ISO Registered Company

MODEL PGR-2
PRESSURE LOADED
PRESSURE REDUCING REGULATOR

SECTION I

I. DESCRIPTION AND SCOPE

Model PGR-2 is a pressure reducing regulator used to control downstream (outlet or P2) pressure. Sizes are 3/8" (DN10), 1/2" (DN15), 3/4" (DN20), 1". This model is applied primarily in gaseous service.

SECTION II

II. REFERENCES

Refer to Technical Bulletin PGR-2-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.

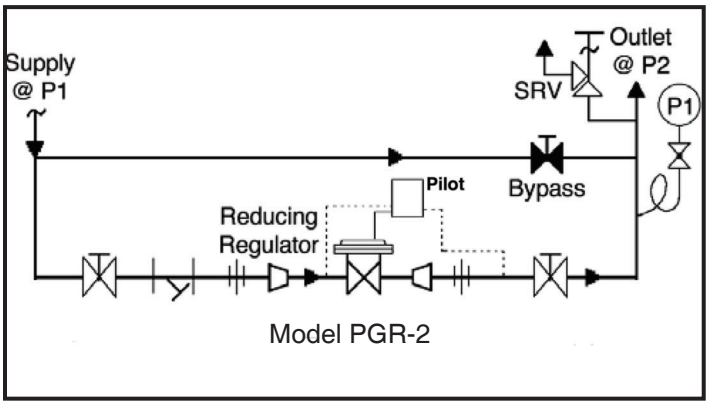
2. Provide space below, above, and around regulator for removal of parts during maintenance.

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-2 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-2 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.



Model PGR-2

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.
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.

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 (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-2.
5. The regulator may now be removed from the pipeline or disassembled for inspection and preventative maintenance while in-line.

SECTION VII

VII. 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. 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.*

B. Main Valve Disassembly:

1. Securely install the body (1) in a vise with the loading chamber (33) directed upwards.
2. Draw or embed a match mark between body casting (1) and loading chamber (33) along flanged area.
3. Remove all diaphragm nuts (9) and bolts (8).
4. Remove loading chamber (33), pressure plate (3) and diaphragm(s) (12). ***NOTE:*** *Refer to the quantity of diaphragms (12) incorporated per the bill of materials listing. Depending on outlet pressure level, multiple metal diaphragms may be "stacked".*
5. Remove pusher plate (11) and inspect for a fit which limits its travel to a vertical direction. Wear will show as excessive wobble in pusher plate (11). If apparent, recommend trim removal and inspection; go to Sub-Section C following. Reinstall pusher plate (11).
6. Inspect pressure plate (3) to ensure no deformation due to over-pressurization. If deformed, replace.
7. Clean body (1) and diaphragm flange. ***NOTE:*** *On regulators originally supplied as "oxygen clean", Option 55, maintenance must include a level of cleanliness equal to Cashco cleaning standard #S-1134.*
8. Position diaphragm(s) (12) into place. Visually center pressure plate (3) onto diaphragm(s) (12).
9. Aligning the matchmarks, place loading chamber (33) over the above stacked parts. Install all bolts (8) and nuts (9) by hand tightening. Mechanically tighten bolting (8 & 9) in a cross pattern that allows loading chamber (33) to be pulled down evenly. Apply 16-20 Ft-Lbs torque to finish tightening bolts.

   NOTE: *Never replace bolting (8 & 9) with just any bolting if lost. Bolt heads and nuts are marked with specification identification markings. Use only proper grades as replacements.*

10. Spray liquid leak detector around bolting (8 & 9) and body (1) and loading chamber (33) flanges and test for leakage. Ensure that an

outlet pressure is maintained during this leak test of at least mid-range spring level; i.e. 10-40 psig (.69 - 2.8 Barg) range spring, 25 psig (1.7 Barg) test pressure minimum.

C. Trim Replacement:

1. Install body (1) in a vise with the body cap (5) on top and the body (1) flange downwards.

2. Loosen and remove body cap (5).

3. Remove piston spring (17), piston (15), and cylinder (16). Do not remove pusher plate (11). Inspect parts for excessive wear, especially at seat surfaces. Replace if worn, nicked or depressed.

