May 2011

Type FEQ Slam-Shut Valve

Figure 1. *Type FEQ Slam-Shut Valve*

Introduction

Type FEQ slam-shut valve is used to totally and rapidly cut the flow of gas when the inlet and/or outlet pressure in the system either exceeds or drops below the set pressure. Consequently, Type FEQ slam-shut valve can protect transmission and distribution networks or pipelines supplying industries and commercial businesses.

Features

- Overpressure Shutoff (OPSO), Underpressure Shutoff (UPSO), Overpressure and Underpressure Shutoff (OPSO/UPSO)
- Two-stage tripping mechanism
- Open by manual operation
- Push button for emergency manual shutoff
- Internal bypass equalizer
- Visual indication of the position of the valve plug
- Optional switches for remote indication of valve position
- Easy in-line maintenance
- PED and EN14382 certified

D103481X012

Specifications

Body Sizes and End Connection Styles
Flange Size:
DN 25, 50, 80, 100, and 150 / 1, 2, 3, 4, and 6-inch
Flange Rating:
CL150, CL300, and CL600 RF

Maximum Inlet Pressure(1)(2)
100 bar / 10.0 MPa

Outlet Pressure Ranges
See Table 1

Maximum Set Pressure(1)
100 bar / 10.0 MPa

Minimum Set Pressure(1)
0.01 bar / 0.001 MPa

Manometric Sensing Device (BMS) Specifications
See Table 1

Flow Capacities
See Table 4

Flow Coefficients
See Table 3

Maximum Shut-off Pressure Differential
100 bar / 10.0 MPa

Maximum Flowing Pressure Differential

BODY SIZE, DN / INCH	MAXIMUM FLOWING PRESSURE DIFFERENCE, BAR / MPa
25 / 1	24.8 / 2.48
50 / 2	24.8 / 2.48
80 / 3	24.8 / 2.48
100 / 4	10.3 / 1.03
150 / 6	5.9 / 0.59

Pressure Registration
External

Accuracy
Up to AG 1

Inlet Pressure Range(1)
P1: ≤ 100 bar / 10.0 MPa

Trip Pressure Range(1)
0.01 to 100 bar / 0.001 to 10.0 MPa

Response Time
≤1 second

Valve Plug Travel and Stem Diameter

BODY SIZE, DN / INCH	VALVE PLUG TRAVEL, mm / INCHES	VALVE PLUG STEM DIAMETER, mm / INCHES
25 / 1	13 / 1/2	3.5 / 0.138
50 / 2	13 / 1/2	
80 / 3	29 / 1-1/8	
100 / 4	51 / 2	
150 / 6	51 / 2	

Temperature Capabilities(1)
-20˚ to 60˚C / -4˚ to 140˚F

Pressure Sensing Connection
3/8 NPT

Working Medium
Natural gas, coal gas, LP-Gas, and other non-corrosive gases

Construction Materials
Body: WCC Steel
Bonnet: Steel
Valve Plug: Steel
Valve Plug Seal O-Ring: Nitrile (NBR) Rubber
Seat Ring: Stainless Steel
Mechanism Box (BM): Cast Iron
First and Second Stage Mechanism: Steel
Diaphragm: Nitrile (NBR) Rubber

Approximate Weights
See Table 7

Options
- Additional manometric sensing device (BMS) for extra pressure sensing
- Explosion-proof switch only for close position
- Explosion-proof switches for open position and close position

1. The pressure/temperature limits in this Bulletin or any applicable standard limitation should not be exceeded.
2. Relief pressure plus maximum allowable buildup over setting.

