

MODEL PGR-1

DIRECT-ACTING, PRESSURE LOADED PRESSURE REDUCING REGULATOR

SECTION I

I. DESCRIPTION AND SCOPE

Model PGR-1 is a pressure reducing regulator used to control downstream (outlet or P2) pressure. Sizes are 1/2" (DN15), 3/4" (DN20), 1" (DN25), 1-1/2" (DN40), 2" (DN50), 3" (DN80) and 4" (DN100). This model is applied primarily in gaseous service.

SECTION II

II. REFERENCES

Refer to Technical Bulletin PGR-1-TB for technical specifications for this regulator.

ABBREVIATIONS

CW	-	Clockwise
CCW	-	Counter Clockwise
ITA	-	Inner Trim Assembly

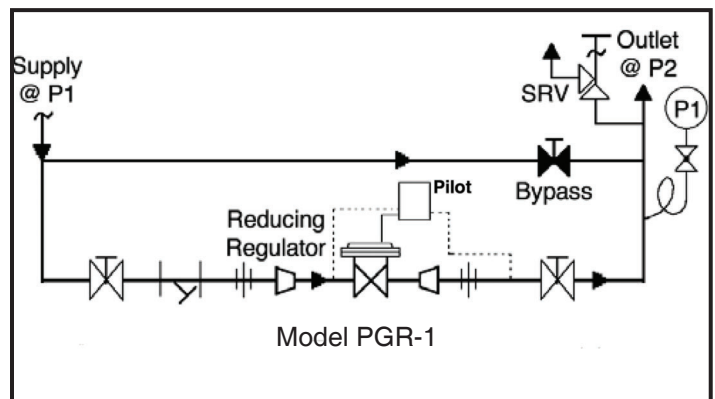
SECTION III

III. INSTALLATION

1. Regulator may be rotated around pipe axis 360 degrees. For ease of maintenance, the recommended position is with the cover dome (2) upwards.
2. Provide space below, above, and around regulator for removal of parts during maintenance.
3. Install block valves and pressure gauges to provide means for adjustment, operation, bypass, or removal of the regulator. A pipeline strainer is recommended before inlet to remove typical pipeline debris from entering valve and damaging internal "soft goods", primarily the dynamic seal.
4. The PGR-1 is designed to regulate pressure via external sensing. Use 3/8" or 1/2" (DN10 or DN15) outer diameter tubing to connect the sensing port on the pilot to the piping down stream of the main regulator. If PGR-1 is constructed with self contained feature, tubing and connection in downstream piping 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.



SECTION IV

IV. PRINCIPLE OF OPERATION

CAUTION

DO NOT HYDROSTATIC TEST THROUGH AN INSTALLED UNIT; ISOLATE REGULATOR FROM TEST. The "OUTLET RATING" as printed on the nameplate is the recommended "upper operating limit" for the sensing diaphragm. Higher pressures could cause internal damage. In addition, note on the nameplate that the Inlet and Outlet pressure and temperature ratings are at different levels.

1. When a loading pressure – P_{Load} – is applied to the top side of a diaphragm, the outlet controlled pressure – P_2 – will balance at approximately .90 – .98 of the loading pressure - P_L .

SECTION V

V. STARTUP

- 1 Start with the block valves closed.

CAUTION

Do not walk away and leave a bypassed regulator unattended!

2. Rotate the adjusting screw (30.17) on the pilot valve CCW so that main regulator is trying to be controlled at 0 psig pressure. **DO NOT rotate the adjusting screw on the stabilizer, stabilizer was preset and calibrated at the factory. NOTE: If an adjustment to the stabilizer is necessary, it is recommended that a gauge be installed in optional port downstream of stabilizer. Once flow is established, if an adjustment is needed, the stabilizer should be set at 8 to 10 PSI above the set point attempting to be controlled.**
3. **DO NOT rotate knob on metering valve**, it was preset at the factory at 2 to 3 full revolutions from closed position. **DO NOT close metering valve.**
4. 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. 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.**
5. Crack open the outlet (downstream) block valve to approximately 10% full open.
6. Slowly open the inlet (upstream) block valve to about 25% open. Rotate the adjusting screw

2. Movement occurs as pressure variations register on the diaphragm. The registering pressure is the outlet, P_2 , or downstream pressure. The loading pressure fluid opposes diaphragm movement. As outlet pressure drops, the loading pressure pushes the diaphragm down, opening the port; as outlet pressure increases, the diaphragm pushes up and the port opening closes.
3. A diaphragm failure will tend to cause the regulator to fall below setpoint. A loss of loading pressure while inlet pressure is imposed will cause the regulator to fail close.

(30.17) on the pilot valve CW to increase setpoint pressure upwards until the main valve is flowing. Observe the outlet pressure gauge to ensure not over pressurizing.

7. Continue to slowly open the inlet (upstream) block valve until fully open.
8. 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 inlet block valve and go to Step 2. Close bypass valve approximately 25%, repeat procedure.
9. When flow is established steady enough that the outlet (downstream) block valve is 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 set point by rotating the adjusting screw (30.17) on the pilot valve CW to change the setpoint to the desired outlet pressure level. If downstream pressure is unstable, rotate knob on metering valve in quarter turn increments CW or CCW to combat instability. **NOTE: 1/4 turn increments are used due to sensitivity, in some cases the changes to the P_2 are significant. DO NOT rotate knob more than 6 full revolutions from closed position. Metering valve is preset at factory 2 to 3 full revolutions from closed position. DO NOT close metering valve.**
11. Reduce system flow to a minimum level and observe pressure set point. Outlet pressure will rise from the set point of Step. The maximum rise in outlet pressure on decreasing flow should not exceed the 10%. If it does, consult factory.


SECTION VI

VI. SHUTDOWN

1. Shutoff inlet block valve.
2. Allow sufficient time for the line pressure downstream of the inlet block valve to bleed down.
3. Shutoff the outlet block valve.
4. Relieve any trapped upstream and downstream pressure and loading pressure from PGR-1.
5. The regulator may now be removed from the pipeline or disassembled for inspection and preventative maintenance while in-line.

