ISO Registered Company

MODEL BR
BACK PRESSURE / RELIEF REGULATOR

SECTION I

I. DESCRIPTION AND SCOPE

The Model BR is a back pressure relief regulator used to control upstream (inlet) pressure. Sizes are 3/8", 1/2", 3/4", 1", 1-1/2" and 2" (DN 10, 15, 20, 25, 40 and 50) for side (inlet, flow-through,) and bottom (discharge) connections. With proper trim utilization the unit is suitable for liquid, gaseous, or steam service. Refer to Technical Bulletin BR-TB for design conditions and selection recommendations.

⚠ CAUTION

This is not a safety device and must not be substituted for a code approved pressure safety relief valve or a rupture disc.

SECTION II

II. INSTALLATION

1. An inlet block valve should always be installed.

2. If service application is continuous such that shutdown is not readily accomplished, it is recommended that an inlet block valve, outlet block valve, and a manual bypass valve be installed.

3. Pipe unions should be installed to allow removal from piping.

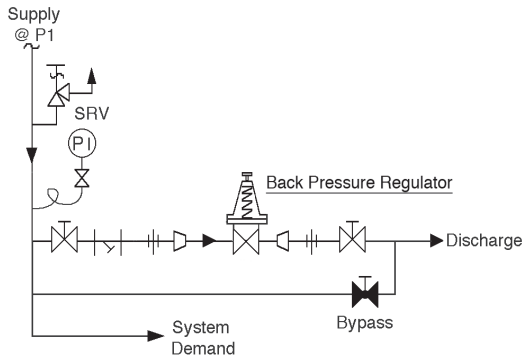
4. An inlet pressure gauge should be located approximately ten pipe diameters upstream and within sight. An outlet pressure gauge is optional.

5. All installations should include an upstream relief device if the inlet pressure could exceed the pressure rating of any equipment or the maximum inlet pressure rating of the unit.

⚠ WARNING

The maximum inlet pressure is equal to 1.5 times the larger number of the stated range spring on the nameplate, and is the recommended "upper operative limit" for the sensing diaphragm. Higher pressures could damage the diaphragm. (Field hydrostatic tests frequently destroy diaphragms. DO NOT HYDROSTATIC TEST THROUGH AN INSTALLED UNIT; ISOLATE FROM TEST.)

6. Clean the piping of all foreign material including chips, welding scale, oil, grease and dirt before installing the regulator. Strainers are recommended.



Recommended Piping Schematic For
Back Pressure/Relief System

7. In placing thread sealant on pipe ends prior to engagement, ensure that excess material is removed and not allowed to enter the regulator upon startup.

8. Flow Direction: Install so the flow direction matches the arrow cast on the body. Connect the inlet pressure to the body side connection(s). Fluid will relieve out of the bottom connection. The double inlet connections are for in-line installation (plug one side connection if in-line installation is not required).

⚠ CAUTION

Installation of adequate overpressure protection is recommended to protect the regulator from overpressure and all downstream equipment from damage in the event of regulator failure.

⚠ CAUTION

For welded installations, all internal trim parts, seals and diaphragm(s) must be removed from regulator body prior to welding into pipeline. The heat of fusion welding will damage non-metallic parts if not removed. NOTE: *This does not apply to units equipped with extended pipe nipples.*

9. Regulator may be installed in a vertical or horizontal pipe. If it is a steam system, assure the piping is properly trapped and oriented.

10. Regulator may be rotated around the pipe axis 360°. Recommended positions are with spring chamber vertical upwards, or horizontal. Orient such that the spring chamber vent hole does not collect rainwater or debris.

11. Regulators are not to be direct buried underground.

12. For insulated piping systems, recommendation is to not insulate regulator.

13. Spring Chamber Vent Tap - All spring chambers are furnished with a 1/8" (DN6) tapped vent hole. See Table 2 for material specifications. specifications. Leave connection vented to atmosphere or pipe to outside or sump (the later if fluid through valve is toxic or could present a hazard) depending on the application and the controlled fluid.

SECTION III

III. PRINCIPLE OF OPERATION

1. Movement occurs as pressure variations register on the diaphragm. The registering pressure is the inlet, P_1 or upstream pressure. The range spring opposes diaphragm movement. As inlet pressure drops, the range spring pushes the diaphragm down, closing the port; as inlet pressure increases, the diaphragm pushes up and the port opens.