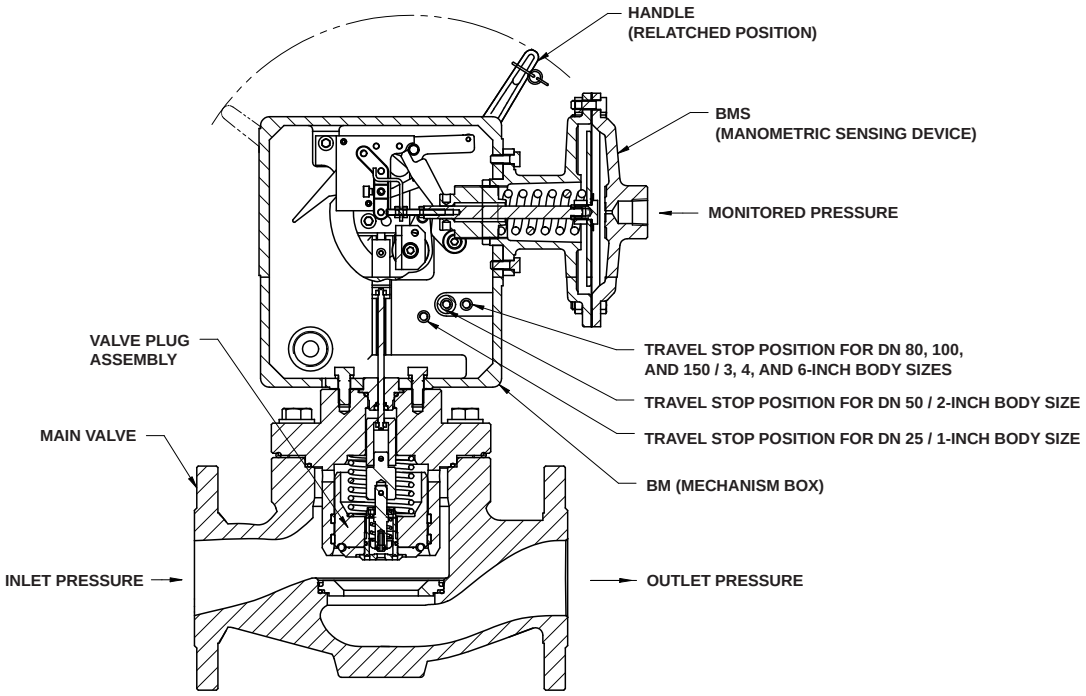


Figure 2. *Type FEQ Configuration*

Configuration

Type FEQ consists of a main valve, a mechanism box (BM), one or two manometric sensing devices (BMS1 or BMS2), a handle and others (see Figure 2 for the configuration). Incorporated in Type FEQ valve plug is an automatic internal bypass valve mechanism which balances pressures on both sides of the plug when resetting.

Principle of Operation

Pressure from the system is sensed through control lines into the manometric sensing device (BMS). The BMS will transmit the pressure fluctuations to the BM. If these fluctuations reach the set pressure of the BMS, the device will activate the tripping mechanism in the BM and cause the valve to slam shut. See Figure 3.

The BM is designed to close the slam-shut valve. The detection of pressure variances is sensed by a double stage trip mechanism. The first stage is the detection stage and will only trip when the system pressure reaches the set pressure of the BMS. The second stage is the power stage and once tripped by the first stage, the closing spring causes the valve plug to slam shut and to remain closed until the valve is manually reset. If there are any inlet pressure variances or vibrations subjected to the second stage components, they are not transmitted to the first stage trip mechanism.

After Type FEQ has closed, it must be manually reset before it can be put back in service. Before resetting Type FEQ, check for and correct the cause of the overpressure/underpressure condition.

To reset the power stage, use the handle hanging outside the BM and rotate it clockwise slowly.

When movement is started on the stem, the internal bypass will open and will equalize the pressure on each side of the valve plug before the valve plug can be moved off the seat. Continue turning the handle for this will raise the valve plug. Compress the closing spring and latch the second stage (power stage) mechanism. Slowly open the inlet valve.