SECTION VII

VII. MAINTENANCE

 <b style="font-size: 1.2em;">WARNING
<p>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.</p>

A. General:

1. The main regulator body may be serviced without removing the regulator from pipeline. The regulator is designed with quick-change trim to simplify maintenance.
2. Record the name plate information to requisition repair parts for the regulator. This information should include: size, Serial Number, and Product Code.
3. Refer to Section IX for recommended repair parts. Only use original equipment parts supplied by Cashco for rebuilding or repairing regulators.
4. Owner should refer to owner's procedures for removal, handling, cleaning and disposal of nonreusable parts, i.e. gaskets, etc.
NOTE: *On regulators originally supplied as "special clean" – Opt-56, maintenance must include a level of cleanliness equal to Cashco cleaning standard #S-1542.*
5. The Inner Trim is removed and replaced back in the body (1) as an assemblage of parts. The **Inner Trim Assembly**, hereinafter called **ITA**, consists of following parts: (See Figure 1)

A detailed view of the dynamic side seal parts is shown on page 5.

Item No.	Dynamic Seal Type	Part Description
4	All	Cage
5	All	Plug
9	All	Guide Bearing
10	All	Seat
13	All	Static Stem Seal
13.1	All	Upper Static Stem Seal
13.2	All	Middle Static Stem Seal
13.3	All	Lower Static Stem Seal
14	All	Cage O-ring Seal
15	OR	Dynamic O-ring Seal
15.1	UC	Dynamic U-cup Seal
15.2	UC	Seal Retainer

B. Main Valve Disassembly:

1. Shut down system in accordance Section VI.
2. Disconnect the external sensing line from the pilot valve sensing port.
3. Though it is possible to disassemble the valve unit while installed in a pipeline, it is recommended that all maintenance be done in a shop. The instructions hereafter will assume in shop disassembly. Remove valve from pipeline.
4. Place the main valve unit in a vise with the cover dome (2) upwards.
5. Loosen all fittings and remove tubing that connects the inlet filter to the stabilizer, the cover dome to the metering valve and the outlet of the metering valve to the outlet of the body.
6. Loosen and remove the two nuts (24) that secure the mounting bracket (3) and pilot to the cover dome (2). Set pilot assembly aside. Place match marks on the cover dome flange to mark the location for the mounting bracket and two longer bolts (23).
7. Loosen the diaphragm flange bolts (23) and nuts (24) uniformly and remove.

8. Place matchmarks on body (1) and cover dome (2) flanges. Remove cover dome.
9. With wrench grasp and hold the milled "flats" on top of the valve plug (5) stationary. Rotate diaphragm nut (11) CCW and remove .
10. Remove upper diaphragm plate (7).
11. Remove diaphragm (6) and o-ring upper stem seal (13). Examine diaphragm to determine whether failed; determine if operating conditions are exceeding pressure, pressure drop or temperature limits.
12. Remove lower diaphragm pusher plate (8).
13. Rotate the cage bolts (22) CCW evenly in single revolution increments. Regulator contains a lower return spring (18); the ITA should rise up as the cage cap screws are evenly backed out. A downwards holding force should be applied to the top of the guide bearing (9) to prevent the ITA from popping up as the last threads of the cage bolts are backed out.
14. Remove the ITA by pulling up on the valve plug (5). Set ITA aside.
15. Remove the lower return spring (18) from within the body (1) cavity.
16. Remove cage o-ring seal (14). It may have been removed when the ITA was lifted out of the body.
17. Remove internal sensing drilled plug (19) using 5/32" (4 mm) allen wrench.
18. Remove body (1) from vise. Clean all reusable metal parts according to owner's procedures.

C. Disassembly of the ITA:

1. See Figure 1 for details:
 - a. While holding the cage (4) pull the valve plug (5) downwards and through of the guide bearing (9) and out the bottom of the cage.
 - b. Remove the guide bearing (9) from the upper end of the cage (4).
 - c. Remove o-ring middle stem seal (13) from guide bearing (9).
 - d. Examine the component(s) (15 or 15.1, 15.2) of the dynamic side seal to determine if significant leakage was occurring.

mine if significant leakage was occurring. If the dynamic side seal shows signs of significant leakage, determine if operating conditions are exceeding pressure, pressure drop, or temperature limits.

Remove dynamic side seal components. Special care should be taken when using "tools" to remove the components to ensure that no scratches are imparted to any portion of the guide bearing (9) groove.

- e. Remove o-ring lower stem seal (13) from plug (5).
- f. Remove seat (10); examine for signs of leakage. If seat ring shows signs of significant leakage, determine if operating conditions of pressure, pressure drop, or temperature are exceeding limits.

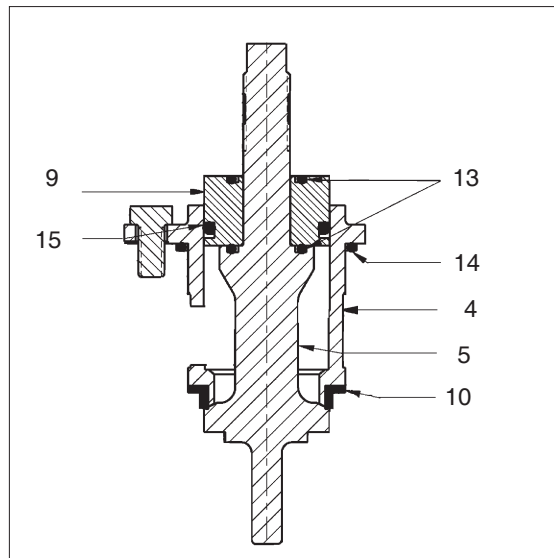


Figure 1: Assembled ITA,

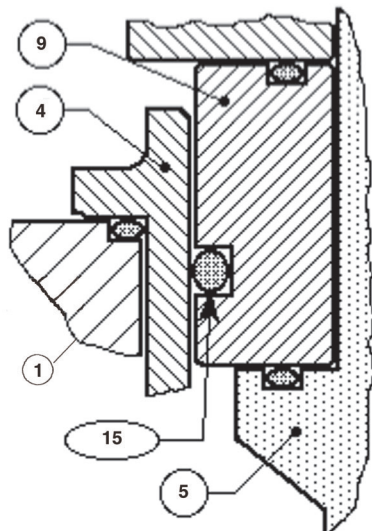
D. Inspection of Parts:

1. After inspection remove from the work area and discard the old "soft goods" parts (i.e. o-rings, diaphragms, seals, gaskets, etc.) after inspection. These parts MUST be replaced with factory supplied new parts.
2. Inspect the metal parts that will be reused. The parts should be free of surface contaminants, burrs, oxides, and scale. Rework and clean parts as necessary. Surface conditions that affect the regulator performance are stated below; replace parts that can not be reworked or cleaned.