2. A complete diaphragm failure may cause the valve to fail closed. A cracked metal diaphragm will leak fluid through the vent hole of the spring chamber, but will continue to operate.

SECTION IV

IV. STARTUP

1. Start with the block valves closed. A bypass valve may be used to maintain system pressure without changing the following steps.

2. Relax the range spring by turning the adjusting screw counterclockwise (CCW) a minimum of three (3) full revolutions. This reduces the inlet (upstream) pressure set point.

3. If it is a “hot” piping system, and equipped with a bypass valve, slowly open the bypass valve to pre-heat the system piping and to allow slow expansion of the piping. Assure proper steam trap operation if installed. Closely monitor inlet (upstream) pressure, via gauge, to assure not over-pressurizing. NOTE: If no bypass valve is installed, extra caution should be used in starting up a cold system; i.e. do everything slowly.

4. Crack open the inlet (upstream) block valve.

5. Slowly open the outlet (downstream) block valve observing the inlet (upstream) pressure gauge. Determine if the regulator is flowing. If not, slowly rotate the regulator adjusting screw counterclockwise (CCW) until flow begins.

6. Continue to slowly open the outlet (downstream) block valve until fully open.

7. Observing the inlet (upstream) pressure gauge, rotate the adjusting screw clockwise (CW) slowly until the inlet pressure begins to rise. Rotate CW until the desired setpoint is reached.

8. Continue to slowly open the inlet (upstream) block valve. If the inlet (upstream) pressure exceeds the desired setpoint pressure, rotate the adjusting screw CCW until the pressure decreases.

9. When flow is established steady enough that both the outlet and inlet block valves are fully open, begin to slowly close the bypass valve if installed.

10. Develop system flow to a level near its expected normal rate, and reset the regulator setpoint by turning the adjusting screw CW to increase inlet pressure, or CCW to reduce inlet pressure.

11. Reduce system flow to a minimum level and observe setpoint. Inlet pressure will rise from the setpoint of Step 9. (Ensure that this rise does not exceed the stated upper limit of the range spring by greater than 50%; i.e. 30-80 psig (2.07-5.52 Barg) range spring, at maximum flow the inlet pressure should not exceed 1.5 x 80 psig (5.6 Barg), or 120 psig (8.3 Barg). If it does, consult factory.)

12. Increase flow to maximum level if possible. Inlet (upstream or P_1) pressure should fall off. Readjust setpoint as necessary at the normal flow rate.

SECTION V

V. SHUTDOWN

1. On systems with a bypass valve, and where system pressure is to be maintained as the regulator is shut down, slowly open the bypass valve while closing the inlet (upstream) block valve. Fully close the inlet (upstream) block valve. (When on bypass, the system pressure must be constantly observed and manually regulated.) Close the outlet (downstream) block valve.

⚠ CAUTION

Do not walk away and leave a bypassed regulator unattended.

2. If the regulator and system are both to be shutdown, slowly close the inlet (upstream) block valve. Close the outlet (downstream) valve only if regulator removal is required.

SECTION VI

VI. MAINTENANCE

⚠ WARNING

SYSTEM UNDER PRESSURE. Prior to performing any maintenance, isolate the regulator from the system and relieve all pressure. Failure to do so could result in personal injury.

A. General:

1. Maintenance procedures hereinafter are based upon removal of the regulator from the pipeline where installed.

2. Owner should refer to owner's procedures for removal, handling, cleaning and disposal of non-reusable parts.

3. Refer to Figure 1 for basic regulator construction. For an angle design with metal seat trim, see Figure 2.

⚠ WARNING

SPRING UNDER COMPRESSION. Prior to removing spring chamber, relieve spring compression by backing out the adjusting screw. Failure to do so may result in flying parts that could cause personal injury.

B. Diaphragm Replacement:

1. Securely install the body (1) in a vise with the spring chamber (2) directed upwards.

2. Relax range spring (13) by turning adjusting screw (6) CCW until removed from spring chamber (2).

3. Draw or embed a match mark between body casting (1) and spring chamber casting (2) along flanged area.

4. Unscrew all diaphragm flange cap screws(8) and remove.

5. Remove spring chamber (2), range spring (13) and spring button (4).

6. The piston hex nut (16) lock washer (17), piston (14), pressure plate (3), and diaphragm (11) assembly can be removed from the body (1). Place the piston (14) into a soft jaw vise, grasping the flats on the piston (14).