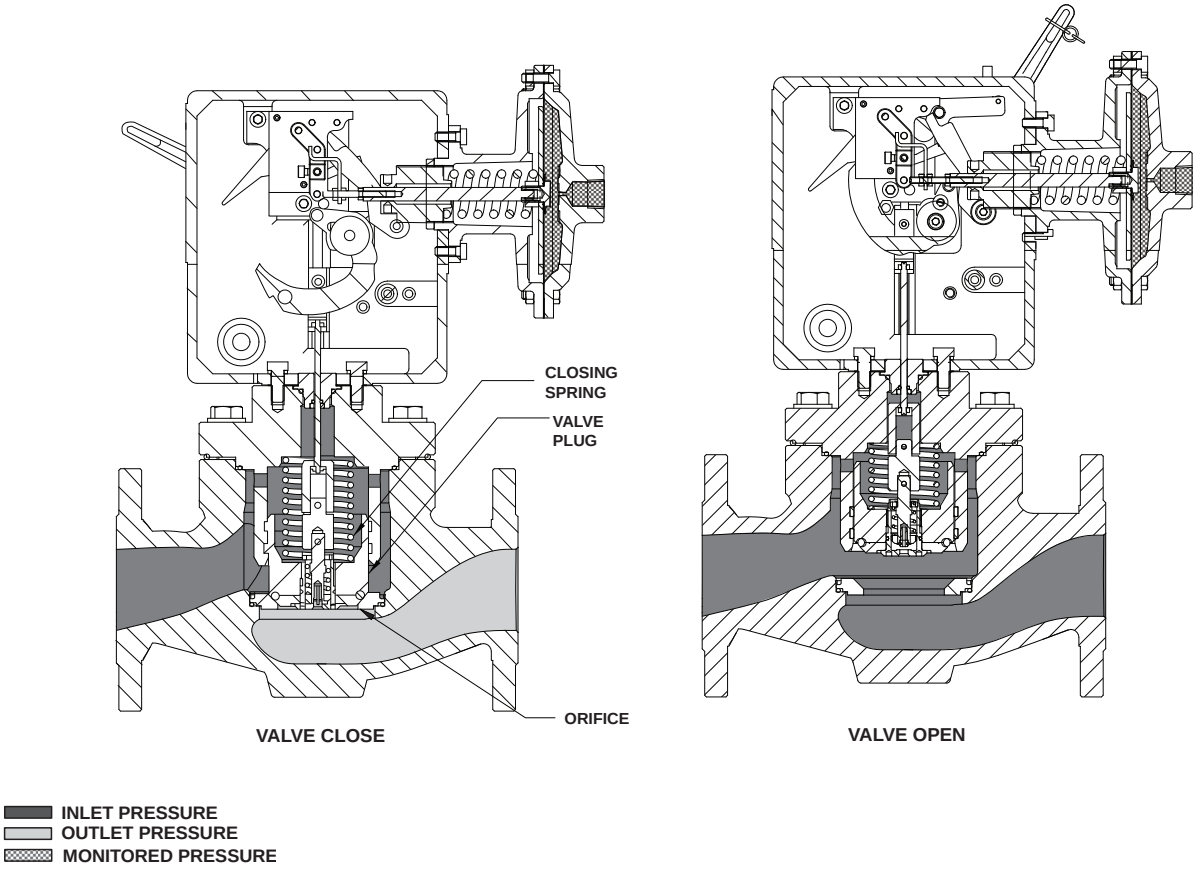


Figure 3. *Type FEQ Operational Schematic*

Installation

Requirements for Installation

Note

Fire and seismic factors are not taken into consideration.

- Ensure that the pipeline pressure matches the operational pressure shown on Type FEQ nameplate.
- The safety manometric sensing device (BMS) and spring selection must correspond to the operating conditions on the outlet side of the regulator.
- Install Type FEQ according to direction of the arrow riveted on the body.
- Clean out all pipelines before installation and ensure that the valve has not been damaged or collected foreign material during shipment.
- When assembling with adjacent elements, care must be taken not to create additional force on the body. If the need arises, a support must be used and be installed under the flanges.
- Type FEQ is installed on the inlet side of the regulator, on a horizontal pipeline, with the mechanism box (BM) above the body (all sizes) or below the pipe (for DN 25, 50, and 80 / 1, 2, and 3-inch body sizes).
- Leave sufficient space for operation, maintenance, and disassembly.
- No modification should be made to the structure of the equipment (drilling, grinding, soldering, etc.).

Table 1. *Spring Adjustment Ranges and Part Numbers*

MANOMETRIC SENSING DEVICE (BMS) TYPE	MANOMETRIC SENSING DEVICE (BMS) SIZE, mm / INCH	MAXIMUM SENSING INLET PRESSURE, BAR / MPa	SPRING RANGE, BAR / MPa	SPRING PART NUMBER	SPRING COLOR	MINIMUM DIFFERENCE ALLOWED BETWEEN SET PRESSURE AND NOMINAL DOWNSTREAM REGULATOR PRESSURE, BAR / MPa	FOR OPSO/UPSO, MAXIMUM DIFFERENCE ALLOWED BETWEEN MAXIMUM AND MINIMUM SET PRESSURE(1), BAR / MPa
A	162 / 6.4 (Diaphragm)	5.0 / 0.5	0.01 to 0.035 / 0.001 to 0.0035	JJJJ56CXT07	Purple	0.004 / 0.0004	0.01 / 0.001
			0.025 to 0.08 / 0.0025 to 0.008	JJJJ56CXT08	Orange	0.005 / 0.0005	0.025 / 0.0025
			0.045 to 0.14 / 0.0045 to 0.014	JJJJ56CXT09	Red	0.01 / 0.001	0.05 / 0.005
			0.07 to 0.24 / 0.007 to 0.024	JJJJ56CXT10	Yellow	0.014 / 0.0014	0.06 / 0.006
			0.115 to 0.38 / 0.0115 to 0.038	JJJJ56CXT11	Green	0.018 / 0.0018	0.15 / 0.015
			0.14 to 0.75 / 0.014 to 0.075	JJJJ56CXT13	Gray	0.05 / 0.005	0.35 / 0.035
			0.25 to 1.3 / 0.025 to 0.13	JJJJ56CXT14	Brown	0.08 / 0.008	0.6 / 0.06
			0.45 to 2.3 / 0.045 to 0.23	JJJJ56CXT15	Black	0.17 / 0.017	1.1 / 0.11
B	71 / 2.8 (Diaphragm)	16 / 1.6	1.0 to 5.1 / 0.1 to 0.51	JJJJ56CXT12	Blue	0.35 / 0.035	2.5 / 0.25
			2.1 to 11 / 0.21 to 1.1	JJJJ56CXT14	Brown	0.7 / 0.07	5.5 / 0.55
			4.0 to 16 / 0.4 to 1.6	JJJJ56CXT15	Black	1.6 / 0.16	10 / 1.0
C	27 / 1.1 (Piston)	100 / 10	16 to 22 / 1.6 to 2.2	JJJJ56CXT14	Brown	3.0 / 0.3	Cannot be used in applications that require one BMS to provide both high and low pressure trip applications
			22 to 40 / 2.2 to 4.0	JJJJ56CXT15	Black	6.5 / 0.65	
D	17 / 0.7 (Piston)	100 / 10	40 to 55 / 4.0 to 5.5	JJJJ56CXT14	Brown	7.0 / 0.7	
			55 to 100 / 5.5 to 10	JJJJ56CXT15	Black	12 / 1.2	