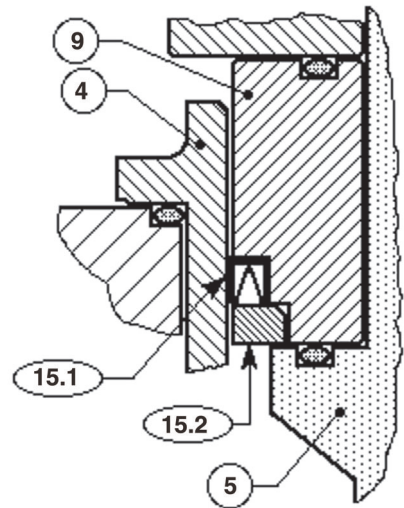
3. QC Requirements:
 - a. Valve plug (5);
 1. 16 rms finish on its seating surface for tight shutoff.
 2. No major defects on bottom guide spindle.
 - b. Cage (4);
 1. 16 rms finish on cylinder bore. No “ledges” formed due to wear from moving dynamic side seal (27) or wiper seal (16).
 - c. Lower guide bushing (24) (non-replaceable):
 1. 16 rms finish on bore.
 2. Max 0.015 inch (0.38 mm) clearance between valve plug (20) spindle and lower guide bushing (24).
 - d. Internal sensing drilled plug (32);
 1. Ensure that bore is minimum 0.125 inch (3.20 mm). Drill out as required.
4. Staging Material for Reassembly.
 - a. Inspect and clean parts, as necessary, from the spare parts kit. (See Article VII A.4. comments for special cleaning.
 - b. Lay out all the regulator parts and check against the bill of material.

E. Reassembly of the ITA:

1. Installation of dynamic side seal (15).
 - a. Type OR:
 1. Stretch o-ring seal (15) over lower circumference of guide bearing (9), taking care not to “cut” o-ring seal. Using thumbs, work the o-ring seal up and into the groove of the guide bearing. **NOTE:** A very slight amount



Type OR — O-Ring
Dynamic Seal



Type UC — U-Cup
Dynamic Seal

of fluid and elastomer compatible lubricant is recommended as an installation aid.

2. Position guide bearing (9) over top of the upper end of cage (4) properly oriented. Using thumbs, evenly press guide bearing into the cage, ensuring not to “cut” o-ring seal. Continue pressing guide bearing into cage until in approximate final position.
- b. Type UC:
 1. Stretch u-cup seal (15.1) over lower circumference of guide bearing (9), taking care not to “cut” u-cup seal on the protruding shelf that is part of the guide bearing's groove. Ensure that the u-cup seal is oriented with the center-open-downwards as shown in image below, as the u-cup seal depends upon the P1-Inlet Pressure to pressure activate the seal for proper sealing action.
 2. Position guide bearing (9) over top of the upper end of cage (4) properly oriented, until the cup seal edge touches the upper lip of the cage (4). While gently applying force to press the guide bearing (9) into the cage, simultaneously use fingers to lightly press the edges of the u-cup seal inwards into the groove of the guide bearing until the u-cup seal (15.1) “slips into” the cage (19). **DO NOT USE TOOLS, LUBRICANT, OR HEAVY FORCE TO ENGAGE THE U-CUP SEAL INTO THE CAGE .**

2. Place properly oriented seat (10) onto its shoulder at the lower end of cage (4).
3. Place new o-ring lower stem seal (13) into groove of valve plug (5).
4. Insert valve plug (5) upwards through lower end of cage (4) and through the center hole in guide bearing (9). Hold plug and cage together in the closed position.
5. Place an oversized nut or stack of washers, the same approximate height of the upper diaphragm plate (7) and the lower diaphragm plate (8), over the upper end of valve plug (5) and temporarily secure with diaphragm nut (11), manually tightened. Do **NOT** allow valve plug to rotate against seat (10) during tightening.
6. This completes ITA preliminary/partial reassembly.

F. Main Valve Reassembly:

1. Place body (1) in a vise flange face up.
2. Reinstall internal sensing drilled plug (19) with compatible thread sealant.
3. Insert the lower return spring (18) into the body (1).
4. Fit the cage o-ring seal (14) into the body groove.
5. With the ITA held manually in the closed position, insert ITA into body (1).
6. Properly align bolt holes in the cage with the holes in the body, as there is only one circumferential location possible for this alignment. Apply downward force to the top of the cage (4) until the ITA is lowered sufficiently to engage the cage bolts (22) into the body (1). Engage all of the cage bolts, Rotate the cage bolts in one-half revolution increments to pull down the ITA evenly, taking care **NOT** TO “ANGLE” the ITA in the body. Torque the cage bolts to 13-15 ft-lbs. (17.6-20.3 N-m).
7. Remove temporarily installed diaphragm nut (11) and spacers of previous Step E.5. this section.
8. Place new o-ring middle stem seal (13) into groove of guide bearing (9) upper surface.

9. Position lower diaphragm plate (8) over upper end of plug (5) with tongue and groove "groove" side up.
10. Place new o-ring upper stem seal (13) over upper end of valve plug (5).
11. Place diaphragm (6) over end of valve plug (5).
12. Place upper diaphragm plate (7) over upper end of plug (5) with tongue and groove “ridge” side down.
13. Place lubricant on valve plug (5) threaded end. Engage diaphragm nut (11) with upper end of valve stem (5) as far as possible manually. Place a wrench on diaphragm nut and a torque wrench on the upper end of valve plug . Hold torque wrench stationary and rotate diaphragm nut (7) to the following torque values:


Body Size in (DN)	Torque Value Ft-lbs (N-m)
1/2" - 1" (15 - 25)	60 - 70 (81 - 95)
2" (50)	120 - 130 (163 - 176)
3" - 4" (80 - 100)	180 - 200 (244 - 271)

DO NOT allow valve plug (20) to rotate against seat ring (21) during tightening.