4. Remove the cylinder gasket (18) and clean contacting surface of body (1).

5. Clean flat mating surfaces of body (1) to body cap (5) shoulder.

6. Clean debris from within body (1) cavity. Clean parts to be reused.

   NOTE: *On regulators originally supplied as "oxygen clean", Option 55, maintenance must include a level of cleanliness equal to Cashco cleaning standard #S-1134.*

7. Reinstall a new cylinder gasket (18). Press firmly and evenly into place using the cylinder (16). Do not use a "homemade" cylinder gasket. Pipe sealant may be lightly coated to cylinder gasket (18) surfaces prior to installation, except when utilized as Item 6 above.

9. Reinstall the cylinder (16) concentrically within the body cap (5) opening.

10. Slide the piston (15) slowly into place, assuring that the piston (15) post slides into the female groove of the pusher plate (11).

12. Place piston spring (17) into piston (15) cavity.

13. Use pipe thread sealant applied to the body cap (5) threads. Thread body cap (5) into body (1). Impact until body cap (5) is metal to metal against body (1) at the body cap (5) shoulder.

14. 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.*

15. Spray liquid leak detector around body cap (5) and body (1) for test for leakage. Test pressure should be a minimum of 100 psig (6.9 Barg) at the inlet. Outlet should be tested to upper value of range spring (14) with a 100 psig (6.9 Barg) minimum.

    NOTE: *When piston (15) assemblies are used with comp seats, Cashco, Inc. does not recommend attempting to remove the comp seat. If composition seat is damaged, replace entire piston assembly.*

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) 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 dia-

phragm 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 (30.1) 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 "Gasoila" 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 (30.23) 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.

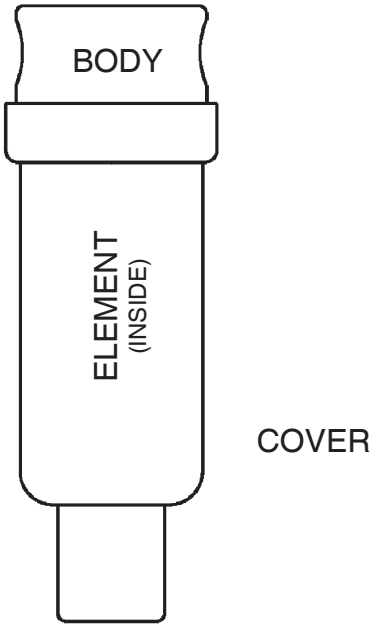
3. Re-connect the external sensing line to the pilot valve sensing port.

⚠ 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.



Inlet Filter

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 pusher 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 (60.10).

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.

3. Remove piston spring (60.17), 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 (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 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 <u>every</u> 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.	C. Rotate knob on metering valve in 1/4 turn increments to be more or less sensitive to changes in P2 pressure. **<u>DO NOT</u>** 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, B-9).
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.

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).

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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.