1. Maximum difference between overpressure and underpressure when using one manometric sensing device (BMS) with one spring. For difference between underpressure and overpressure set pressures greater than this maximum number, use two manometric sensing devices (BMS1 and BMS2) for protection (see Figure 7). When using a BMS1 and a BMS2, the BMS1 can only be used for overpressure shutoff.

Table 2. *Trip Pressure Range*

MANOMETRIC SENSING DEVICE (BMS) TYPE	MANOMETRIC SENSING DEVICE (BMS) SIZE, mm / INCH	TRIP PRESSURE RANGE OF MANOMETRIC SENSING DEVICE (BMS), BAR / MPa
A	162 / 6.4	0.01 to 2.3 / 0.001 to 0.23
B	71 / 2.8	1.0 to 16 / 0.1 to 1.6
C	27 / 1.1	16 to 40 / 1.6 to 4.0
D	17 / 0.7	40 to 100 / 4.0 to 10

Table 3. *Flow Coefficients*

FLOW COEFFICIENT	BODY SIZE, DN / INCH				
	25 / 1	50 / 2	80 / 3	100 / 4	150 / 6
C_g	570	2073	4817	7845	15 398
C_1	31	30	31	31	34
C_v	18	69	153	249	453

- The equipment should not receive any type of shock, especially the release relay.
- The manometric sensing device (BMS) requires an external sensing line which should be tapped into a straight run of pipe 4 to 6 pipe diameters downstream of the slam-shut valve. See Figures 4 and 5 for details.
- Use gauges to monitor inlet and outlet pressures. See Figures 4 and 5.

Note

When Type FEQ has already been mounted on the pipeline and cleaning maintenance or pressure testing in the pipeline is desired, disassembly of the slam-shut valve is necessary.

Capacity Information

Flows are in thousands of Nm^3/h at 0°C and 1.01325 bar and in thousands of SCFH at 60°F and 14.7 psia of 0.6 specific gravity natural gas.

To determine equivalent capacities for air, propane, butane, or nitrogen, multiply the capacity by the following appropriate conversion factor: 0.775 for air, 0.628 for propane, 0.548 for butane, or 0.789 for nitrogen. For gases of other specific gravities, multiply the given capacity by 0.775, and divide by the square root of the appropriate specific gravity.

The following formulas refer to normal operating conditions in a **sub-critical state** with: $P_2 > \frac{P_1}{2}$

$$Q = 0.5 \cdot C_g \cdot P_1 \cdot \sin\left(\frac{3417}{C_1} \cdot \sqrt{\frac{P_1 - P_2}{P_1}}\right)^o$$

where,

Q = Natural gas flow rate in Stm^3/h
P_1 = Absolute inlet pressure in bar
P_2 = Absolute outlet pressure in bar
C_g = Flow rate coefficient
C_1 = Body shape factor
ΔP = Power loss in bar
d = Relative density of the gas