14. Aligning matchmarks and bolt holes, place cover dome (2) onto body (1).
15. Reinstall all flange bolts (23) and nuts (24) with nameplate (26) located under one bolt head. Hand-tighten nuts. Make sure to install the two longer bolts for the pilot bracket in the correct location.
16. Evenly tighten the bolting in an alternating cross pattern in one revolution increments to the following torque values:

Body Size in (Dn)	Torque Value Ft-lbs (N-m)
1/2" - 2" (15 - 50)	30 - 35 (41 - 47)
3" - 4" (80 - 100)	45 - 50 (61 - 69)

G. Pilot Valve Disassembly:

 **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.

1. Shut down system in accordance Section VI.
 2. Disconnect the external sensing line, from the pilot valve sensing port.
 3. Loosen all fittings and remove tubing that connect the inlet filter to the stabilizer, the cover dome to the metering valve and the outlet of the metering valve to the outlet of the body.
 4. Loosen and remove the two nuts (24) that secure the mounting bracket (3) and pilot to the cover dome (2).
 5. Remove pilot assembly from main valve.
 6. Place the pilot valve body (30.1) in a vise with the spring chamber (30.2) upwards.
 7. Loosen adjusting screw nut (30.18) one revolution CCW. Relax range spring (30.4) forces by rotating adjusting screw (30.17) CCW until removed from spring chamber (30.2).
 8. Loosen the diaphragm flange bolts (30.19) and nuts (30.21) uniformly and remove bolting.
 9. Place match marks on body (30.1) and spring chamber (30.2) flanges. Remove spring chamber.
 10. Remove spring button (30.5), range spring (30.4) and pressure plate (30.6).
 11. Remove diaphragm (30.13). Examine diaphragm to determine whether failed; determine if operating conditions are exceeding pressure, pressure drop or temperature limits. If just replacing the diaphragm, proceed to Step H.9 and skip the following instructions.
 12. Grasp pusher post (30.12) and lift up to remove. Place socket wrench over retainer (30.10) and rotate CCW to remove from body.
 13. Remove seal gasket (30.15), piston seal (30.14) and a second seal gasket (30.15) from bore inside the body.
 14. To remove the stem (30.8), remove the body from the vise and slowly turn upside down. Stem will slide out of the body, Do Not let the stem fall and hit the floor.
 15. Place body (30.1) in a vise with the body cap (30.3) upwards. Rotate cap bolts (30.20) CCW to remove bracket and body cap. Remove cap seal (30.16).
 16. Remove return spring (30.11), ball holder (30.9), and ball (30.22).
 17. Place socket wrench over seat (30.7) and rotate CCW to remove from body.
 18. Remove body (1) from vise. Clean all reusable metal parts according to owner's procedures.
- H. Pilot Valve Reassembly:**
1. Place body (30.1) in a vise flange face down.
 2. Apply "Gasolite" or equivalent, thread sealant to the threads of the seat (30.7). Engage the seat threads into the body and apply 20 - 25 ft-lbs. torque. Place the ball (30.22), ball holder (30.9) and return spring (30.11) onto seat.
 3. Place the o-ring (30.16) into the groove in the body cap (30.3) and place onto the body. Position the bracket on the body cap and re-install cap bolts (30.20). Make sure the return spring (30.11) fits inside the bore of the body cap. Tighten nuts evenly in a star crossing pattern. Apply 15 - 18 ft-lbs. torque to tighten the cap bolts.
 4. Remove body from the vise. Reinstall body again in vise with the bolt flange facing up.
 5. Insert the stem (30.8) into the center hole of the body and the seat (30.7), square end first.
 6. Place one seal gasket (30.15), one piston seal (30.14) and one seal gasket (30.15) into the center bore on top of the stem (30.8). See Detail "A". Ensure to align the seal and gaskets so they are centered inside the threaded bore hole.
 7. Engage the retainer (30.10) threads into the center bore hole to hold the piston seal and gaskets in place and apply 75 in-lbs. torque. to tighten.
 8. Insert pusher post (30.12) into retainer (30.10).
 9. Place diaphragm (30.13) on bolt flange, centered between bolt holes. Center the pressure plate (30.6) on top of the diaphragm.
 10. Place range spring (30.4) in center of the pressure plate (30.6) cup. Apply Mobile XHP

222 grease or equivalent into recessed area of the spring button (30.5) and place on top of the range spring. (Also lubricate the threads of the adjusting screw lightly).

11. Engage threads of the adjusting screw (30.17) into the spring chamber (30.2) three or four revolutions and place the spring chamber over the spring button and spring.
12. Align the match marks on the body and spring chamber flanges. **NOTE:** Vent hole in the spring chamber should be directly above the sense port in the body.
13. Place flange bolts through holes in spring chamber and body and engage nuts (30.21). Tighten nuts evenly in a star crossing pattern. Apply 15 - 18 ft-lbs. torque to finish tightening. Secure the name plate (53) under one of the flange bolts (30.19) above the "inlet" of the pilot.
14. Rotate adjusting screw (30.17) CW into the spring chamber (30.2) to where the nut (30.18) comes in contact with the top of the spring chamber. Pilot valve set pressure should approach the set point prior to removal from the piping installation. Retighten nut (30.18).

I. Mounting Pilot Valve to Main Valve:

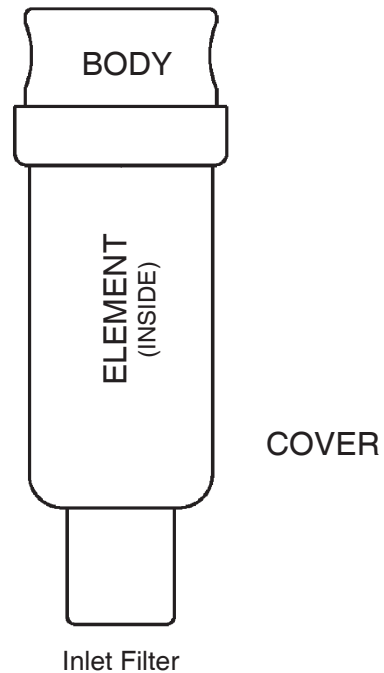
1. Place the bolt holes for the mounting bracket over the two longer bolts (23) installed throughout the top of the cover dome (2). Engage the final two nuts (24) and secure tight.
2. Re-install tubing and fittings that previously connected the inlet filter to the stabilizer, the cover dome to the metering valve and the outlet of the metering valve to the outlet of the body.
3. Re-connect the external sensing line to the pilot valve sensing port.