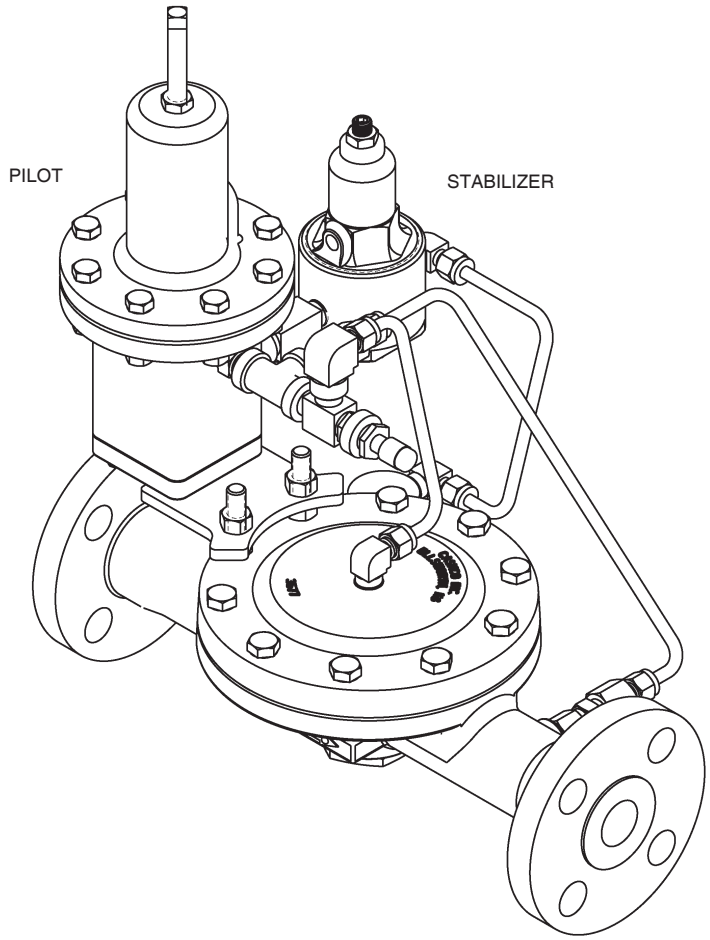
PARTS "KIT" for FIELD REPAIR:

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".*

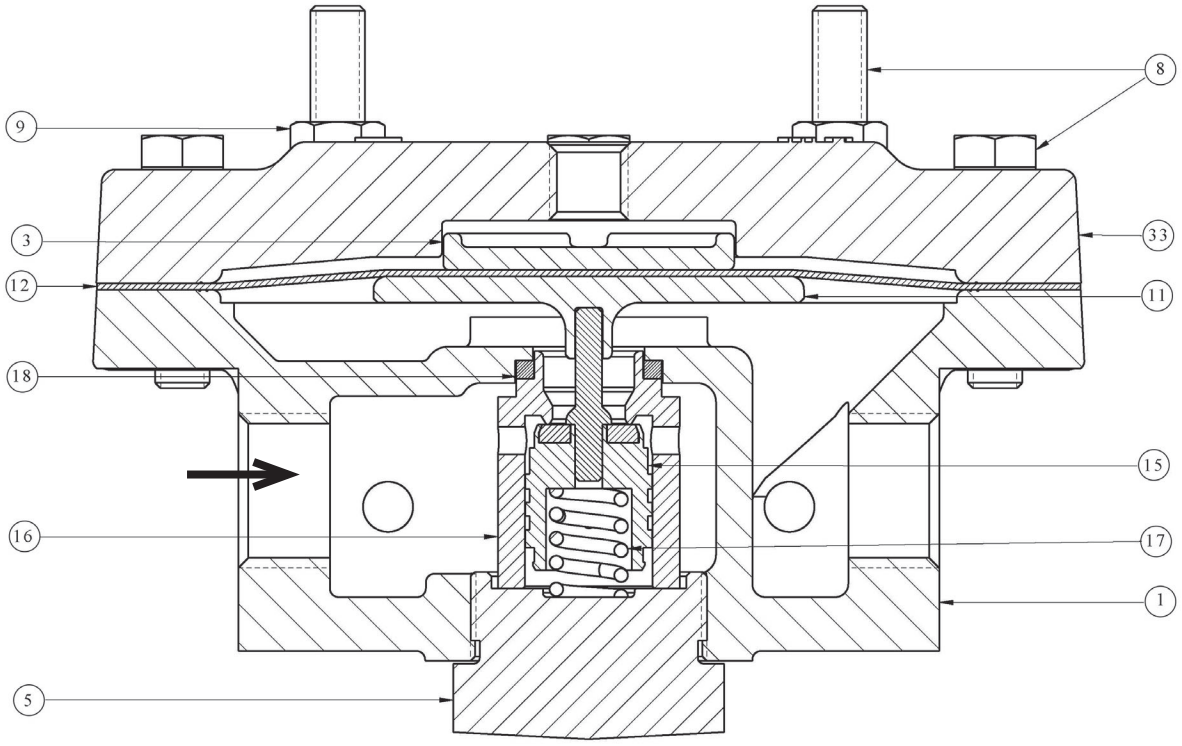
If the "BOM" is not available, refer to the cross-sectional drawings included in this manual for part identification and selection.