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:

$$F = \sqrt{\frac{0.6}{d}}$$

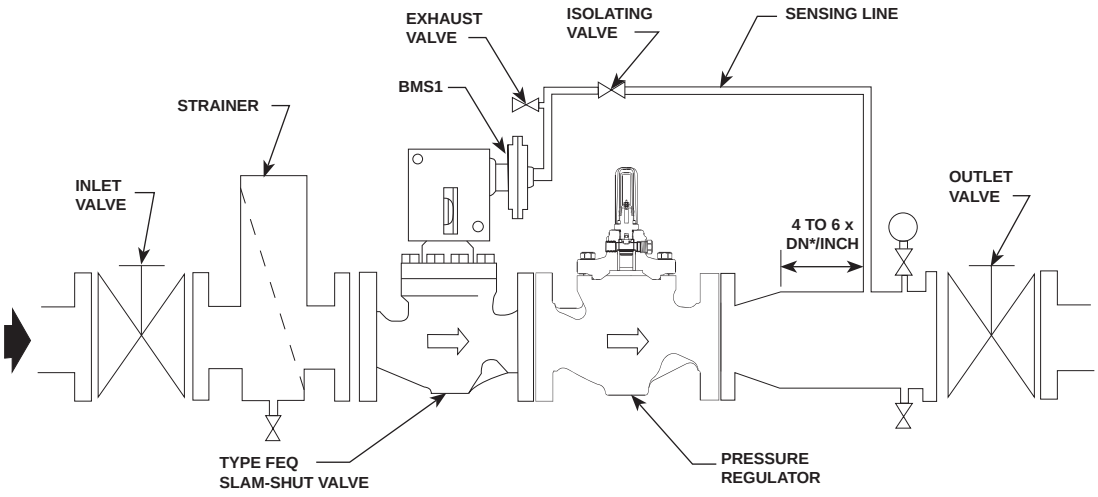
GAS	RELATIVE DENSITY d	FACTOR F
Air	1	0.78
City gas	0.44	1.17
Butane	2.01	0.55
Propane	1.53	0.63
Nitrogen	0.97	0.79
Carbon dioxide	1.52	0.63
Hydrogen	0.07	2.93

Power loss (ΔP):

$$\Delta P = P_1 \times \left\{\frac{C_1}{3417} \times \left[\arcsin\left(\frac{Q}{0.5 \cdot C_g \cdot P_1}\right)\right]^o\right\}^2$$