7. Separate the hex nut (16) from the piston (14) by turning it CCW. Slide the lock washer (17) over the threads and remove from piston (14). Then take off the pressure plate (3) and inspect to ensure no deformation due to over-pressurization. If deformed, replace.

8. Remove diaphragm (11). For metal diaphragm, also remove diaphragm gasket (12), and piston O-ring (18).

9. Clean body (1) and diaphragm flange.

   NOTE: On valves originally supplied as "special cleaned", option -55 or -36, maintenance must include a level of cleanliness equal to Cashco's cleaning standard #S-1134. Contact factory for details.

10. Install new diaphragm (11). For metal diaphragm, also install piston O-ring (18) and diaphragm gasket (12).

11. Reposition pressure plate (3) over the threaded end of the piston (14). Replace the piston lock washer (17). Apply Locktite 242, or equivalent, onto the threads of the piston. Thread the piston hex nut (16) onto the piston (14). Place

the range spring (13) on to the retainer hub of the pressure plate (3).

12. Place multi-purpose, high temperature grease into depression of spring button (4) where adjusting screw bears. Set spring button (4) onto range spring (13); ensure spring button (4) is laying flat.

13. Aligning the match marks, place spring chamber (2) over the above stacked parts. Install all cap screws (8) by hand tightening. Mechanically tighten cap screws (8) in a cross pattern that allows spring chamber (2) to be pulled down evenly. Recommended torques are as follows:

Regulator wSize	Bolt Size	Metal Dia-phragm	Comp. Diaphragm
3/8" - 1" (DN20,25)	3/8" - 24	30 ft/lbs.	16-20 Ft-Lbs (22-27 N-m)
1-1/2" (DN40)	1/2" - 20	45 ft/lbs.	28-32 Ft-Lbs (38-43 N-m)
2" (DN50)	1/2" - 20	70 ft/lbs.	32-36 Ft-Lbs (43-49 N-m)

NOTE: *Never replace cap screws (8) with just any bolting if lost. Bolt heads are marked with specification identification numbers. Use only proper grades as replacements.*

14. Reinstall adjusting screw (6) with jam nut (7).

15. Soap solution test around cap screws (8), body (1) and spring chamber (2) flanges for leakage. Ensure that an inlet pressure is maintained during this leak test of at least mid-range level; i.e. 30-80 psig (2.07-5.52 Barg) range spring, 60 psig (4.14 Barg) test pressure minimum.

C. Trim Replacement (For Metal Seated Units)**:**

1. Trim removal requires that the diaphragm be removed. Refer to previous procedure Section VI., Sub-section B, Steps 1 through 9.

2. Remove piston (14.) Inspect for excessive wear or nicks.

3. Remove body (1) from vise and place on workbench with the diaphragm flange resting on the workbench.

4. Loosen and remove body cap (5). Remove cylinder (15) and seat (10). Inspect parts for excessive wear, especially at seat surfaces. Replace if worn, nicked or depressed.

5. Clean the body (1) cavity. Clean all parts to be reused.
   NOTE: On regulators originally supplied with Options BR-5 or -36, "special cleaned", maintenance must include a level of cleanliness equal to Cashco's cleaning standard #S-1134. Contact factory for details.

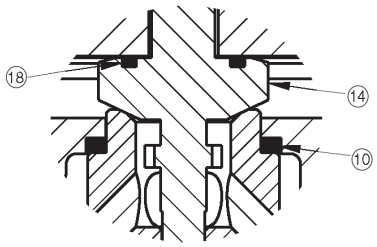
6. Reinstall the seat (10) and the cylinder (15) concentrically within the body cap (5) opening. Apply the appropriate sealant to the body cap (5) and thread it into the body (1).

7. Securely install the body (1) in a vise with the body cap (5) on the bottom and the body (1) flange upwards.

8. Reinstall diaphragm (9) per Section VI., Sub-section B., Steps 10 through 15.

9. Bench test unit for suitable operation. ***NOTE:*** *Regulators are not tight shutoff devices. Even if pressure falls below setpoint, a regulator may or may not develop bubble tight shutoff. In general, tighter shutoff can be expected with composition seat.*

10. Soap solution test around body (1) flange for leakage. Test pressure should be the maximum allowed.



Metal Seat

D. Trim Replacement (For TFE Seated Units)**:**

1. Follow same steps as listed under "Trim Replacement - Metal Seated Units" except for the following guidelines:

2. When inspecting parts for excessive wear (VI.C.4), ensure there are no foreign particles embedded or nicks in the TFE seat.

