flow coefficients

DN	C_g	C1
BM5/25	525	29
BM5/40	1420	28
BM5/50	2250	26
BM5/65	3600	28
BM5/80	5400	30
BM5/100	8700	26
BM5/150	18600	28

Flow rate Q

$$Q = 0.525 \cdot C_g \cdot P1 \cdot \text{sine}\left(\frac{3417}{C1} \cdot \sqrt{\frac{P1-P2}{P1}}\right)^{\circ}$$

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

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

Power loss Δp

$$\Delta p = \frac{P1 - \sqrt{P1^2 - 4 \cdot \left(\frac{Q}{C_g \cdot 1.05}\right)^2}}{2}$$

DN size

Calculate the required Cg with the following: $C_g = \frac{Q}{0.525 \cdot P1 \cdot \text{sine}\left(\frac{3417}{C1} \cdot \sqrt{\frac{P1-P2}{P1}}\right)^{\circ}}$

N.B. The formula appearing above is valid only when the flow rate refers to natural gas. For other gases, divide the flow rate by the correction factor F (see table).

Choose the slam shut valve with the C_g higher than the calculated value. (see table)

After having determined the slam shut valve diameter, it is suggested to check that the velocity on the seal seat is not higher than 120 m/sec. by 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 (Stm^3/h)
DN = valve nominal diameter (mm)
P_e = inlet pressure in relative value (bar)

In case of velocities higher than indicated limits, increase the valve diameter.

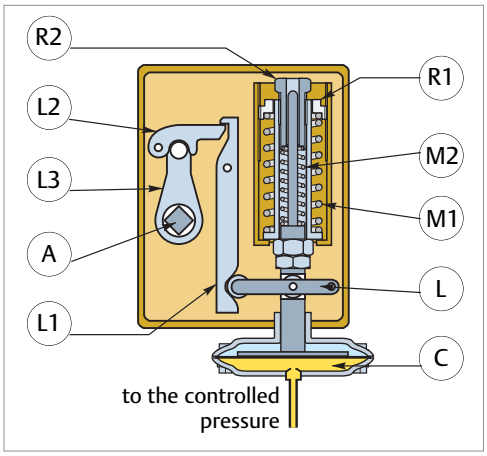
OS/80X pilot

Operation

The controlled pressure acts within the pilot chamber (C) and under normal operating conditions it is contrasted by the maximum pressure spring load (M1) and prevails over the action of the minimum pressure spring (M2).

The system is in a state of equilibrium under these conditions and the lever (L) is in a centered positioned with respect to the housing machined on the lever (L1).

The lever (L1), in turn, keeps the bracket (L2) coupled. The latter blocks rotation of the lever (L3), which is an integral part of the shaft (A). The pilot is thus reset and keeps the butterfly disk open.



Whenever the controlled pressure reaches the set point for activation of the slam shut valve due to any irregularity, the existing equilibrium is altered causing the lever (L) to move. The lever (L1) ridges are pressed and the bracket (L2) is released. The shaft (A) can rotate and subjected to the thrust of the spring (M), the butterfly disk closes.

The OS/80X series pilot can be used for overpressure only by removing the spring (M2).
The pilot can also be adopted for underpressure only by tightening the ring nut (R1) until the spring (M1) is completely loaded. Various OS/80X series pilot models are available and supplied on the basis of the required setting ranges.

Pilot reset

The reset procedure can only be carried out manually and takes place by means of the simple rotation of the shaft (A).

If there is no pressure in the lines, the valve can be opened by simply rotating the shaft using the respective lever. If there is pressure in the line, proceed as follows:

a) Close the shut-off valve downstream and open the upstream one slightly.

b) Press on the by-pass valve knob and keep it pressed until the pressure upstream and downstream from the valve is completely balanced.

c) Insert the reset lever and rotate it slowly (in the direction shown by the arrow) until the valve is completely opened.

d) Keep the lever in this position and wait until the pressure downstream stabilizes.
Try to start rotation of the shaft several times ensuring that the compound lever keeps the pilot set.

e) If the reset proves to be hesitant or if the pilot does not remain set, check the connections, the setting and proceed with maintenance if needed.