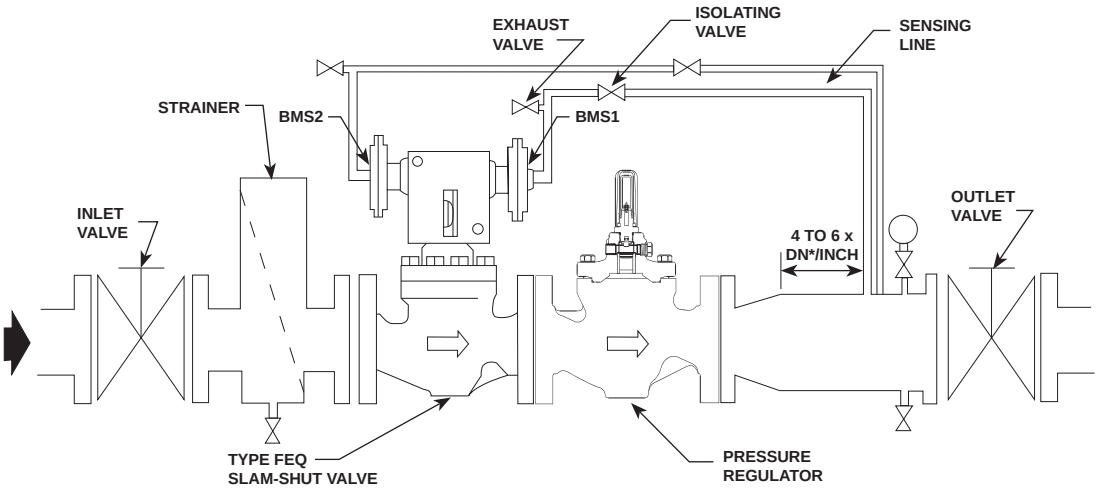
Table 4. *Typical Capacities*

INLET PRESSURE, BAR / MPa	PRESSURE DROP, BAR / MPa	CAPACITIES IN THOUSANDS OF Nm^3/h / SCFH OF 0.6 SPECIFIC GRAVITY NATURAL GAS				
		DN 25 / 1-INCH	DN 50 / 2-INCH	DN 80 / 3-INCH	DN 100 / 4-INCH	DN 150 / 6-INCH
0.69 / 0.069	0.34 / 0.034	0.3 / 11.1	1.2 / 46.6	2.8 / 103	4.6 / 173	9.2 / 344
3.5 / 0.35		0.5 / 19.2	2.1 / 80.4	4.8 / 178	8.7 / 325	16.0 / 597
6.9 / 0.69		0.7 / 26.0	2.9 / 109	6.4 / 240	11.8 / 441	21.7 / 810
13.8 / 1.38		1.0 / 36.0	4.0 / 150	8.9 / 332	16.4 / 611	30.0 / 1121
20.7 / 2.07		1.2 / 43.7	4.9 / 182	10.8 / 404	19.9 / 743	36.6 / 1365
27.6 / 2.76		1.3 / 50.3	5.6 / 210	12.5 / 465	22.9 / 855	42.0 / 1567
34.5 / 3.45		1.5 / 56.1	6.3 / 234	13.9 / 518	25.6 / 954	46.8 / 1748
41.4 / 4.14		1.6 / 61.3	6.9 / 256	15.2 / 567	27.9 / 1040	51.2 / 1912
55.2 / 5.52		1.9 / 70.7	7.9 / 295	17.5 / 654	32.2 / 1203	59.1 / 2204
69.0 / 6.90		2.1 / 78.9	8.8 / 330	19.6 / 730	36.0 / 1343	66.0 / 2462
3.5 / 0.35	1.4 / 0.14	0.9 / 34.2	3.8 / 143	8.8 / 329	15.1 / 565	28.1 / 1047
6.9 / 0.69		1.3 / 48.8	5.5 / 204	12.7 / 473	21.9 / 817	40.4 / 1506
13.8 / 1.38		1.9 / 69.5	7.8 / 290	18.2 / 678	31.4 / 1173	57.8 / 2157
20.7 / 2.07		2.3 / 85.4	9.6 / 357	22.4 / 835	38.8 / 1446	71.2 / 2655
27.6 / 2.76		2.6 / 98.8	11.1 / 413	25.9 / 966	44.9 / 1675	82.4 / 3074
41.4 / 4.14		3.2 / 121	13.6 / 506	31.8 / 1187	55.2 / 2058	101 / 3775
55.2 / 5.52		3.7 / 140	15.7 / 585	36.8 / 1372	63.8 / 2380	117 / 4365
69.0 / 6.90		4.2 / 156	17.6 / 655	41.2 / 1536	71.4 / 2664	131 / 4884



* The sensing line should be tapped 4 to 6 nominal pipe diameters downstream of the slam-shut valve.

Figure 4. *Overpressure and Underpressure Shutoff using one Manometric Sensing Device (BMS1)*



* The sensing line should be tapped 4 to 6 nominal pipe diameters downstream of the slam-shut valve.

Figure 5. *Overpressure and Underpressure Shutoff using two Manometric Sensing Devices (BMS1 and BMS2)*

