

MODELS 3381 AND 4381

PRESSURE REDUCING REGULATORS

SECTION I

I. DESCRIPTION AND SCOPE

Models 3381 and 4381 are pressure reducing regulators used to control downstream (outlet or P₂) pressure. Sizes are 1/4" and 3/8" (DN8 and DN10) for the 3381. Sizes for the 4381 are 1/4", 3/8", and 1/2" (DN8, DN10, and DN15). The 3381 is a bronze bodied unit; the 4381 incorporates a stainless steel body. With proper trim utilization, both units are suitable for liquid, gaseous and steam service (the 4381 can also be used with various chemicals). Refer to Technical Bulletins 3381-TB and 4381-TB for specific design conditions and selection recommendations.

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

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.

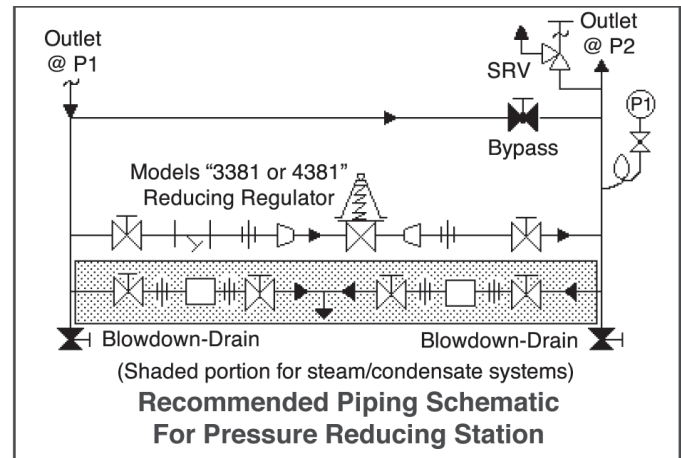
⚠ CAUTION

Option-1+6 contains single diaphragm construction. In the event of diaphragm failure, the process fluid will mix with the loading fluid. Please alert your representative so an alternative product can be selected.

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 outlet pressure gauge should be located approximately ten pipe diameters downstream, and within sight.
5. All installations should include a downstream relief device if the inlet pressure could exceed the pressure rating of any downstream equipment or the maximum outlet pressure rating of the unit.
6. Clean the piping of all foreign material including chips, welding scale, oil, grease and dirt

⚠ 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.



before installing the regulator. Strainers are recommended.

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 main regulator body.
9. For best performance, install in well drained horizontal pipe, properly trapped if a steam service application.

- 10 A. Basic Regulator - (Refer to Figure 1, Model 3381 or 4381): 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.
- 10B. Cryogenic Regulator - Options 3381-5 and 4381-36 (Refer to Figure 2, Model 3381 or 4381):
 - 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 be supplied to spring chamber through vent hole and be discharged out drain hole.

- 11. Regulators are not to be buried underground.
- 12. For insulated piping systems, recommendation is to not insulate regulator.

SECTION III

III. PRINCIPLE OF OPERATION


- 1. Movement occurs as pressure variations register on the diaphragm. The registering pressure is the outlet, P_2 , or downstream pressure. The range spring opposes diaphragm movement. As

outlet pressure drops, the range spring pushes the diaphragm down, opening the port; as outlet pressure increases, the diaphragm pushes up and the port opening closes.

- 2. A complete diaphragm failure will cause the regulator to fail open.

SECTION IV

IV. STARTUP


CAUTION

The maximum outlet pressure is listed on the nameplate as the upper range spring pressure level, and is the recommended "upper operative limit" for the sensing diaphragm (See Section IV. Startup, Step 7). Higher pressures could damage the diaphragm. (Field hydrostatic tests frequently destroy diaphragms. **DO NOT HYDROSTATIC TEST THROUGH AN INSTALLED UNIT; ISOLATE FROM TEST.**)

- 1. Start with the block valves closed. A bypass valve may be used to maintain outlet pressure in the downstream system without changing the 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 outlet (downstream) pressure set point.
- 3. If it is a "hot" piping system, and equipped with a bypass valve, slowly open the bypass valve to preheat the system piping and to allow slow expansion of the piping. Ensure proper steam trap operation if installed. Closely monitor outlet (downstream) pressure via gauge to ensure 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 outlet (downstream) block valve.