Pilot setting

Overpressure or underpressure value are adjusted separately, using the respective registers (R1) and (R2) for the springs (M1) and (M2).

OS/80X features

Technical features

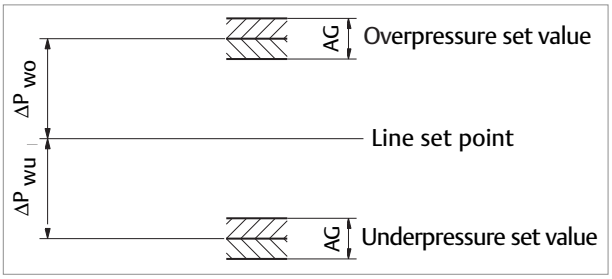
Type	Servomotor body resistance (bar)	Overpressure set range W_{ho} (bar)	Underpressure set range W_{hu} (bar)
OS/80X-BP	5	0.03 ÷ 2	0.01 ÷ 0.6
OS/80X-BPA-D	20	0.03 ÷ 2	0.01 ÷ 0.6
OS/80X-MPA-D	100	0.5 ÷ 5	0.25 ÷ 4
OS/80X-APA-D	100	2 ÷ 10	0.30 ÷ 7
OS/84X	100	5 ÷ 41	4 ÷ 16
OS/88X	100	18 ÷ 80	8 ÷ 70

Setting ranges and accuracy ranges

The reset differential indicates the minimum value to be considered with respect to the line set point for proper resetting of the pilot.

Ex.: line set point 3 bar.

Choose OS/80X-MPA-D with red spring, maximum setting 3.5 bar or higher, minimum setting 2.3 bar or lower.



Model	Spring colour	Overpressure range W_{ao} (bar)	Reset differential ΔP_{wo} (bar)	Underpressure range W_{au} (bar)	Reset differential ΔP_{wu} (bar)	Accuracy class AG			
						- 10 + 60 °C		- 20 + 60 °C	
						max	min	max	min
OS/80X-BP OS/80X-BPA-D	Black	0.03 ÷ 0.07	0.015	0.01 ÷ 0.03	0.01	2.5	10	10	20
	Aluminium	0.07 ÷ 0.15	0.03	0.03 ÷ 0.07	0.02	2.5	10	10	20
	Yellow	0.15 ÷ 0.30	0.04	0.07 ÷ 0.14	0.03	2.5	10	5	15
	Blue	0.30 ÷ 0.70	0.07	0.13 ÷ 0.40	0.06	1	5	5	15
	Red	0.70 ÷ 2	0.15	0.40 ÷ 0.60	0.20	1	5	2.5	10
OS/80X-MPA-D	Yellow	0.50 ÷ 0.70	0.15	0.25 ÷ 0.40	0.15	2.5	10	10	20
	Blue	0.70 ÷ 2.50	0.30	0.40 ÷ 0.90	0.30	1	5	5	15
	Red	2.50 ÷ 5	0.50	0.90 ÷ 4	0.70	1	5	5	15
OS/80X-APA-D	Yellow	-	-	0.30 ÷ 0,80	0.25	-	10	-	15
	Blue	2 ÷ 4	0,40	0.80 ÷ 2	0.50	1	5	5	15
	Red	4 ÷ 10	1	2 ÷ 7	1.50	1	5	2.5	10
OS/84X	Blue	5 ÷ 25	3	4 ÷ 8	3	1	5	5	15
	Red	24 ÷ 41	5	7 ÷ 16	6	1	5	2.5	10
OS/88X	Yellow	18 ÷ 50	8	8 ÷ 30	8	1	5	2.5	10
	Blue	40 ÷ 80	12	20 ÷ 70	15	1	5	2.5	10

OS/80X pilot materials

Servomotor body	BP Aluminium
	BPA Aluminium
	MPA Steel
	APA Steel
Diaphragm	NBR Rubber/Fabric-finished PVC
O-Ring	NBR Rubber

OS/84X OS/88X Materials

Servomotor body	Brass
Lip seal	Teflon (PTFE)
O-Ring	NBR Rubber

OS/80X-PN pilot

Operation

Under normal operating conditions, there is atmospheric pressure in the pilot chamber (C) as the controlled pressure is intercepted by the valve (V) for the PRX pilots and the chamber itself (C) is connected with the atmosphere by means of the jet.