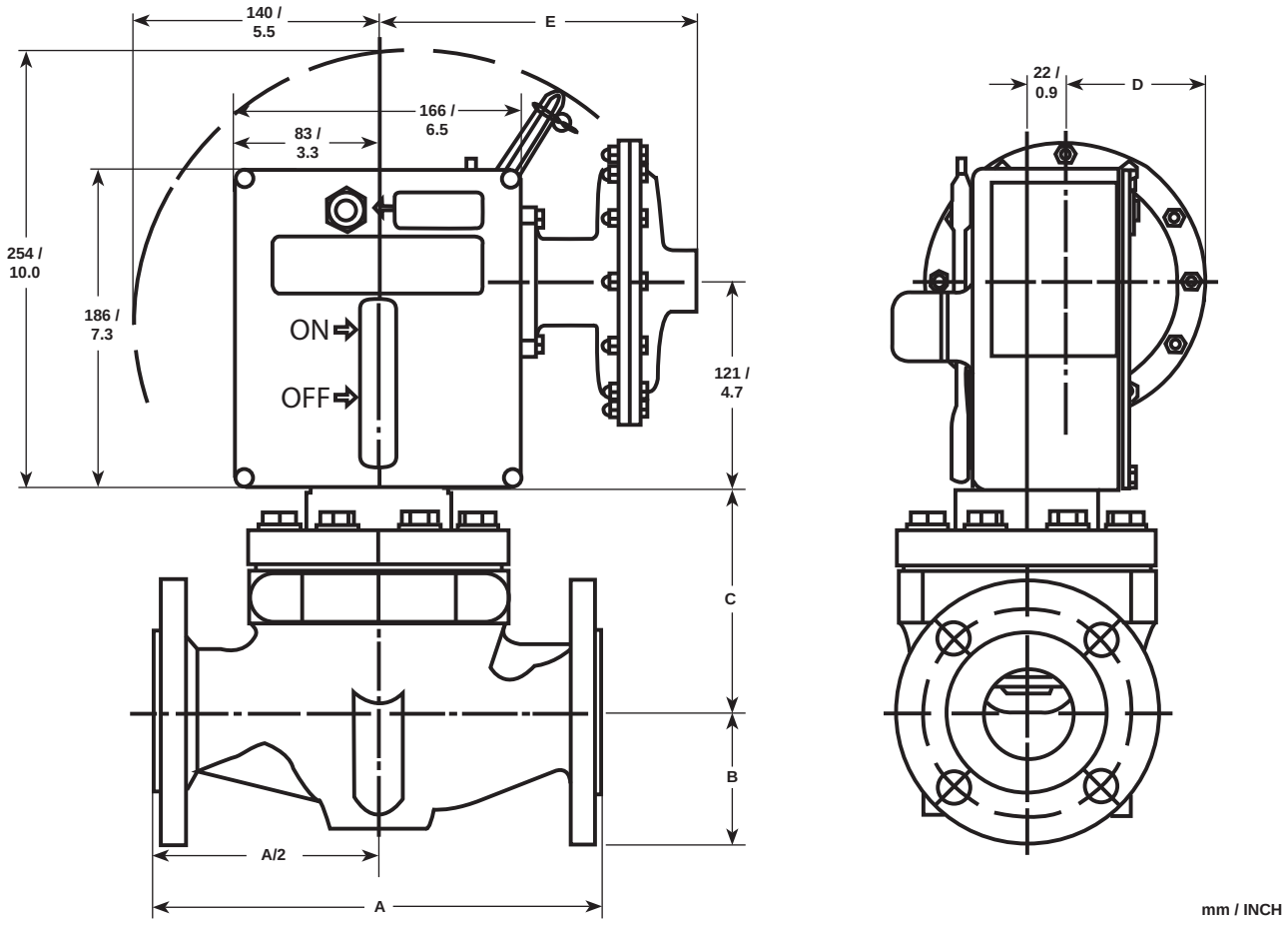


Figure 6. *Type FEQ attached with Mechanism Box (BM) and Manometric Sensing Device (BMS)*

Table 5. *Type FEQ attached with BM and BMS Dimensions*

BODY SIZE, DN / INCH	MANOMETRIC SENSING DEVICE (BMS) TYPE DIMENSIONS	DIMENSION, mm / INCH		
		CL150 RF	CL300 RF	CL600 RF
25 / 1	A	185 / 7.3	197 / 7.8	210 / 8.3
	B	54 / 2.1	62 / 2.4	62 / 2.4
	C	117 / 4.6	117 / 4.6	117 / 4.6
50 / 2	A	254 / 10.0	267 / 10.5	286 / 11.3
	B	77 / 3.0	83 / 3.3	83 / 3.3
	C	129 / 5.1	129 / 5.1	129 / 5.1
80 / 3	A	299 / 11.8	318 / 12.5	337 / 13.3
	B	96 / 3.8	105 / 4.1	105 / 4.1
	C	163 / 6.4	163 / 6.4	163 / 6.4
100 / 4	A	353 / 13.9	368 / 14.5	394 / 15.5
	B	115 / 4.5	127 / 5.0	137 / 5.4
	C	203 / 8.0	203 / 8.0	203 / 8.0
150 / 6	A	451 / 17.8	473 / 18.6	508 / 20.0
	B	140 / 5.5	159 / 6.3	178 / 7.0
	C	210 / 8.3	210 / 8.3	210 / 8.3

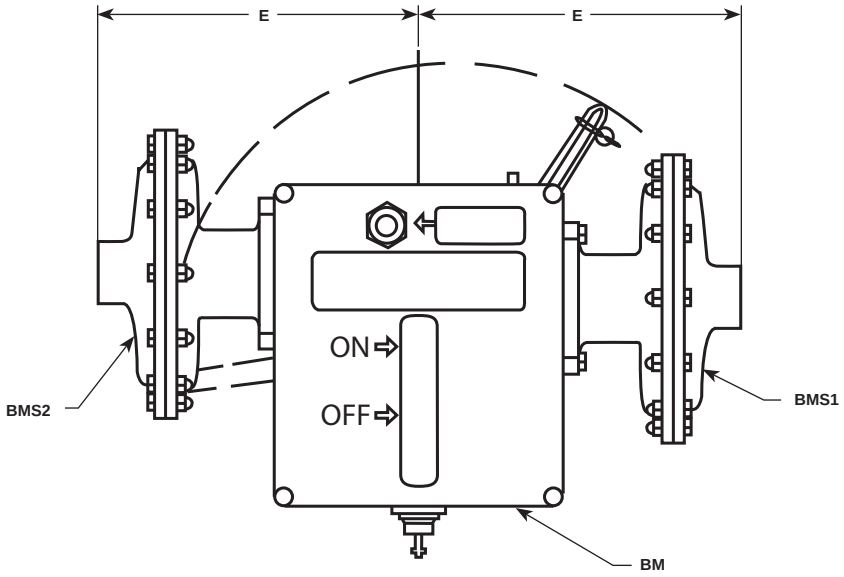


Figure 7. *BM with Two Manometric Sensing Devices (Different Manometric Sensing Device Type can be used to BMS1 and BMS2)*