⚠ 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.

J. Changing the filter element:

1. See Section IV.



2. Unscrew the filter cover from the body. Remove old element and replace with new element.
3. Screw cover on filter body and secure tight.

K. Disassembly of the Stabilizer:

1. Maintenance procedures hereinafter are based upon removal of the stabilizer from the pilot. Shut down system in accordance Section VI.
2. Owner should refer to owner's procedures for removal, handling, cleaning and disposal of nonreusable parts, i.e. gaskets, etc.
3. Loosen fitting and remove tubing that connect the inlet filter to the stabilizer. Remove stabilizer from fittings that run between the stabilizer and the pilot.
4. Secure stabilizer body (60.1) in a vise with the spring chamber (60.2) oriented upwards

⚠ 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.

DIAPHRAGM REPLACEMENT -

 **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. Loosen adjusting screw nut (60.11) one revolution CCW. Relax range spring (60.15) forces by rotating adjusting screw (60.8) CCW until removed from spring chamber (60.2).
2. Loosen spring chamber (60.2) by placing wrench on “flats” and rotating CCW making sure **not** to use the flat where the vent hole is located.
3. Remove spring chamber (60.2), spring (60.15) and spring button (60.5).
4. Remove the diaphragm subassembly consisting of the pressure plate nut (60.10), lock washer (60.9), pressure plate (60.3), diaphragm (60.12), pusher plate seal (60.13) and pusher plate (60.4).
5. Loosen pressure plate nut (60.10) and separate all parts (60.3, 60.4, 60.9, 60.12 & 60.13) of the diaphragm subassembly.
6. Inspect pressure plate (60.3) to ensure no deformation due to over-pressurization. If deformed, replace.
7. Clean all reusable metal parts according to owner's procedures.
8. Reassemble diaphragm subassembly by placing pusher plate seal (60.13) over threaded post of pusher plate (60.4), placing diaphragm (60.12) and pressure plate (60.3) over the threaded post. Assure the pressure plate (60.3) is placed with curved outer rim down next to the diaphragm (60.12) surface. Place a thread sealant compound on the threads of the pusher plate post (60.4). Apply 15 in-lbs torque to tighten the nut.
9. Place spring (60.15) over the pusher plate nut (60.10) of the diaphragm subassembly.
10. Place multipurpose, high temperature grease into depression of spring button (60.5) where adjusting screw (60.8) makes contact. Set spring button (60.5) onto range spring (60.15); ensure spring button is laying flat on top of spring.

11. Rotate the spring chamber (60.2) CW by hand into the threaded portion of the body (60.1) ensuring not to cross thread. Continue rotating CW until firmly seated against the upper diaphragm. Tighten to 30-35 ft-lbs (41-47 N-m) torque value.
12. Reinstall adjusting screw (60.8) with nut (60.11) into the spring chamber (60.2).
13. Pressurize with air and spray liquid leak detector to test around body and spring chamber 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.

TRIM REPLACEMENT -

1. Secure stabilizer body (60.1) in a vise with the body cap (60.6) oriented up and the spring chamber (60.2) 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 (60.6).
3. Remove piston spring (60.7), and piston (60.14). Note that the seat and piston guide are integral parts of the body (60.1) 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.

***NOTE:** Piston (60.14) assembly is a composition seat, 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 (60.1) to body cap (60.6) shoulder. Be careful not to scratch either surface.
5. Clean debris from within the body (60.1) cavity. Parts to be reused should be cleaned according to owner's procedures.
6. Slide the post end of the piston (60.14), slowly into the body cavity.
7. Place piston spring (60.7) over spring hub of the piston (60.14).

8. Apply pipe thread sealant to the body cap (60.6) threads. Thread body cap into body. When body cap is fully down against body at the body cap shoulder, impact the body cap into the body tight. **NOTE:** *When unit is put into service and pressurized, these two parts seal metal-to-metal with no gasket.*
9. 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.*
10. Pressurize with air and spray liquid leak detector to test around body cap (60.6) and body (60.1) for leakage. Test pressure should be a minimum of 100 psig (6.9 Barg) at the inlet.
11. Remove body from vise, rotate down side up and secure body in vise with body cap down.
12. Reassemble diaphragm subassembly by placing pusher plate seal (60.13) over threaded post of pusher plate (64), placing diaphragm (60.12) and pressure plate (60.3) over the threaded post. Assure the pressure plate (60.3) is placed with curved outer rim down next to the diaphragm (60.12) surface. Place a thread sealant compound on the threads of pusher plate post (60.4). Apply 15 in-lbs. torque to tighten the nut.
13. Place spring (60.15) over the pusher plate nut (60.10) of the diaphragm subassembly.
14. Place multipurpose, high temperature grease into depression of spring button (60.5) where adjusting screw (60.8) makes contact. (Also lubricate the threads of the adjusting screw lightly).
15. Set spring button (60.5) onto range spring (60.15); ensure spring button is laying flat on top of spring.
16. Rotate the spring chamber (60.2) CW by hand into the threaded portion of the body (60.1) ensuring not to cross thread. Continue rotating CW until firmly seated against the upper diaphragm. Tighten to 30-35 ft-lbs (41-47 N-m) torque value.
17. Rotate adjusting screw (60.8) CW into the spring chamber (60.2) to where the nut (60.11) comes in contact with the top of the spring chamber. Stabilizer set pressure should approach the set point prior to removal from the piping installation. Retighten nut (60.11).
18. Pressurize with air and spray liquid leak detector to test around body and spring chamber 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.

CALIBRATION -

If adjustments are necessary proceed with the following steps:

1. Install a gauge in optional port downstream of stabilizer.
2. Establish flow as close to normal operating conditions as possible.
3. Set stabilizer 8 to 10 PSI above set point (determined at time of order placement).
4. Adjust pilot to obtain desired P_2 .
5. If downstream pressure is unstable, adjust by rotating metering valve in 1/4 turn increments. **NOTE:** *It is important that 1/4 turn increments are used due to sensitivity. The P_2 changes can be significant in some cases.*
6. Verify that external sensing is tubed to tap closest to where control of pressure is desired.