SECTION VII

VII. TROUBLE SHOOTING GUIDE

1. Erratic Operation; chattering.

Possible Causes	Remedies
A. Oversized regulator.	A1. Check actual flow conditions, resize regulator for minimum and maximum flow. Tighten flange bolting. A2. Increase flow rate. A3. Decrease regulator pressure drop; decrease inlet pressure by placing a throttling orifice in inlet piping union. A4. Install next step higher range spring. A5. Before replacing regulator, contact factory.
B. Inadequate Rangeability.	B1. Increase flow rate. B2. Decrease regulator pressure drop. B3. Install next step higher range spring. Contact factory.

2. Regulator inlet (upstream) pressure too high.

Possible Causes	Remedies
A. Regulator undersized.	A1. Confirm by opening bypass valve together with regulator. A2. Check actual flow conditions, resize regulator; if regulator has inadequate capacity, replace with larger unit.
B. Incorrect range spring (screwing out CCW of adjusting screw does not allow bringing pressure level to a stable and proper level).	B.1 Replace range spring with proper lower range. B.2 Contact factory.
C. Too much build.	C1. Review build expected. C2. Contact factory.
D. Restricted diaphragm movement.	D. Ensure no moisture in spring chamber at temperatures below freeze point. Ensure no dust or debris entering vent opening. If rainwater or debris can enter, reorient spring chamber.

3. Excessive seat leakage.

Possible Causes	Remedies
A. Foreign matter on the seating surface, erosion of the seating surface or foreign matter on the cylinder.	A. Clean or replace seat (TFE) or cylinder. For metal, replace regulator if integral seat is damaged. Replace seal.

4. Leakage through the spring chamber vent hole.

Possible Causes	Remedies
A. Normal-life diaphragm failure.	A. Replace diaphragm.
B. Abnormal short-life diaphragm failure.	B1. Can be caused by excessive chattering. See No. 1. to remedy chatter. B2. Can be caused by corrosive action. Consider alternate diaphragm material. B3. Upstream (inlet) pressure build-up occurring that overstresses diaphragms. Relocate regulator or protect with safety relief valve.

5. Sluggish operation.

Possible Causes	Remedies
A. Plugged spring chamber vent.	A. Clean vent opening.
B. Fluid too viscous.	B. Heat fluid. Contact factory.
C. Broken spring.	C. Replace spring.

SECTION VIII

VIII. ORDERING INFORMATION
NEW REPLACEMENT UNIT vs PARTS "KIT" FOR FIELD REPAIR

To obtain a quotation or place an order, please retrieve the Serial Number and Product Code that was stamped on the metal name plate and attached to the unit. This information can also be found on the Bill of Material ("BOM"), a parts list that was provided when unit was originally shipped. (Serial Number typically 6 digits). Product Code typical format as follows: (last digit is alpha character that reflects revision level for the product).

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NEW REPLACEMENT UNIT:

Contact your local Cashco, Inc., Sales Representative with the Serial Number and Product code. With this information they can provide a quotation for a new unit including a complete description, price and availability.

⚠ CAUTION

Do not attempt to alter the original construction of any unit without assistance and approval from the factory. All purposed changes will require a new name plate with appropriate ratings and new product code to accommodate the recommended part(s) changes.

PARTS "KIT" for FIELD REPAIR:

Contact your local Cashco, Inc., Sales Representative with the Serial Number and Product code. Identify the part s and the quantity required to repair the unit from the "BOM" sheet that was provided when unit was originally shipped.

NOTE: *Those part numbers that have a quantity indicated under "Spare Parts" in column "A" reflect minimum parts required for inspection and rebuild, - "Soft Goods Kit". Those in column "B" include minimum trim replacement parts needed plus those "Soft Goods" parts from column "A".*

If the "BOM" is not available, refer to the cross-sectional drawings included in this manual for part identification and selection.

A Local Sales Representative will provide quotation for appropriate Kit Number, Price and Availability.