Under these conditions, as the pilot is not equipped for underpressure shut-off, it will remain set.

An increase in the controlled pressure exceeding the set point will cause the PRX/182 valve (V) to open.

The controlled pressure that produces the lever (L) movement, resulting in the closure of the slam shut valve is in the OS/80X-PN chamber (C) .

A drop in the controlled pressure exceeding the set point will cause the PRX/181 valve (V) to open.

The controlled pressure that produces the lever (L) movement is generated in the OS/80X-PN chamber (C), resulting in the closure of the slam shut valve.
When the OS/80X-PN is activated, a small amount of gas escapes into the atmosphere from the jet until normal operating conditions are reestablished.

Owing to its particular characteristics, it is possible to adopt an unlimited number of PRX/181 and PRX/182 pilots to monitor various pressures and various points in the system.

The OS/80X-PN pilot makes it possible to monitor the pressure at one or more points in the system.

Two models are available:

- OS/80X-PN:
  Equipment consisting of an OS/80X-APA-D set at about 0.4 bar with a varying number of PRX/182 pilots for maximum pressure and PRX/181 pilots for minimum pressure.

- OS/84X-PN:
  Equipment consisting of an OS/84X set at about 20 bar with a varying number of pilots PRX-AP/182 for maximum pressure and PRX-AP/181 or PRX/181 for minimum pressure.

Pilot reset

The reset procedure can only be carried out manually and takes place by means of the simple rotation of the shaft (A).

If there is no pressure in the lines, the valve can be opened by simply rotating the shaft using the respective lever. If there is pressure in the line, proceed as follows:

a) Close the shut-off valve downstream and open the upstream one slightly.

b) Press on the by-pass valve knob and keep it pressed until the pressure upstream and downstream from the valve is completely balanced.

c) Insert the reset lever and rotate it slowly (in the direction shown by the arrow) until the valve is completely opened.

d) Keep the lever in this position and wait until the pressure downstream stabilizes.
Try to start rotation of the shaft several times ensuring that the compound lever keeps the pilot set.

e) If the reset proves to be hesitant or if the pilot does not remain set, check the connections, the setting and proceed with maintenance if needed.

Pilot setting

Setting is performed using the adjusting screws for the PRX/182 pilots for the overpressure shut-off and PRX/181 pilots for underpressure shut-off. The pilot is supplied already adjusted for normal operation and therefore no setting adjustment is required.

OS/80X-PN features

Technical features

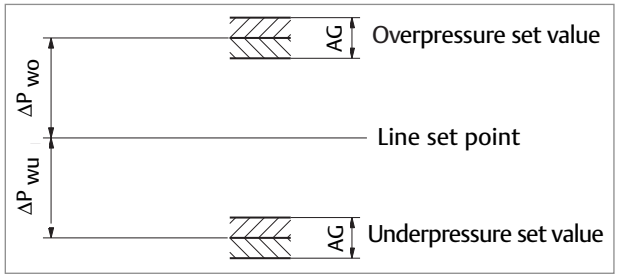
Type	Servomotor body resistance (bar)	Overpressure set range W_{ho} (bar)	Underpressure set range W_{hu} (bar)
OS/80X-PN	100	0.5 ÷ 40	0.5 ÷ 40
OS/84X-PN	100	30 ÷ 80	30 ÷ 80

Setting ranges and accuracy ranges

The reset differential indicates the minimum value to be considered with respect to the line set point for proper resetting of the pilot.

Ex.: Line set point 10 bar.

Choose OS/80X-PN with PRX181 and PRX182 with gold spring, PRX182 setting at 10.5 bar or higher, PRX181 setting at 9.4 bar or lower.