- 5. Slowly open the inlet (upstream) block valve observing the outlet (downstream) pressure gauge. Determine if the regulator is flowing. If not, slowly rotate the regulator adjusting screw clockwise (CW) until flow begins.
- 6. Continue to slowly open the inlet (upstream) block valve until fully open.
- 7. Continue to slowly open the outlet (downstream) block valve, especially when the downstream piping system isn't pressurized. If the outlet (downstream) pressure exceeds the desired pressure, close the block valve and go to Step 2, then return to Step 4.
- 8. When flow is established steady enough that the outlet (downstream) block valve is fully open, begin to slowly close the bypass valve if installed.
- 9. Develop system flow to a level near its expected normal rate, and reset the regulator set point by turning the adjusting screw CW to increase outlet pressure, or CCW to reduce outlet pressure.
- 10. Reduce system flow to a minimum level and observe set point. Outlet pressure will rise from the set point of Step 9. The maximum rise in outlet pressure on decreasing flow should not exceed the stated upper limit of the range spring by greater than 10%; i.e. 20-80 psig (1.38-5.52 Barg) range spring. (Example: at low flow the outlet pressure should not exceed 88 psig (6.07 barg), if it does, consult factory).

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 3381 or 4381 for the basic regulator and Figure 2, Model 3381 or 4381 for the cryogenic regulator. Blow-ups of options and the composition seat trim are on either drawing.

B. Diaphragm Replacement - Model 3381:

CAUTION

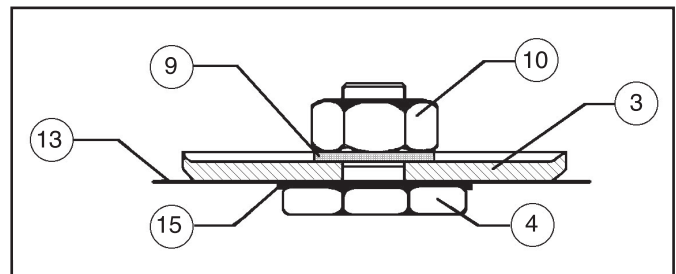
To prevent damage to body, use soft jaws when securing the body in a vise. Position so that vise closes over the inlet and the outlet connections.

WARNING

SPRING UNDER COMPRESSION. Prior to removing the 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.

1. Securely body (1) in a vise with the spring chamber (2) oriented upwards.
2. Relax range spring (17) by turning adjusting screw (8) 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 flat where the vent hole is located.
4. Remove spring chamber (2), range spring (17) and spring button (5).
5. Remove the diaphragm subassembly consisting of the pressure plate nut (10), lock washer (9), pressure plate (3), diaphragm (13), pusher plate seal (15) and pusher plate (4). **NOTE:** Refer to the quantity of diaphragms (13) incorporated per the bill of materials listing. Depending on outlet pressure level, multiple metal diaphragms may be "stacked".
6. Loosen pusher plate nut (10) and separate all parts (3, 4, 9, 13 & 15) of the diaphragm subassembly.



Diaphragm Subassembly

7. Inspect pressure plate (3) to ensure no deformation due to over-pressurization. If deformed, replace.
8. Remove diaphragm gasket (14). (If a composition diaphragm is used there is no diaphragm gasket (14).
9. Clean body (1) and diaphragm flange. Do not scratch diaphragm gasket seating surface. **NOTE:** On regulators originally supplied as "oxygen clean", Options 3381-5 & -55, 4381-36 & -55, maintenance must include a level of cleanliness equal to Cashco's cleaning

standard #S-1134. For regulators originally supplied as “cleaned for Pharmaceutical and Food applications” Options 4381-37 and 4381-37S, maintenance must include a level of cleanliness equal to Cashco cleaning standard #S-1576. Contact factory for details.

10. Reassemble diaphragm subassembly by placing pusher plate seal (15) over threaded post of pusher plate (4), placing diaphragm(s) (13) and pressure plate (3) over the threaded post. Assure the pressure plate (3) is placed with curved outer rim down next to the diaphragm (13) surface. Place a thread sealant compound on the threads of the pusher plate post (4) prior to tightening the pusher plate nut (10) to the following torque values:

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

11. For metal diaphragm(s) (13), place diaphragm gasket (14) into body (1) recess (none required for composition diaphragm). Set diaphragm subassembly into the body.
12. Place the range spring (17) over the pusher plate nut (10) of the diaphragm subassembly.
13. Place multipurpose, high temperature grease into depression of spring button (5) where adjusting screw (8) makes contact. Set spring button (5) onto range spring (17); ensure spring button (5) is laying flat on top of spring.
14. Rotate the spring chamber (2) CW by hand into the threaded portion of the body (1) ensuring not to cross thread. Continue rotating CW into the body and tighten approximately 1/4 turn past initial contact with the diaphragm. Use caution when tightening the spring chamber, contact with the wrench on the vent hole boss may damage it.
15. Reinstall adjusting screw (8) with locknut (11) into the spring chamber (2).
16. Pressurize with air and spray liquid leak detector to test around body (1) and spring chamber (2) for leakage. Ensure that an outlet 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 4381:

1. Procedures are the same as Model 3381.

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 (13) is utilized on the Model 4381, the TFE coating is the wetted side of the diaphragm.
2. If the Option-2 is utilized, the adjusting screw (8) and locknut (11) are replaced with a handwheel (18) and lock nut (11). With the Option-22 panel mounting w/handwheel, the adjusting screw (8) and lock nut (11) are replaced with a handwheel (18), lock nut (11) and a panel mounting nut (19).
3. If the Option-1+6 is utilized with metal diaphragms, there will be one diaphragm gasket (14) on top of and one below the diaphragm(s).



CAUTION

Option-1+6 contains single diaphragm construction. In the event of diaphragm failure, the process fluid will mix with the loading fluid. Please alert your representative so an alternative product can be selected.

E. Trim Replacement:

1. Secure body (1) in a vise with the body cap (6) oriented up and the spring chamber (2) downwards.



CAUTION

To prevent damage to the body, use soft jaws when securing body in a vise. Position body so that vise closes over the inlet and the outlet connections.

2. Loosen and remove body cap.
3. Remove piston spring (7), and piston (16). Note that the seat and piston guide are integral parts of the body (1) casting. Inspect integral seat and guide for excessive wear, especially at seat surfaces. Replace if worn, nicked or depressed. If integral seat is nicked, use seat lapping compound to remove. Valves equipped with Opt-4 Stabilizer will have the u-cup stabilizer seal (30) removed when the piston (16) is removed from body (1). Remove stabilizer seal (30), if installed.

NOTE: When piston (16) assemblies are used with composition seats, Cashco, Inc. does not recommend attempting to remove the composition seat. If composition seat is damaged, replace entire piston assembly.

4. Clean flat mating surfaces of body (1) to body cap (6) shoulder. Be careful not to scratch either surface.
5. Clean debris from within the body (1) cavity. Parts to be reused should be cleaned according to owner's procedures. **NOTE:** *On regulators originally supplied as "oxygen clean", Options 3381-5 & -55, 4381-36 & 55 maintenance must include a level of cleanliness equal to Cashco's cleaning standard #S-1134. For regulators originally supplied as "cleaned for Pharmaceutical and Food applications" Options 4381-37 and 4381-37S, maintenance must include a level of cleanliness equal to Cashco cleaning standard #S-1576. Contact factory for details.*
6. If supplied with Opt-4 Stabilizer, install new stabilizer seal (30) properly oriented onto piston (16).
7. Slide the piston (16), including stabilizer seal (30) if supplied, slowly into the body cavity. Use thumbs to ease stabilizer seal(30) into the body cavity.
8. Place piston spring (7) over spring hub of the piston (16).
9. Apply pipe thread sealant to the body cap (6) threads. Screw body cap (6) into body (1). When body cap is fully down against body (1) at the body cap (6) shoulder, impact the body cap (6) into the body (1). **NOTE:** *When unit is put into service and pressurized, these two parts seal metal-to-metal with no gasket.*
10. Bench test unit for suitable operation. **NOTE:** *Regulators are not tight shutoff devices. Even if pressure builds up beyond set point, a regulator may or may not develop bubble tight shutoff. In general, tighter shutoff can be expected with composition seat.*
11. Pressurize with air and spray liquid leak detector to test around body cap (6) and body (1) for leakage. Test pressure should be a minimum of 100 psig (6.9 Barg) at the inlet.

SECTION VII

VII. TROUBLE SHOOTING GUIDE

1. Erratic operation; chattering.

Possible Causes	Remedies
A. Oversized regulator; inadequate rangeability.	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 trim (possible body replacement).
C. Weakened/broken piston spring.	C. Replace piston spring. Determine if corrosion is causing the failure.

2. Regulator can't pass sufficient flow.

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 higher range. Contact factory.
C. Too much droop.	C1. Review droop expected. C2. Contact factory.

3. 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. For composition diaphragms, ensure not subjecting to over-temperature conditions. B4. Downstream (outlet) pressure buildup occurring that overstresses diaphragms. Relocate regulator or protect with safety relief valve.

4. Sluggish operation.

Possible Causes	Remedies
A. Fluid too viscous.	A. Heat fluid. Contact factory.