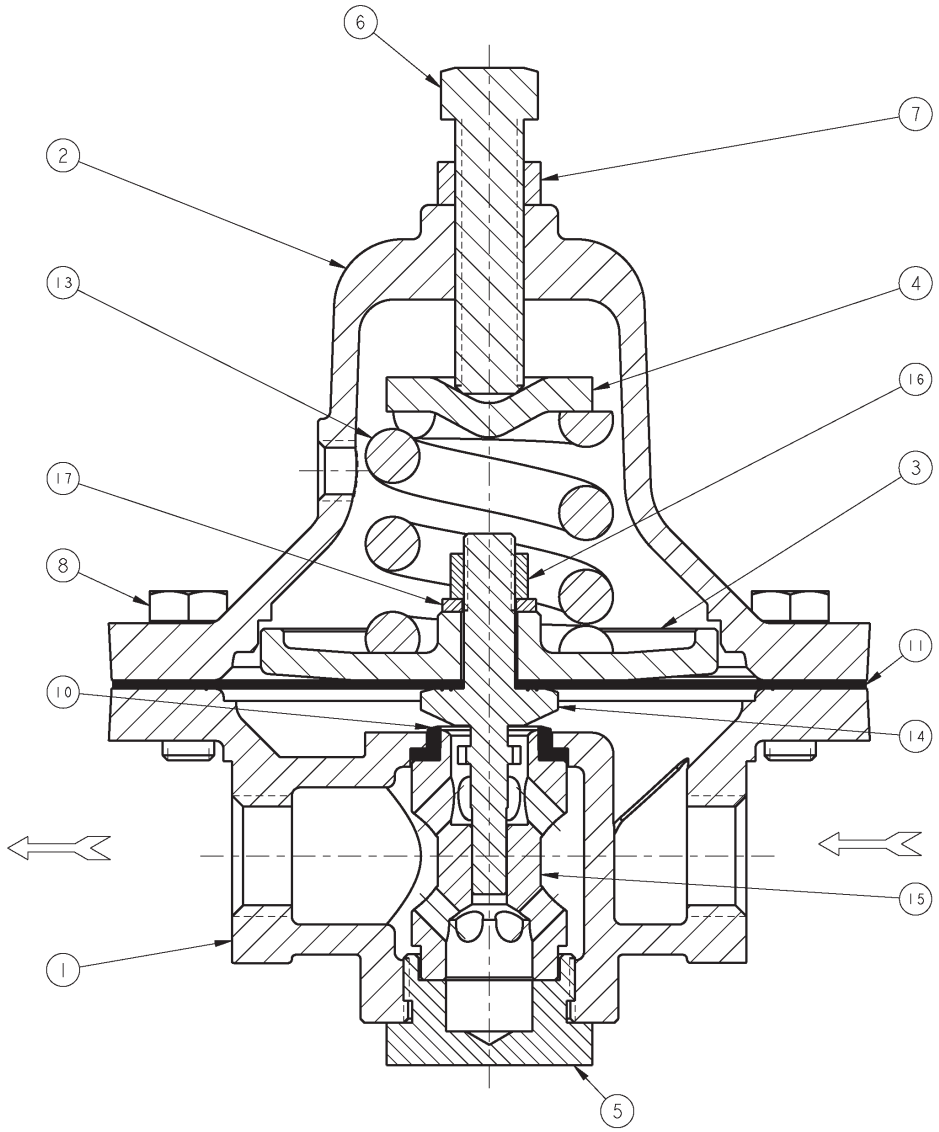

Figure 1
Globe Design
Composition Seat Construction

Item No.	Description
1	Body
2	Spring Chamber
3	Pressure Plate
4	Spring Button
5	Body Cap
6	Adjusting Screw
7	Jam Nut
8	Cap Screw (Diaphragm Flange)
10	Seat (Composition Seat)
	Seal (Metal Seat)
11	Diaphragm
12	Diaphragm Gasket
	(Metal Diaphragm Only)
13	Range Spring

Item No.	Description
14	Piston
15	Cylinder
16	Piston Hex Nut
17	Piston Lock Washer
18	Piston O-ring
	(Metal Diaphragm Only)
19	Body Plug
	(Angle Style Only)
Not Shown:	
9	Name Plate
20	Flow Arrow
21	Flow Arrow Drive Screw
22	Handwheel
23	Locking Lever
24	Spring Pin for Handwheel