SECTION VIII

VIII. TROUBLE SHOOTING GUIDE

When trouble shooting this regulator there are many possibilities as to what may be causing problems. Many times, the regulator itself is not defective, but one or more of the accessories may be. Sometimes the process may be causing difficulties.

The key to efficient trouble shooting is information and communication. The customer should try to be as precise as possible in their explanation of the problem, as well as their understanding of the application and operating conditions.

It is imperative the following information be provided by the customer:

- Type of Service (with fluid properties)
- Range of flow rate
- Range of inlet pressure
- Range of outlet pressure
- Range of temperature
- Range of ambient temperature

Pressure readings should be taken at every location where pressure plays a role - i.e., regulator inlet (as close as possible to inlet port), regulator outlet (as close as possible to outlet port), etc.

Following are some of the more common complaints along with possible causes and remedies.

1. Erratic regulation, instability or hunting.	
Possible Causes	Remedies
A. Sticking of internal parts.	A. Remove internals, clean, and if necessary, replace.
B. Oversized regulator.	B. Check actual flow conditions; resize regulator for minimum and maximum flow; if necessary, replace with smaller regulator.
C. Metering Valve may not be adjusted correctly.	C1. Rotate knob on metering valve in 1/4 turn increments to be more or less sensitive to changes in P2 pressure. DO NOT fully close the metering valve.
2. Downstream pressure will not reach desired setting.	
Possible Causes	Remedies
A. Supply pressure is down (confirm on pressure gauge).	A. Increase supply pressure.
B. Undersized regulator.	B. Check actual flow conditions; resize regulator for minimum and maximum flow; if necessary, replace with larger regulator.
C. Pressure loading system pressure restricted.	C1. Clean filter. C2. Clean pilot valve.
D. Faulty loading pressure control device.	D. Replace/repair loading pressure control device.
3. Diaphragm continually breaks.	
Possible Causes	Remedies
A. Stem seals (13) which protect fluorocarbon elastomer in diaphragm assembly may have deteriorated.	A. Replace with new stem seals (13).
B. Diaphragm nut (11) may not be torqued to correct value.	B. Confirm torque value in accordance with Section VII, F-13.

4. Diaphragm continually breaks (all regulators).	
Possible Causes	Remedies
A. Differential pressure across diaphragm may have exceeded limits.	A1. Be aware of limits as well as where the various pressures are acting. Install pressure safety equipment as necessary.
5. Leakage at diaphragm flange.	
Possible Causes	Remedies
A. Body bolts not torqued properly.	A. Torque to proper value (see Section VII, F-16).
B. Pressures at diaphragm may be too high.	B. Consult factory.
6. Leakage across seat.	
Possible Causes	Remedies
A. Contamination (debris) in regulator.	A. Remove internals, clean, and if necessary, replace sealing and seating elements. *
B. Oversized regulator; valve plug operates directly next to seat.	B. Check actual flow conditions; resize regulator for minimum and maximum flow; if necessary, replace with smaller regulator.
* Seat leakage may be diagnosed when a failure of the dynamic side seal has occurred. Inspect both potential internal leak paths.	

SECTION IX

IX. 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).

□□□ - □□□ 7 - □□□□□□□□□□

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.

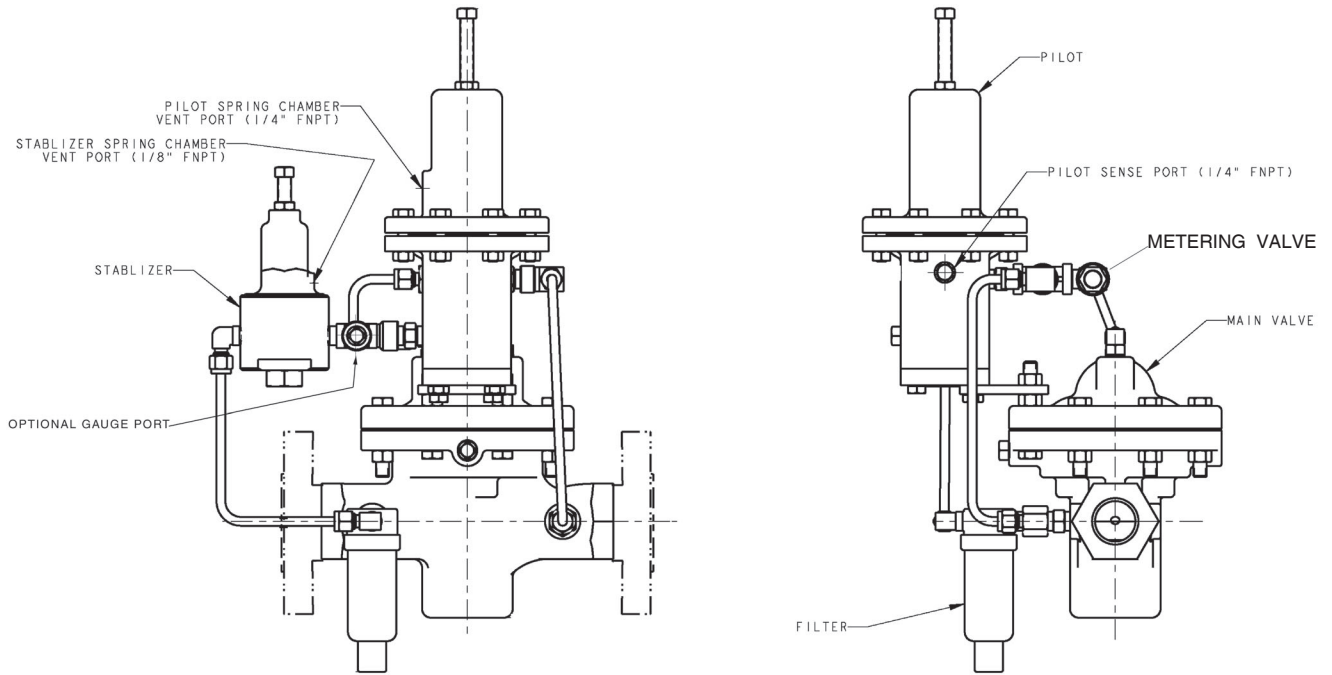
Contact your local Cashco, Inc., Sales Representative with the Serial Number and Product code. Identify the parts and the quantity required to repair the unit from the "BOM" sheet that was provided when unit was originally shipped.

