



ISO Registered Company

# MODELS 1171 AND 2171 BACK PRESSURE / RELIEF REGULATORS

## SECTION I

### I. DESCRIPTION AND SCOPE

Models 1171 and 2171 are back pressure/relief regulators used to control upstream (inlet or  $P_1$ ) pressure. Sizes are 1/4", 3/8" and 1/2" (DN8, DN10 and DN15). The 1171 is a bronze bodied unit; the 2171 incorporates a stainless steel body. With proper trim utilization, both units are suitable for liquid, gaseous and steam service (the 2171 can also be used with various chemicals). Refer to Technical Bulletins 1171-TB and 2171-TB for specific design conditions and selection recommendations.

The instructions in this manual will refer to both models, unless otherwise stated.

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

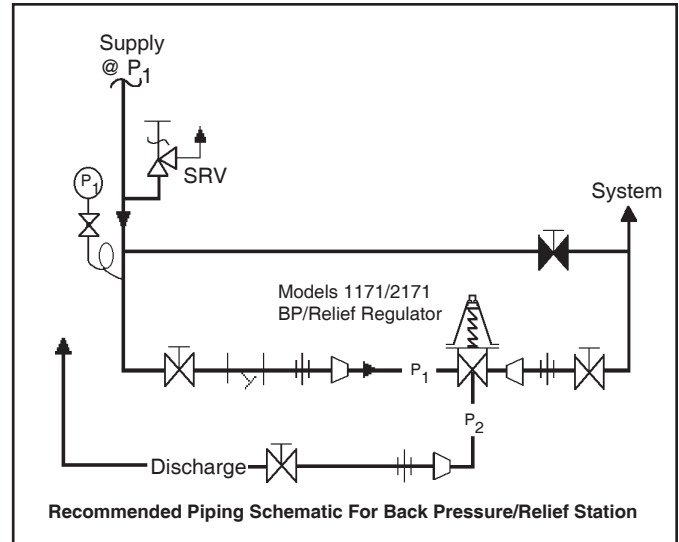
## SECTION II

### II. INSTALLATION

**⚠ 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.

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.

**⚠ CAUTION**  
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.)



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.
6. Clean piping of all foreign material including chips, welding scale, oil, grease and dirt before installing the regulator. Strainers are recommended.
7. In placing thread sealant on pipe ends prior to engagement, assure that excess material is removed and not allowed to enter regulator upon startup.

8. 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).
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.A. Basic Regulator - (Refer to Figure 1, Model 1171 or 2171): Regulator may be rotated around the pipe axis 360°. Recommended position is with spring chamber vertical upwards. Orient such that the spring chamber vent hole does not collect rainwater.
- 10.B. Cryogenic Regulator - Options 1171-5 and 2171-36 (Refer to Figure 2, Model 1171 or 2171):
  - a. Recommended installation is with spring chamber hanging directly below the body in a vertical downwards orientation. Allows water to drain; etc.
  - b. Recommend inert purge gas to spring chamber through vent hole and out drain hole.
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 – Option -25: Pipe spring chamber vent opening to remote location.



## 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.**

### 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 will cause the regulator to fail closed.

### SECTION IV

#### IV. START-UP

1. Start with the block valves closed. A bypass valve may be used to maintain inlet pressure in upstream system without changing following steps.
2. Relax the range spring by turning the adjusting screw counter clockwise (CCW) a minimum of three (3) full revolutions. This reduces the inlet (upstream) pressure setpoint.
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 counter clockwise (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. Using a downstream valve, reduce system flow to a minimum level and observe setpoint. Inlet pressure will rise from the setpoint of Step 9. (Ensure this rise does not exceed the stated upper limit of the range spring (16) by greater than 50%, i.e. 20-80 psig (1.4 - 5.5 Barg) range spring, at maximum flow the inlet pressure should not exceed 1.5 x 80 psig (5.5 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 to both be shut down, 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 unit from the pipeline where installed.
2. Owner should refer to owner's procedures for removal, handling, cleaning and disposal of nonreusable parts, i.e. gaskets, etc.
3. Refer to Figure 1, Model 1171 or 2171 for the basic regulator and Figure 2, Model 1171 or 2171 for the cryogenic regulator. Blow-ups of options and the composition seat trim are on either drawing.