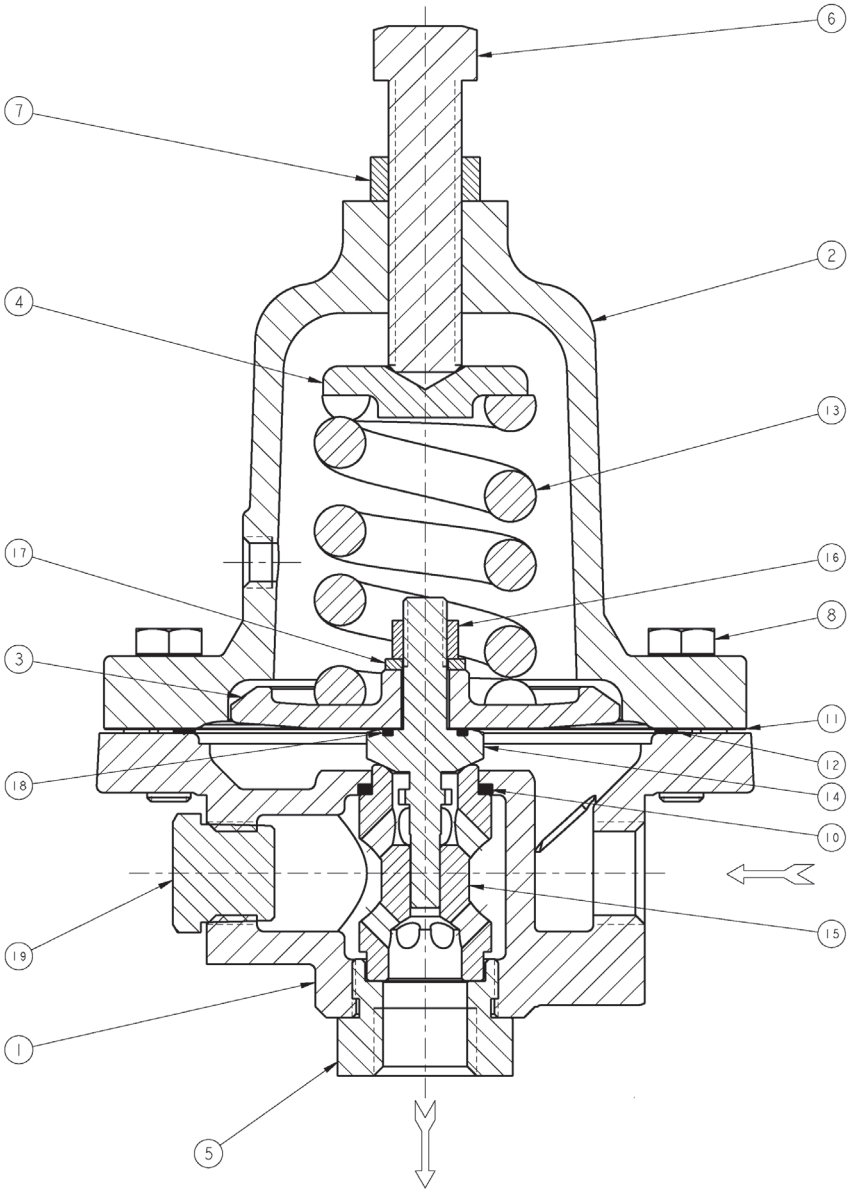

Figure 2
Angle Design
Metal Seat Construction

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IOM ADDENDUM:

ATEX DIRECTIVE 2014/34/EU and THE EQUIPMENT AND PROTECTIVE SYSTEMS INTENDED FOR USE IN POTENTIALLY EXPLOSIVE ATMOSPHERES REGULATIONS 2016

Cashco, Inc. declares that the products listed in the table below has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of products intended for use in potentially explosive atmospheres given in Annex II of the ATEX Directive 2014/34/EU and given in Schedule 1 of The Equipment and Protective Systems Indented for Use in Potentially Explosive Atmospheres Regulations 2016. Compliance with the Essential Health and Safety Requirements has been assured by compliance with EN ISO 80079-36:2016 and EN ISO 80079-37:2016. The product will be marked as follows:

II 2 G
Ex h IIB T6... T1 Gb
1000ATEXR1 X

The 'X' placed after the technical file number indicates that the product is subject to specific conditions of use as follows:

1. The maximum surface temperature depends entirely on the operating conditions and not the equipment itself. The combination of the maximum ambient and the maximum process medium temperature shall be used to determine the maximum surface temperature and corresponding temperature classification, considering the safety margins described prescribed in EN ISO 80079-36:2016, Clause 8.2. Additionally, the system designer and users must take precautions to prevent rapid system pressurization which may raise the surface temperature of system components and tubing due to adiabatic compression of the system gas. Furthermore, the Joule-Thomson effect may cause process gases to rise in temperature as they expand going through a regulator. This could raise the external surface temperature of the regulator body and the downstream piping creating a potential source of ignition. Whether the Joule-Thomson effect leads to heating or cooling of the process gas depends on the process gas and the inlet and outlet pressures. The system designer is responsible for determining whether the process gas temperature may raise under any operating conditions.