Table 6. *BM with Two Manometric Sensing Devices (BMS1 and BMS2) Dimensions*

MANOMETRIC SENSING DEVICE (BMS) TYPE	MANOMETRIC SENSING DEVICE (BMS) SIZE, mm / INCH	D, mm / INCH	E, mm / INCH
A	162 / 6.4	81 / 3.2	182 / 7.2
B	71 / 2.8	36 / 1.4	175 / 6.9
C	27 / 1.1	36 / 1.4	205 / 8.1
D	17 / 0.7	36 / 1.4	205 / 8.1

Table 7. *Approximate Weights*

BODY SIZE, DN / INCH	APPROXIMATE SHIPPING WEIGHTS OF TYPE FEQ, kg / Pounds
25 / 1	23 / 51
50 / 2	36 / 79
80 / 3	64 / 141
100 / 4	101 / 223
150 / 6	204 / 450
Note: These data belong to Type FEQ with Manometric Sensing Device (BMS) Type A, WCC body.	

Ordering Information

When ordering, complete the ordering guide on this page. Refer to the Specifications section on page 2. Review the description to the right of each of each specification and the information in each referenced table or figure. Specify your choice whenever a selection is offered.

Ordering Guide

Body Size (Select One)

- ☐ DN 25 / 1-inch***
- ☐ DN 50 / 2-inch***
- ☐ DN 80 / 3-inch***
- ☐ DN 100 / 4-inch***
- ☐ DN 150 / 6-inch***

End Connection (Select One)

- ☐ CL150 RF***
- ☐ CL300 RF**
- ☐ CL600 RF**

Slam-Shut Trip Pressure Setting (Select One)

Overpressure Protection Only (OPSO)

- ☐ Supply setpoint required _____

Underpressure Protection Only (UPSO)

- ☐ Supply setpoint required _____

Overpressure and Underpressure Protection (OPSO/UPSO)

- ☐ Supply overpressure setpoint required _____
- ☐ Supply underpressure setpoint required _____

Manometric Sensing Device (BMS) Type and Trip Pressure Range (Select One)

Type A

- ☐ 0.01 to 0.035 bar / 0.001 to 0.0035 MPa, Purple
- ☐ 0.025 to 0.08 bar / 0.0025 to 0.008 MPa, Orange
- ☐ 0.045 to 0.14 bar / 0.0045 to 0.014 MPa, Red
- ☐ 0.07 to 0.24 bar / 0.007 to 0.024 MPa, Yellow
- ☐ 0.115 to 0.38 bar / 0.0115 to 0.038 MPa, Green
- ☐ 0.14 to 0.75 bar / 0.014 to 0.075 MPa, Gray
- ☐ 0.25 to 1.3 bar/ 0.025 to 0.13 MPa, Brown
- ☐ 0.45 to 2.3 bar/ 0.045 to 0.23 MPa, Black

Type B

- ☐ 1.0 to 5.1 bar / 0.1 to 0.51 MPa, Blue
- ☐ 2.1 to 11 bar / 0.21 to 1.1 MPa, Brown
- ☐ 4.0 to 16 bar / 0.4 to 1.6 MPa, Black

Type C

- ☐ 16 to 22 bar / 1.6 to 2.2 MPa, Brown
- ☐ 22 to 40 bar / 2.2 to 4.0 MPa, Black

Type D

- ☐ 40 to 55 bar / 4.0 to 5.5 MPa, Brown
- ☐ 55 to 100 bar / 5.5 to 10.0 MPa, Black

One Explosion-Proof Limit Switch for Close Position (Optional)

- ☐ With Cable Gland
- ☐ Without Cable Gland

Two Explosion-Proof Limit Switches for Open Position and Close Position (Optional)

- ☐ With Cable Gland
- ☐ Without Cable Gland

Bulletin: Type FEQ

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet

Application:
Specific Use _____
Line Size _____
Gas Type and Specific Gravity _____
Gas Temperature _____

Relief Valve Size:
Brand of upstream regulator? _____
Orifice size of the upstream regulator? _____
Wide-open coefficient of the upstream regulator? _____

Pressure:
Maximum Inlet Pressure (P_{1max}) _____
Minimum Inlet Pressure (P_{1min}) _____
Downstream Pressure Setting(s) (P_2) _____
Maximum Flow (Q_{max}) _____

Performance Required:
Accuracy Requirements? _____
Need for Extremely Fast Response? _____

Other Requirements: _____

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