5. Excessive pressure downstream.

Possible Causes	Remedies
A. Regulator not closing tightly.	A. Inspect the seating. Clean and lap metal seat surfaces; replace if lapping does not remedy. If composition seats are depressed, nicked or embedded with debris, replace trim.
B. Downstream block.	B. Check system; isolate (block) flow at regulator inlet - not outlet. Relocate regulator if necessary.
C. No pressure relief protection.	C. Install safety relief valve, or rupture disc.
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 regulator.

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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PARTS "KIT" for FIELD REPAIR:

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.

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.

 **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.

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MODEL 3381

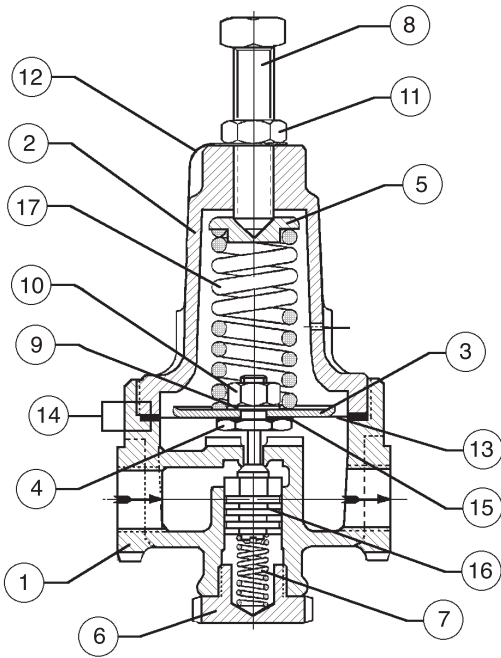
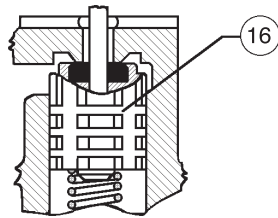


Figure 1:
Basic Model 3381 with Metal Seat Design



Composition Seat Design

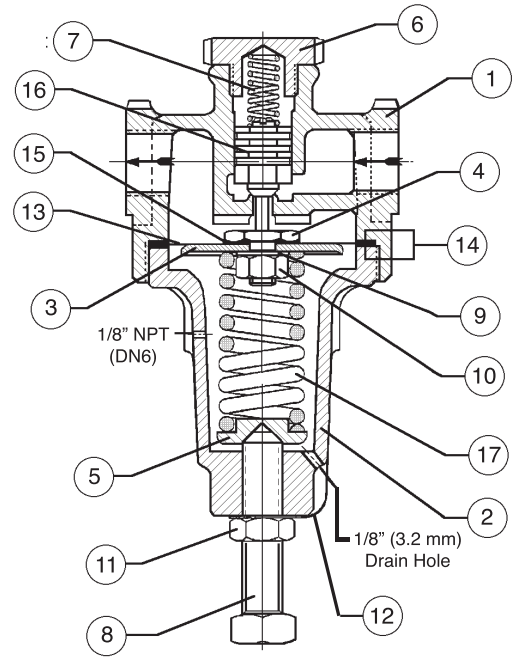
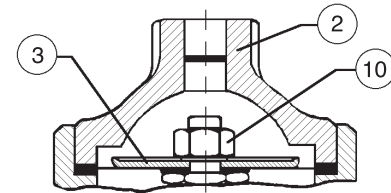
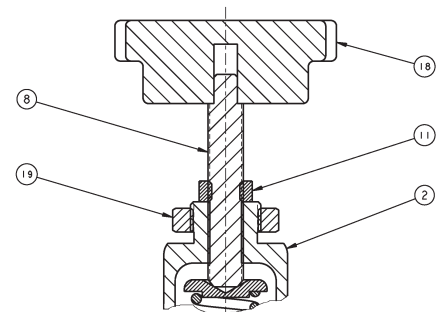


Figure 2:
Option-5 Cryogenic Model 3381, Metal Seat Design
(NOTE: Mount in Horizontal line with Adjusting Screw down as shown.)



Option-20, Dome Loaded



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

Repair Parts Kit B

Item No.	Description	Kit B
1	Body	
2	Spring Chamber	
3	Pressure Plate	
4	Pusher Plate	
5	Spring Button	
6	Body Cap	
7	Piston Spring -----	##
8	Adjusting Screw	
9	Lock Washer	
10	Pressure Plate Nut	
11	Adjusting Screw Locknut	
12	Nameplate	
13	Diaphragm -----	##
14	Diaphragm Gasket(s)	##
15	Pusher Plate Gasket	##
16	Piston -----	##
17	Range Spring	
18	Handwheel	
19	Mounting Nut	