#### B. Diaphragm Replacement - Model 1171:



### CAUTION

**To prevent damage to body, use lead jaws when placing body in a vise. Position body so that vise closes over the side inlet connections.**

1. Install the body (1) in a vise with the spring chamber (2) oriented upwards.

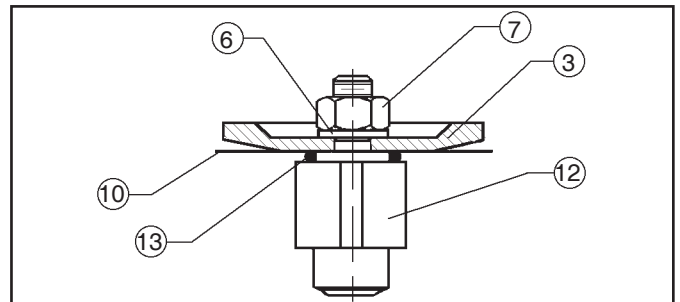


### WARNING

**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.**

2. Relax range spring (16) by turning adjusting screw (5) CCW until removed from spring chamber (2).

3. Loosen spring chamber (2) by placing wrench on "flats" and rotating CCW making sure **not** to use the flats on either side of the vent hole.
4. Remove spring chamber (2), range spring (16), spring button (4).
5. Remove the diaphragm subassembly consisting of the pressure plate nut (7), lock washer (6), pressure plate (3), diaphragm (10), piston O-ring (13) and piston (12).  
**NOTE:** Refer to the quantity of diaphragms (10) incorporated per the bill of materials. Depending on inlet pressure level, multiple metal diaphragms (10) may be "stacked".
6. Loosen pressure plate nut (7) and separate all parts (3, 6, 7, 10, 12 & 13) of the diaphragm subassembly.



**Model's 1171/2171 Diaphragm Subassembly**

7. Inspect pressure plate (3) to ensure no deformation due to over-pressurization. If deformed, replace.
8. Remove diaphragm gasket (11). (If a composition diaphragm is used there is no diaphragm gasket (11)).
9. Clean body (1) and diaphragm flange.  
**NOTE:** On regulators originally supplied as "oxygen clean", Options 1171-5 & -55, 2171-36 & -55, maintenance must include a level of cleanliness equal to Cashco's cleaning standard #S-1134. Contact factory for details.

10. Reassemble diaphragm subassembly by placing piston O-ring (13), diaphragm(s) (10), pressure plate (3) and lock washer (6) over threaded post of piston(12). Assure the pressure plate (3) is placed with curved outer rim down next to the diaphragm (10) surface. Place a thread sealant compound similar to Loctite #271 on the threads of the piston's post (12) prior to tightening the pressure plate nut (7) to the following torque values:

Sizes	Diaphragm		Torque	
	ALL	Metal	60 In-lbs	(6.8 N-m)
Composition		15 In-lbs	(1.7 N-m)	

11. Formetal diaphragm(s) (10), place diaphragm gasket (11) into body (1) recess (none required for composition diaphragm). Set diaphragm subassembly into the body.
12. Place the range spring (16) over the pressure plate nut (7) of the diaphragm subassembly.
13. Place multipurpose, high temperature grease into depression of spring button (4) where adjusting screw bears. Set spring button (4) onto range spring (16); assure spring button is laying flat on spring.
14. Rotate the spring chamber (2) CW by hand into the threaded portion of the body (1) assuring not to cross thread. **NOTES:** *Inspect and clean threads prior to reassembly. For the Model 2171 apply an appropriate thread lubricant to the spring chamber (2) threads prior to reassembly to prevent seizing together with body (1).* Continue hand rotating CW until firmly seated against the upper diaphragm gasket (11). Tighten the spring chamber (2) and body (1) connection to the following torque value: All sizes - 30-35 Ft. lbs (41-47 Nm).
15. Reinstall adjusting screw (5) with locknut (8) into the spring chamber (2).
16. Pressurize body with air and spray liquid leak detector around body (1) and spring chamber (2) to test for leakage. Ensure that an inlet pressure is maintained during this leak test of at least mid-range spring level; i.e. 20-80 psig (1.4-5.5 Barg) range spring, 50 psig (3.4 Barg) test pressure minimum.