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".*

 CAUTION
<p>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.</p>

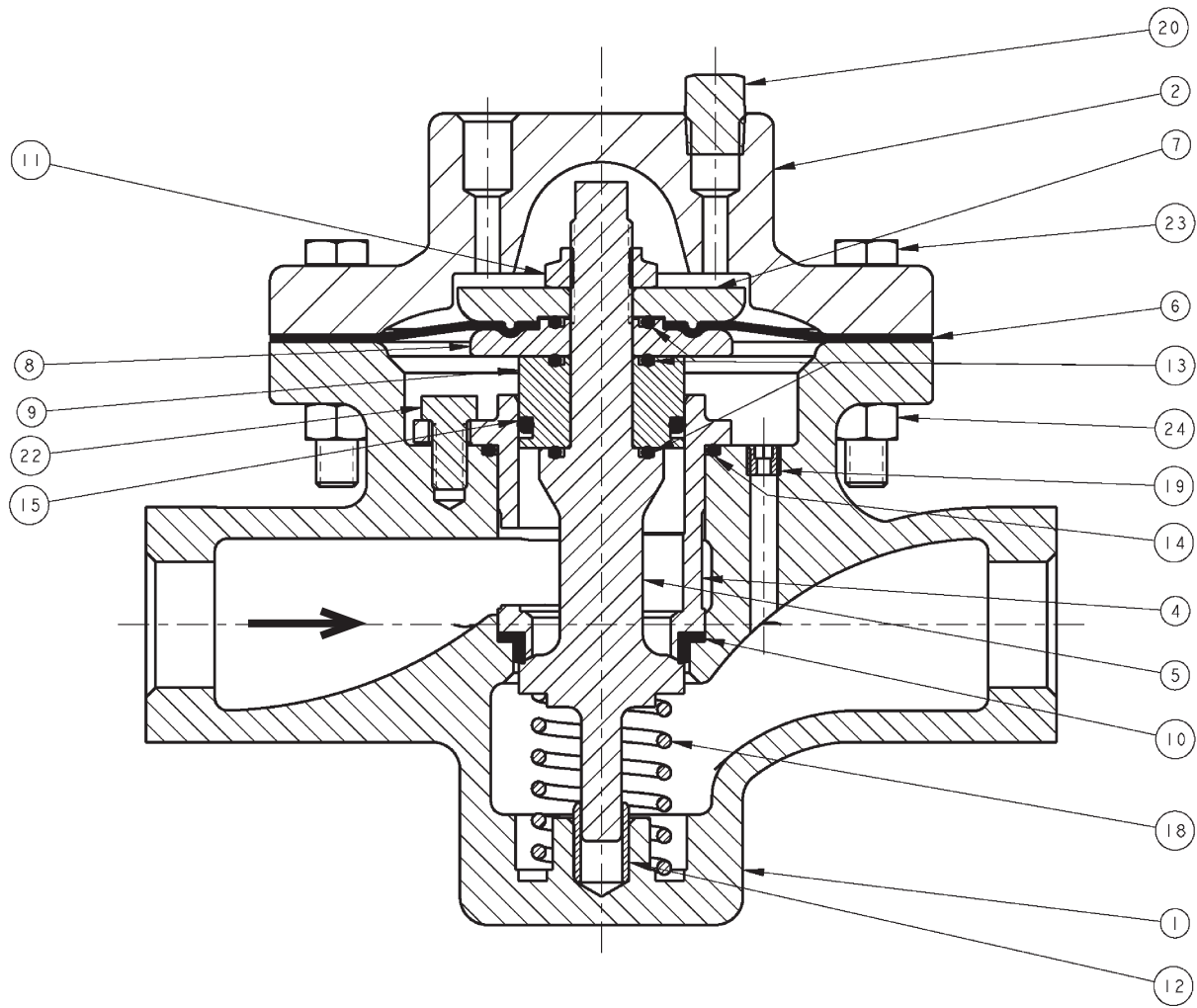
If the "BOM" is not available, refer to the cross-sectional drawings included in this manual for part identification and selection.

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



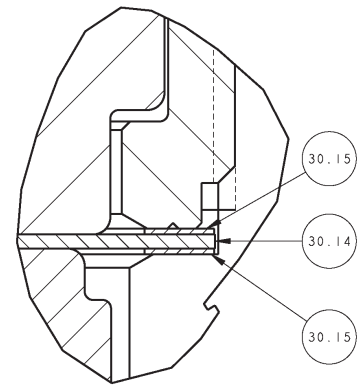
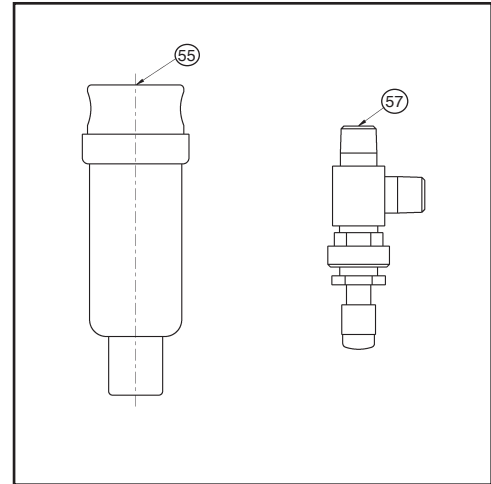
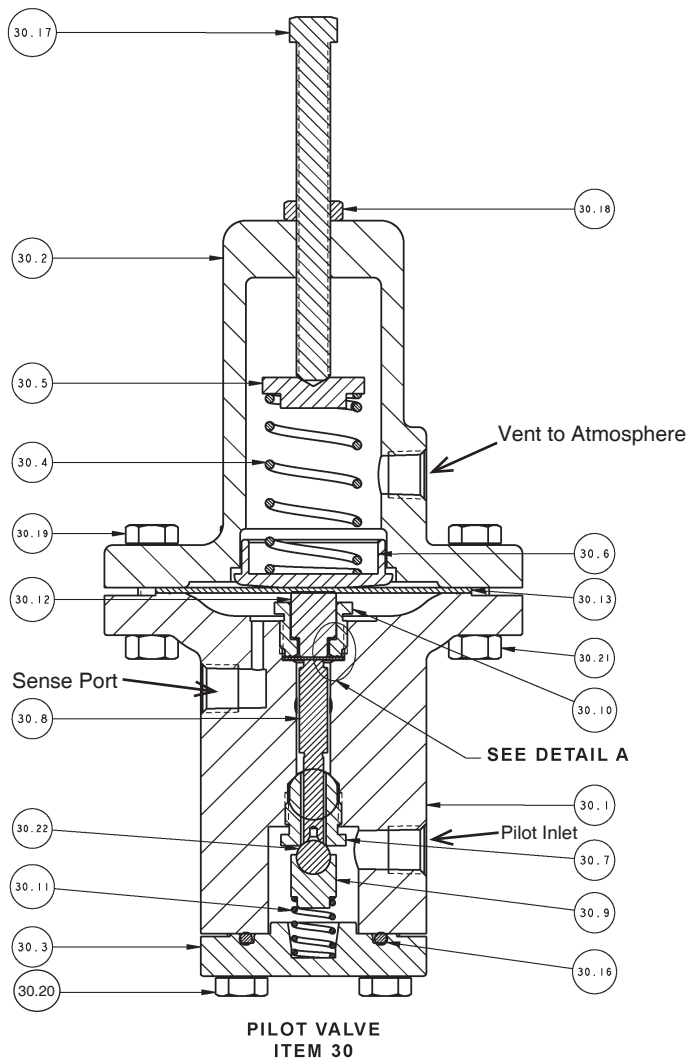
Assembled View