Model	Spring colour	Overpressure range W_{ao} (bar)	Reset differential ΔP_{wo} (bar)	Underpressure range W_{au} (bar)	Reset differential ΔP_{wu} (bar)	Accuracy class AG			
						- 10 + 60 °C		- 20 + 60 °C	
						max.	min.	max.	min.
PRX/181 PRX/182	Yellow	0.5 ÷ 1.5	0.2	0.5 ÷ 1.5	0.3	1	1	2.5	2.5
	Green	1 ÷ 3	0.3	1 ÷ 3	0.4	1	1	2.5	2.5
	Black	2 ÷ 8	0.4	2 ÷ 8	0.6	1	1	2.5	2.5
	Gold	5 ÷ 20	0.5	5 ÷ 20	0.6	1	1	1	2.5
	Red	15 ÷ 42	0.6	15 ÷ 42	0.8	1	1	1	2.5
PRX-AP/181 PRX-AP/182	Neutral	30 ÷ 80	0.8	30 ÷ 80	1	1	1	1	1

PRX pilots materials

Body	Steel
Diaphragm	Fabric-finished NBR
O-Ring	NBR Rubber

Accessories

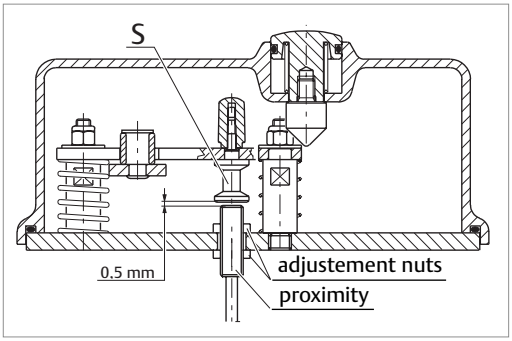
Proximity switch

A proximity switch is used to transmit an open/closed signal to the slam shut valve.
It is suited for installation in a hazardous zone.
This switch is designed for use with an inherent safety system separation barrier (available upon request), which must be installed in a safe zone.

The distance between the proximity switch and the barrier must be calculated on the basis of the type of gas and the electrical specifications of the system.

The proximity switch must be positioned at a distance of about 0.5 mm from the stem (S).

The adjustment nuts are used for adjustments.

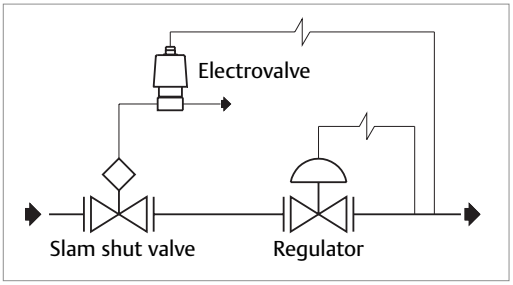


Upon request it is possible to supply the pilot in a version with two proximity switches to signal the farthest open and closed valve positions.

Electrovalve for remote controlled closure

In addition to its normal use in protecting the system against increases and/or drops in pressure, the BM6X/ slam shut valve can be equipped with a 3-way valve with explosion-proof construction to permit remote-controlled closure of the valve itself.

This electrovalve can be used in the OS/80X and the OS/80X-PN when the latter are equipped with a shut-off device for minimum pressure.



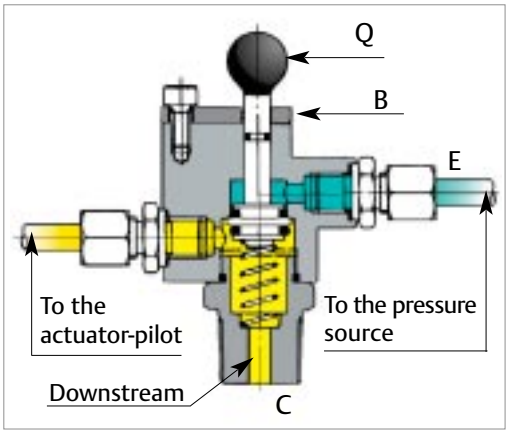
IT/3V three-way valve for setting control (P_e max 50 bar)

The BM5 slam shut valves can be equipped with a three-way valve for pilot 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.