#### C. Diaphragm Replacement - Model 2171:

1. Procedures are the same as Model 1171.
2. For SST body (1) and SST spring chamber (2), use thread lubricant to minimize potential of seizing threads.

#### D. Special Instructions for Diaphragm Removal:

1. If the TFE coated diaphragm is utilized on the Model 2171, the TFE coating is the wetted side of the diaphragm.

2. If the Option -2 handwheel is utilized, the adjusting screw (5) and locknut (8) are replaced with a handwheel (17) and lock nut (8). With the Option-22 panel mounting w/ handwheel, the adjusting screw and lock nut are replaced with a handwheel (17), lock nut (8) and a panel mounting nut (18).
3. Use only those gaskets manufactured and supplied by Cashco, Inc.

#### E. Piston / Seat Replacement:

1. Trim removal requires that diaphragm subassembly be removed and disassembled. Refer to previous procedure, Section VI.B.
2. Inspect inside surface of cylinder wall inside the body. **(NOTE: The cylinder is an integral part of the body. Replace the regulator should any damage be noted on the cylinder or seat surfaces).** If there are no signs of erosion/ wear on seating surfaces, piston (12) alone may be replaced.

#### Standard 1171/2171 Composition Seat

If composition seat (14) is damaged or worn, rotate the set screws (15) CCW to remove. Grasp the seat and pull it out of the piston (12). Insert new seat into the end of the piston and install set screws to hold the seat in place.

#### Option-80 2171 Composition Seat

If composition seat (14) is damaged or worn, rotate the seat screws (15) CCW to remove. Place new seat (14) onto the end of the piston. Apply Loctite 242 Blue to the seat screw (15). Fasten assembly together and torque to 96 in/oz.

3. Clean body (1) cavity. Clean all parts to be reused. **NOTE:** *On regulators originally supplied as "oxygen clean", Option's 1171-5-55, 2171-36-55, maintenance must include a level of cleanliness equal to Cashco's cleaning standard #S-1134. Contact factory for details.*
4. Use special care cleaning the body (1) and cylinder shoulder, as this pressurized joint is metal-to-metal with no gasket.
5. Reinstall diaphragm subassembly per Section VI.B., Diaphragm Replacement.
6. Bench test unit for suitable operation. **NOTE:** *Regulators are not tight shut off devices. Even if pressure falls below setpoint, a regulator may or may not develop bubble tight shut off. In general, tighter shut off can be expected with composition seat.*
7. Spray liquid leak detector to test for leakage around body (1) and spring chamber (2). Test pressure should be the maximum allowed by the range spring (16) at the inlet.

## SECTION VII

### VII. TROUBLE SHOOTING GUIDE

#### 1. Erratic operation; chattering.

Possible Causes	Remedies
A. Oversized regulator.	A1. Check actual flow conditions, re-size regulator for minimum and maximum flow. 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. Contact factory A5. Before replacing regulator, contact factory.
B. Worn piston; inadequate guiding.	B. Replace regulator.

#### 2. Regulator inlet (upstream) too high:

Possible Causes	Remedies
A. Regulator undersized.	A1. Confirm by opening bypass valve together with regulator. A2. Check actual flow conditions, re-size regulator; if regulator has inadequate capacity, replace with larger unit.
B. Incorrect range spring (screwing in CW of adjusting screw does not allow bringing pressure level up to proper level.	B. Replace range spring with proper lower range. B.2 Contact factory.
C. Too much rise (build).	C1. Review rise (build) expected. C2. Contact factory.