MODEL 4381

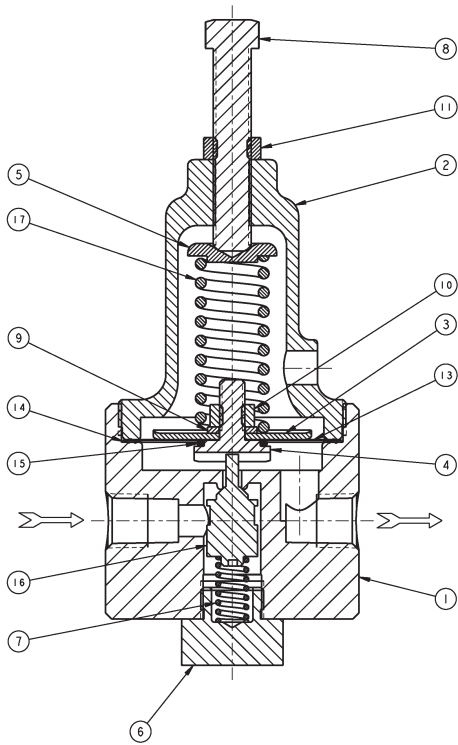


Figure 1:

Basic Model 4381 with Metal Seat Design

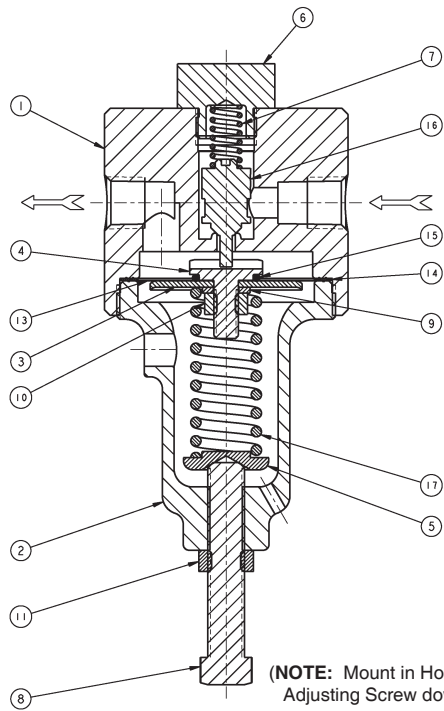
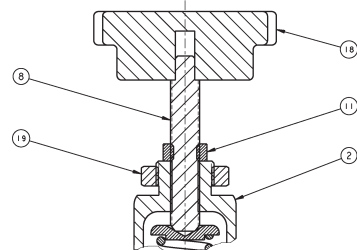


Figure 2:

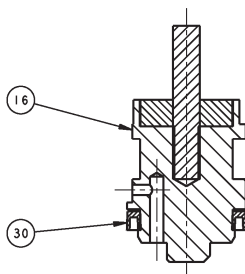
Option -36 Cryogenic Model 4381 with Metal Seat Design

Item No.	Description	Repair Parts Kit B
1	Body	
2	Spring Chamber	
3	Pressure Plate	
4	Pusher Plate	
5	Spring Button	
6	Body Cap	
7	Piston Spring	##
8	Adjusting Screw	
9	Lock Washer	
10	Pressure Plate Nut	
11	Adjusting Screw Locknut	
12	Nameplate	
13	Diaphragm	##
14	Diaphragm Gasket	##
15	Pusher Plate Seal	##
16	Piston	##
17	Range Spring	
18	Handwheel	
19	Mounting Nut	
21	Thrust Bearing	
22	Upper Bearing	
23	Lower Bearing	
30	U-Cup	##

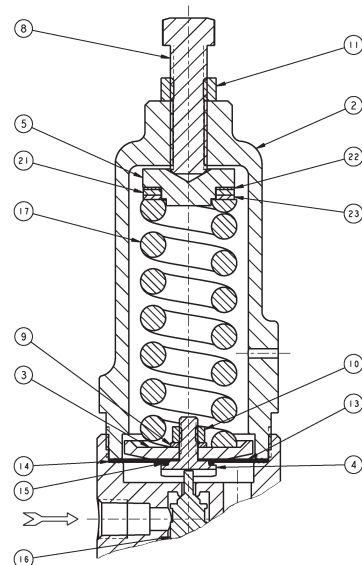


Option-22 Panel Mounting

(Handwheel portion is same as Option-2 Handwheel).
Option-22 **NOT** available with Option-80.
Spring Chamber Thread 3/4"-16 UNF-2A



Composition Seat
with Option -4 Stabilizer




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 <math>< 3.3 \text{ m/s}</math> (<math>< 3.3 \text{ ft/s}</math>) 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
	FL800/FL200
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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