Installation

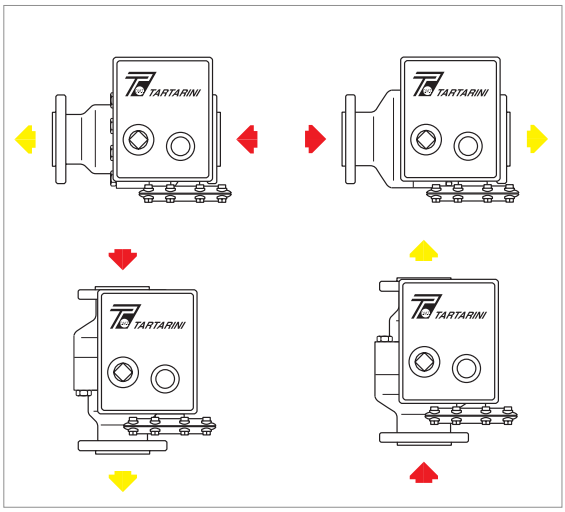
Orientations

BM5 series slam shut valves can be installed on the piping with both horizontal axis and vertical axis and with any gas flow orientation.

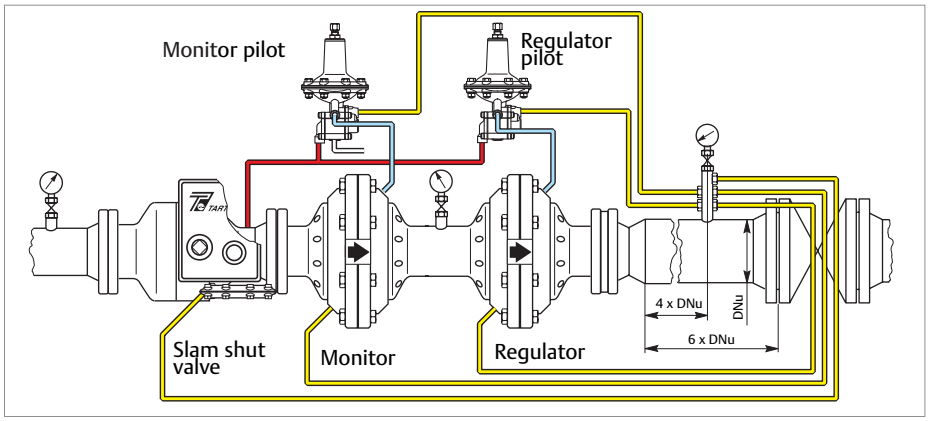
The pilot can be turned by 90° steps to allow the orientation in vertical position with the adjusting screws turned upwards in order to obtain an optimal operation and an easier setting control.

This slam shut valve has been designed to work even in the presence of relatively dirty gas since the seal pad is not hit directly by the gas flow.

However, being a safety device, it is suggested to install a filter upstream of it.