#### 3. Leakage through the spring chamber vent hole.

Possible Causes	Remedies
A. Normal-life diaphragm failure.	A1. 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. For composition diaphragms, ensure not subjecting to over temperature conditions. B4. Upstream (inlet) pressure build-up occurring that overstresses diaphragms. Relocate regulator or protect with safety relief valve.

#### 4. Sluggish operation.

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



## 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 parts and the quantity required to repair the unit from the "BOM" sheet that was provided when unit was originally shipped.

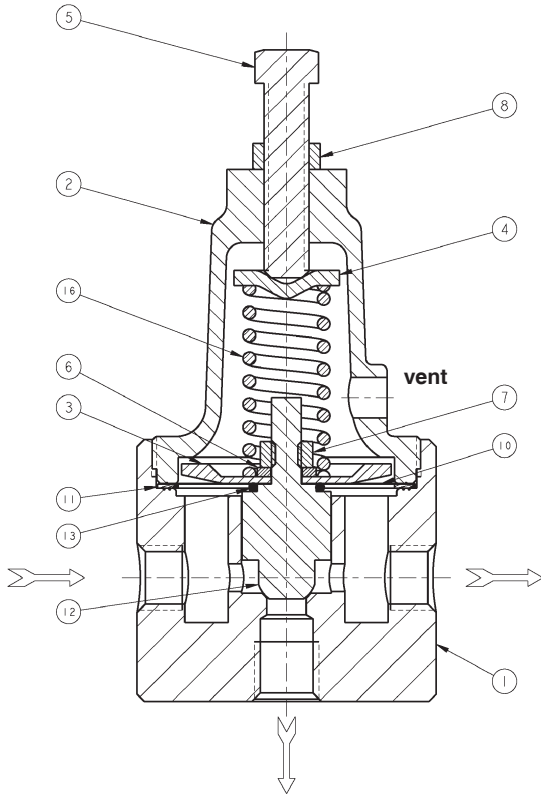
**NOTE:** *Those part numbers that have a quantity indicated under "Spare Parts" in column "A" reflect minimum parts required for inspection and rebuild, - "Soft Goods Kit". Those in column "B" include minimum trim replacement parts needed plus those "Soft Goods" parts from column "A".*

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

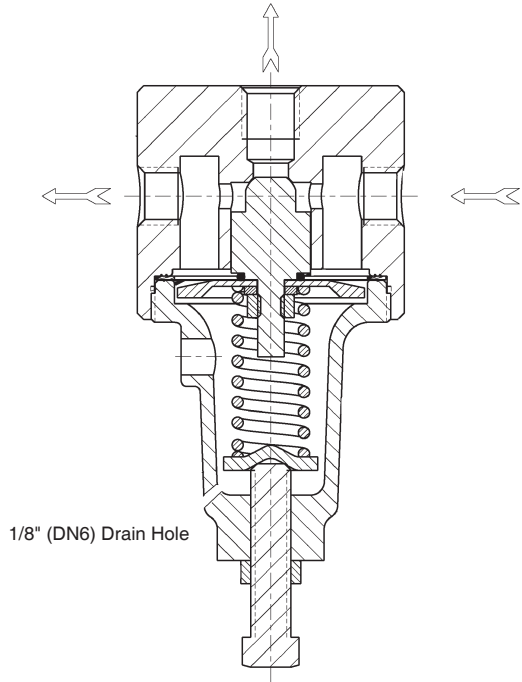
A Local Sales Representative will provide quotation for appropriate Kit Number, Price and Availability.