2. Where the process medium is a liquid or semi-solid material with a surface resistance in excess of 1GΩ, special precautions shall be taken to ensure the process does not generate electrostatic discharge.

3. Special consideration shall be made regarding the filtration of the process medium if there is a potential for the process medium to contain solid particles. Where particles are present, the process flow shall be <1m/s (<3.3 ft/s) in order to prevent friction between the process medium and internal surfaces.

4. Effective earthing (grounding) of the product shall be ensured during installation.

5. The valve body/housing shall be regularly cleaned to prevent build up of dust deposits.

6. Regulators must be ordered with the non-relieving option (instead of the self-relieving option) if the process gas they are to be used with is hazardous (flammable, toxic, etc.). The self-relieving option vents process gas through the regulator cap directly into the atmosphere while the non-relieving option does not. Using regulators with the self-relieving option in a flammable gas system could create an explosive atmosphere in the vicinity of the regulator.

7. Tied diaphragm regulators with outlet ranges greater than 7 barg (100 psig) should be preset to minimize the risk that improper operation might lead to an outboard leak and a potentially explosive atmosphere.

8. All equipment must only be fitted with manufacturer's original spare parts.

9. Ensure that only non-sparking tools are used, as per EN 1127-1, Annex A.

	PRODUCT
REGULATORS	31-B, 31-N
	1164, 1164(OPT-45)
	1171, 1171(OPT-45), 1171(CRYO)
	2171, 2171(OPT-45), 2171(CRYO), 3171
	1465, 3381, 3381(OPT-45), 3381(OPT-40)
	4381, 4381(OPT-37), 4381(CRYO), 4381(OPT-45), 5381
	MPRV-H, MPRV-L
	PBE, PBE-L, PBE-H
	CA-1, CA-2
	CA1, SA1, CA4, SA4, CA5, SA5
	DA2, DA4, DA5, DA6, DA8
	DA0, DA1, DAP, SAP
	SLR-1, SLR-2, PTR-1
	ALR-1, ULR-1, PGR-1
	BQ, BQ(OPT-45), BQ(CRYO)
	123, 123(CRYO), 123(OPT-45), 123(OPT-46G)
	123-1+6, 123-1+6(OPT-45), 123-1+6(OPT-46G), 123-1+6+S, 123-1+6+S(OPT-40)
	1000HP, 1000HP(OPT-37), 1000HP(OPT-45), 1000HP(OPT-45G), 1000HP(CRYO)
	1000HP-1+6, 1000HP-1+8, 1000LP, 1000LP(OPT-45), 1000LP(OPT-46G)
	6987
	8310HP, 8310HP-1+6, 8310HP-1+8, 8310LP, 8311HP, 8311LP
	345, 345(OPT-45)
	BA1/BL1, PA1/PL1
	C-BPV, C-PRV, C-CS
	D, D(CRYO), D(OPT-37), D(OPT-20), D(OPT-45)
	DL, DL(LCC), DL(OPT-45)
	BR, BR(CRYO)
	HP, HP(LCC), HP(OPT-45), HP(OPT46G), HP-1+6+S(OPT-40), HP-1+6+S
	P1, P2, P3, P4, P5, P7
	B2, B7
	POSR-1, POSR-2
	5200P, 5300P
	135
	NW-PL, NW-SO
	CG-PILOT
	FG1
CONTROL VALVES	RANGER, 987, PREMIER
	964, 521, 988, 988-MB, 989
	2296/2296HF
	SCV-30, SCV-S
TANK BLANKETING	8700, 8910, 8920, 8930, 8940
	2100, 2199
	3100, 3200, 3300, 3400, 3500, 3600, 3700
	1078, 1088, 1100, 1049
	5100, 5200, 5400 ,5500
	4100, 4200, 4300, 4400, 4500, 4600
MISC	764P/PD, 764-37, 764T

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