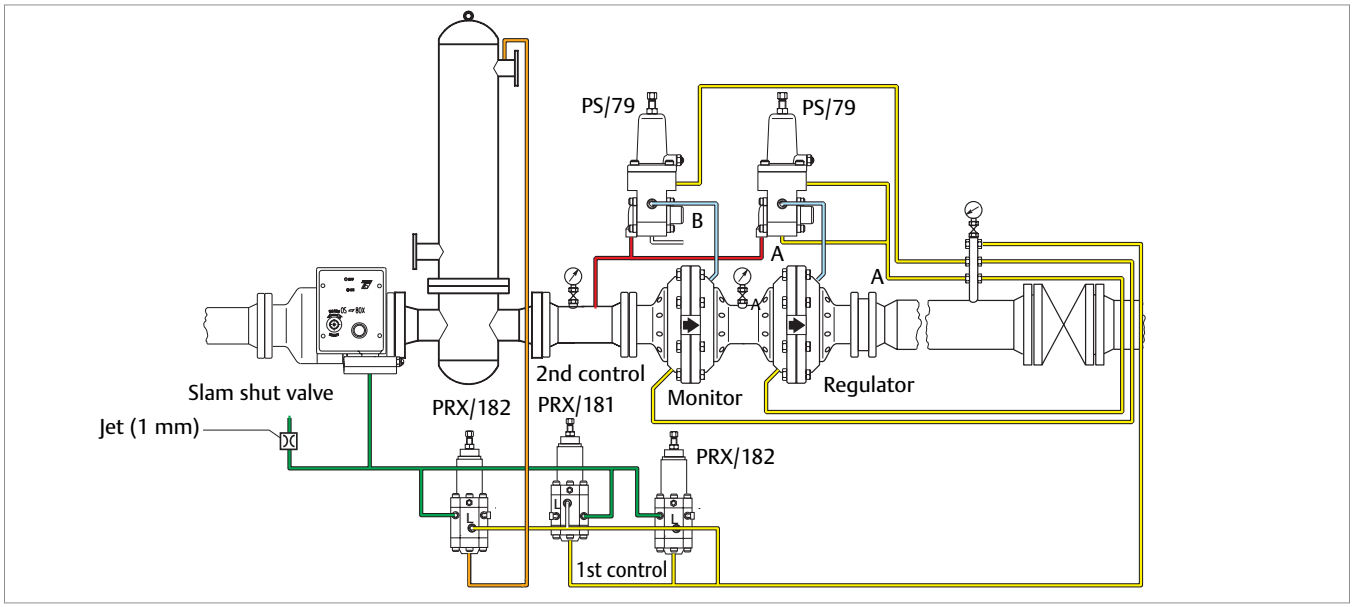


Installation example in a low pressure regulating unit



- Outlet pressure and/or OS/80X series starting up pressure
- Inlet pressure
- Moving pressure
- OS/80X - PN series starting up pressure
- Pressure in the exchanger shell

Installation example to control the overpressure and underpressure downstream of regulators and the pressure in the exchanger shell.

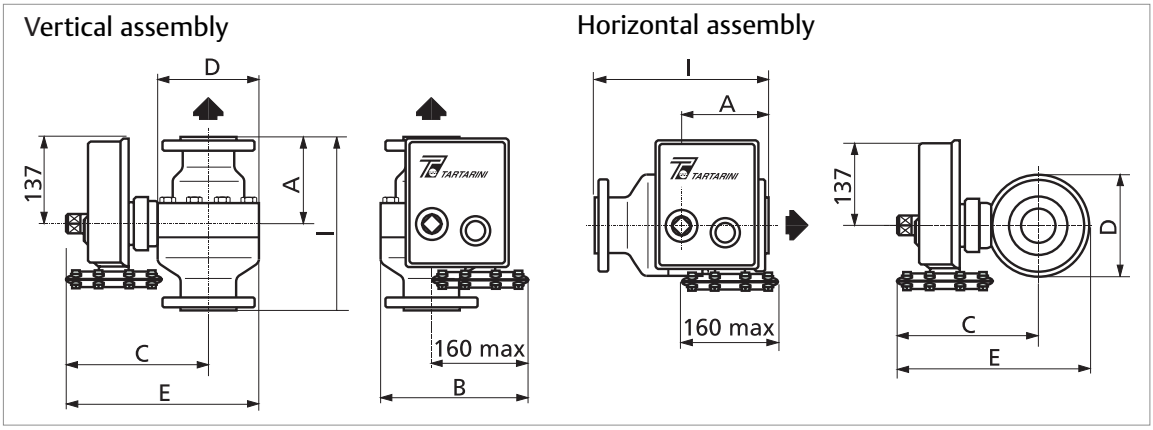


Overall dimensions and weights

Overall dimensions (mm)

Type/DN		BM5/25	BM5/40	BM5/50	BM5/65	BM5/80	BM5/100	BM5/150
A		100	125	145	155	165	195	250
B		220	235	245	255	275	295	365
C		200	205	215	225	245	270	380
D		125	155	165	190	230	275	410
E		260	280	300	320	360	410	585
I	PN 16	184	222	254	276	298.5	352,5	451
I	PN 25	184	-	254	-	298.5	352.5	451
I	ANSI 150	184	222	254	276	298.5	352.5	451
I	ANSI 300	197	235	266.5	292	317.5	368.5	473
I	ANSI 600	210	251	286	311	336.5	394	508

Note: Dimensions C are indicative and refer to models with the greatest overall dimensions.
The threaded hole for the control piping connection is 1/4" NPT female.



Weights (Kg)

TYpe/DN	BM5/25	BM5/40	BM5/50	BM5/65	BM5/80	BM5/100	BM5/150
PN16/25 - ANSI150	15	21	26	38	54	83	170
ANSI 300/600	17	25	30	41	62	105	280

Weight of the valve complete with pilot

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