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# MODEL 1171

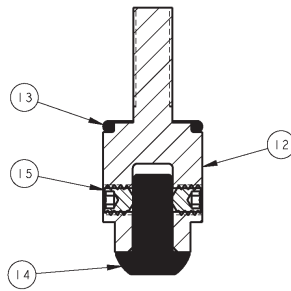


**Figure 1: Basic Model 1171 with Metal Seat Design**

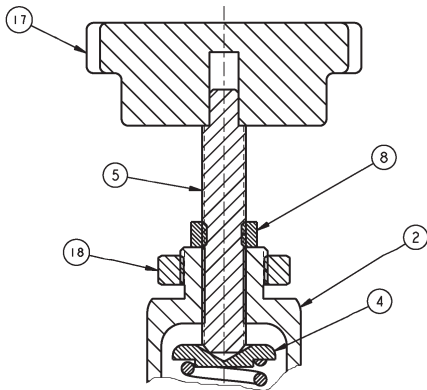


**Figure 2: Option -5 Cryogenic, Model 1171, Metal Seat Design**

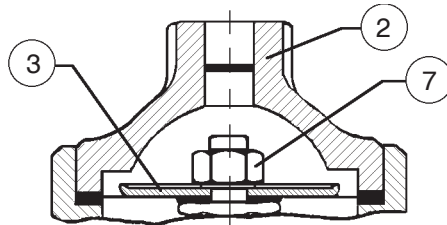
(NOTE: Mount in Horizontal line with Adjusting Screw down as shown.)



**Composition Seat Design**



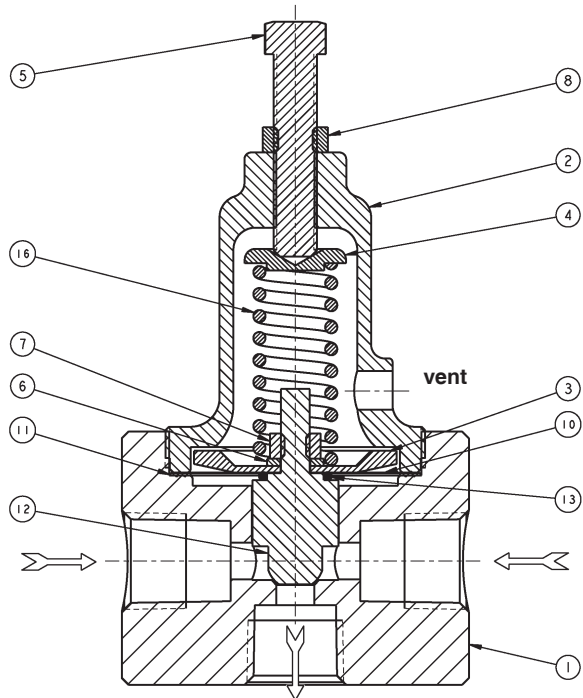
**Option -22 Panel Mounting (handwheel portion is same for Option -2 Handwheel) Spring Chamber Thread 3/4"-16 UNF-2A**



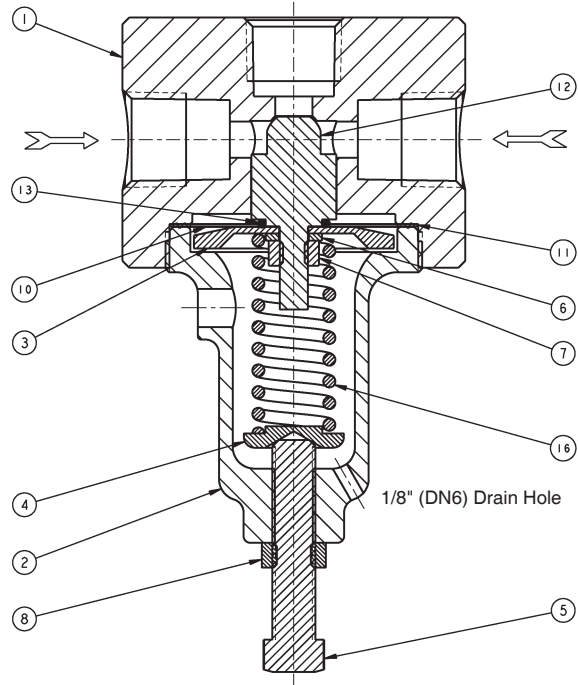
**Option -20, Dome Loaded**

Item No.	Description	Repair Kit B
1	Body	
2	Spring Chamber	
3	Pressure Plate	
4	Spring Button	
5	Adjusting Screw or Handwheel Assy	
6	Lock Washer	
7	Pressure Plate Nut	
8	Adjusting Screw Lock Nut	
9	Nameplate (Not Shown)	
10	Diaphragm(s)	††
11	Diaphragm Gasket	††
12	Piston	††
13	Piston O-ring	††
14	Composition Seat	††
15	Seat Set Screws	††
16	Range Spring	
17	Handwheel	
18	Mounting Nut	