The PGR-1 is designed for external sensing. Use 3/8" or 1/2" (DN10 or DN15) outer diameter tubing to connect the pilot sensing port to a location in the piping down stream of the main regulator. If PGR-1 is constructed with self contained feature - tubing and connection in downstream piping is not required.



**Main Body Assembly with
Dynamic O-ring Seal**

<u>Item No.</u>	<u>Description</u>	<u>Item No.</u>	<u>Description</u>
1	Body	15	Dynamic Seal (Guide Bearing) *
2	Cover Dome	18	Return Spring
4	Cage	19	Internal Sensing Plug
5	Plug	20	Pipe Plug (Dome)
6	Diaphragm *	22	Cage Bolts
7	Upper Diaphragm Plate	23	Flange Bolts
8	Lower Diaphragm Plate	24	Flange Nuts
9	Guide Bearing		
10	Seat *		
11	Nut		
12	Guide Bushing		
13	Static Seal (Plug) *		
14	Static Seal (Cage) *		
		* Recommended Spare Parts.	
		Items not shown	
		3	Mounting Bracket
		15.2	Seal Retainer
		16	Seal Retainer (Dynamic)
		21	Pipe Plug (Body)
		25	Flow Arrow
		26	Name Plate
		27	Drive Screws



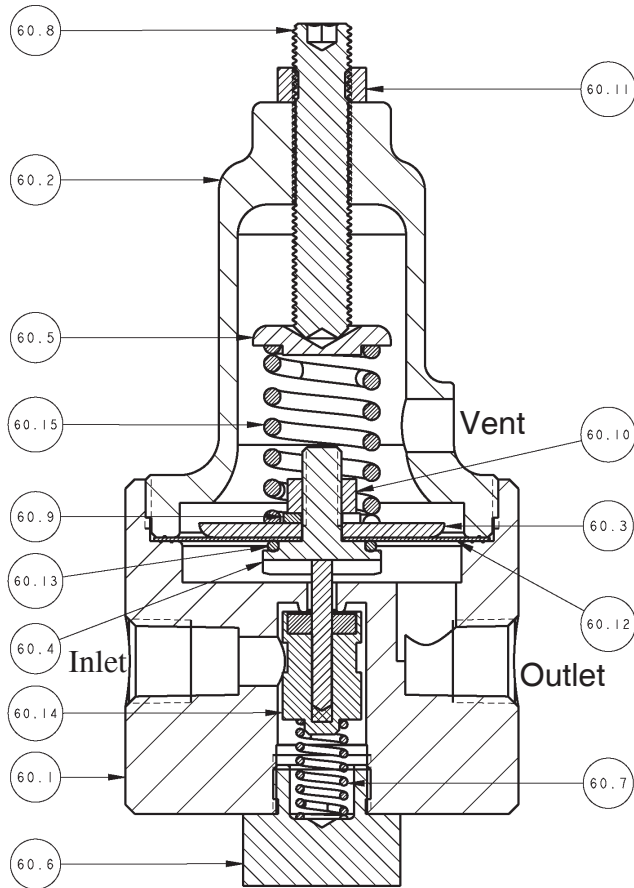
DETAIL A

<u>Item No.</u>	<u>Description</u>
30.1	Body
30.2	Spring Chamber
30.3	Body Cap
30.4	Range Spring
30.5	Spring Button
30.6	Pressure Plate
30.7	Seat
30.8	Stem
30.9	Ball Holder
30.10	Retainer
30.11	Return Spring
30.12	Pusher Post

<u>Item No.</u>	<u>Description</u>	
30.13	Diaphragm	*
30.14	Piston Seal	*
30.15	Seal Gasket	*
30.16	Seal (Body Cap)	*
30.17	Adjusting Screw	
30.18	Jam Nut	
30.19	Flange Bolts	
30.20	Body Cap Bolts	
30.21	Flange Nuts	
30.22	Ball	*
53	Name Plate (Not Shown)	
55	Filter	
57	Metering Valve	

* Recommended Spare Parts

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STABILIZER ITEM 60

Item No.	Description	
60.1	Body	
60.2	Spring Chamber	
60.3	Pressure Plate	
60.4	Pusher Plate	
60.5	Spring Button	
60.6	Body Cap	
60.7	Piston Spring	
60.8	Adjusting Screw	
60.9	Lock Washer	
60.10	Nut (Pressure Plate)	
60.11	Nut	
60.12	Diaphragm	*
60.13	O-ring	*
60.14	Piston	*
60.15	Range Spring	

* Recommended Spare Parts

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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
TANK BLANKETING	FL800/FL200
	8700, 8910, 8920, 8930, 8940
	2100, 2199
	3100, 3200, 3300, 3400, 3500, 3600, 3700
	1078, 1088, 1100, 1049
	5100, 5200, 5400, 5500
MISC	4100, 4200, 4300, 4400, 4500, 4600
	764P/PD, 764-37, 764T