# MODEL 2171

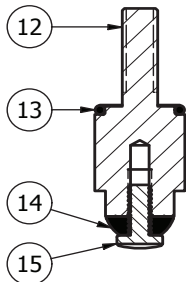


**Figure 1:** Basic Model 2171 with Metal Seat Design

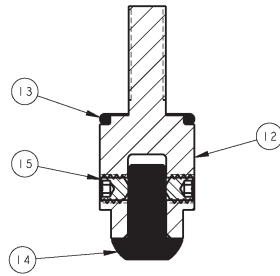


**Figure 2:** Option -36 Cryogenic, Model 2171, Metal Seat Design

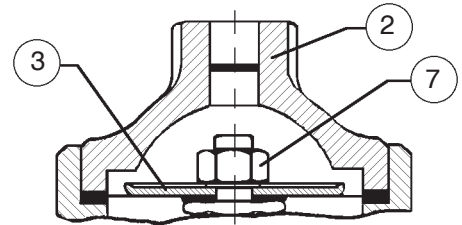
(NOTE: Mount in Horizontal line with Adjusting Screw down as shown.)



Option-80, Composition Seat Design

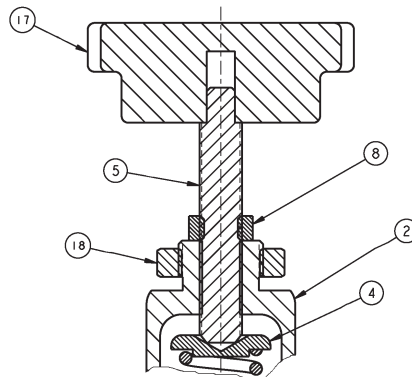


Standard Composition Seat Design

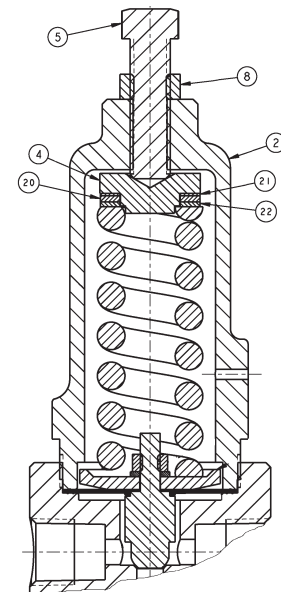


Option -20, Dome Loaded

Item No.	Description	Repair Kit B
1	Body	
2	Spring Chamber	
3	Pressure Plate	
4	Spring Button	
5	Adjusting Screw or Handwheel Assy	
6	Lock Washer	
7	Pressure Plate Nut	
8	Adjusting Screw Lock Nut	
9	Nameplate (Not Shown)	
10	Diaphragm(s)	††
11	Diaphragm Gasket	††
12	Piston	††
13	Piston O-ring	††
14	Composition Seat	††
15	Seat Set Screws	††
16	Range Spring	
17	Handwheel	
18	Mounting Nut	
20	Thrust Bearing	
21	Upper Bearing Washer	
22	Lower Bearing Washer	



Option -22 Panel Mounting (Handwheel portion is same for Option -2 Handwheel) Spring Chamber Thread 3/4"-16 UNF-2A




Option -80, High Pressure Spring Chamber Construction



## ATEX 2014/34/EU: Explosive Atmospheres and Cashco Inc. Products



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. 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:

CE  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
<b>REGULATORS</b>	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	
<b>CONTROL VALVES</b>	RANGER, 987, PREMIER
	964, 521, 988, 988-MB, 989
	2296/2296HF
	SCV-30, SCV-S
	FL800/FL200
<b>TANK BLANKETING</b>	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
<b>MISC</b>	764P/PD, 764-37, 764T

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Printed in U.S.A. IOM-1171/2171