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



Assembled View

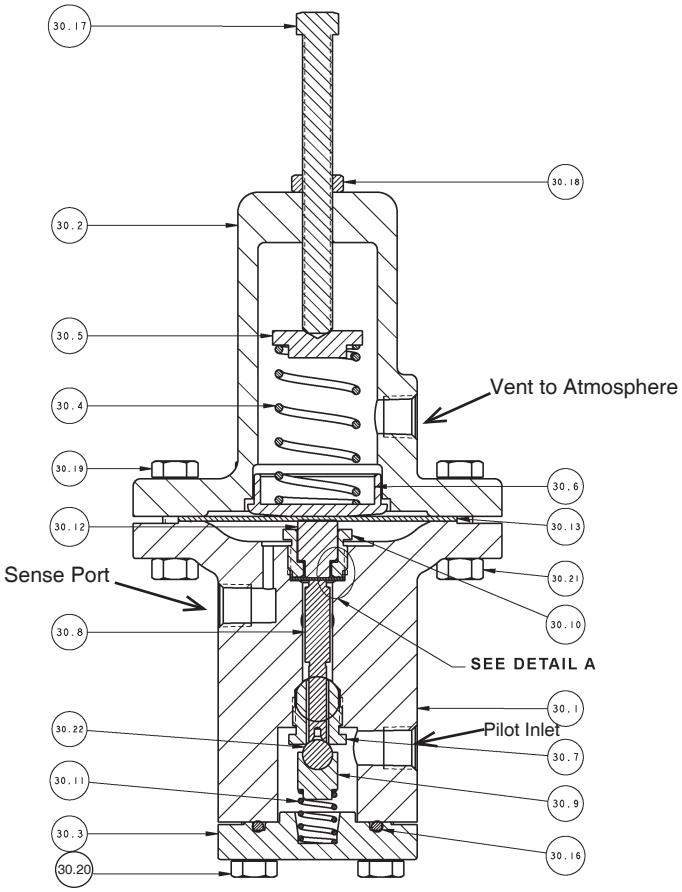
The PGR-2 is designed for external sensing. Use 3/8" or 1/2" (DN10 or DN15) outer diameter tubing to connect the pilot sensing port to a location in the piping down stream of the main regulator. If PGR-2 is constructed with self contained feature - tubing and connection in downstream piping is not required.



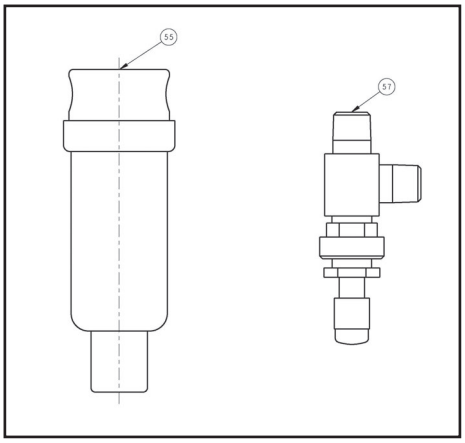
Main Body Assembly

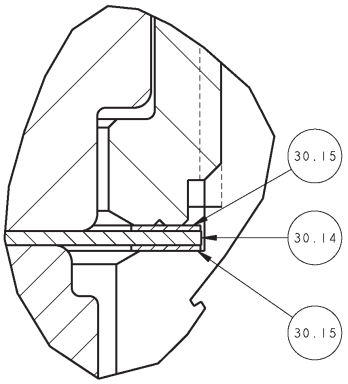
Item No.	Description	
1	Body	
3	Pressure Plate	
5	Body Cap	
8	Cap Screw (Flange Bolting)	
9	Nut (Hex) (Flange Bolting)	
11	Pusher Plate	*
12	Diaphragm	*
15	Piston	*
16	Cylinder	*
17	Piston Spring	*
18	Cylinder Gasket	*
33	Loading Chamber	

* Recommended Spare Parts



PILOT VALVE
ITEM 30





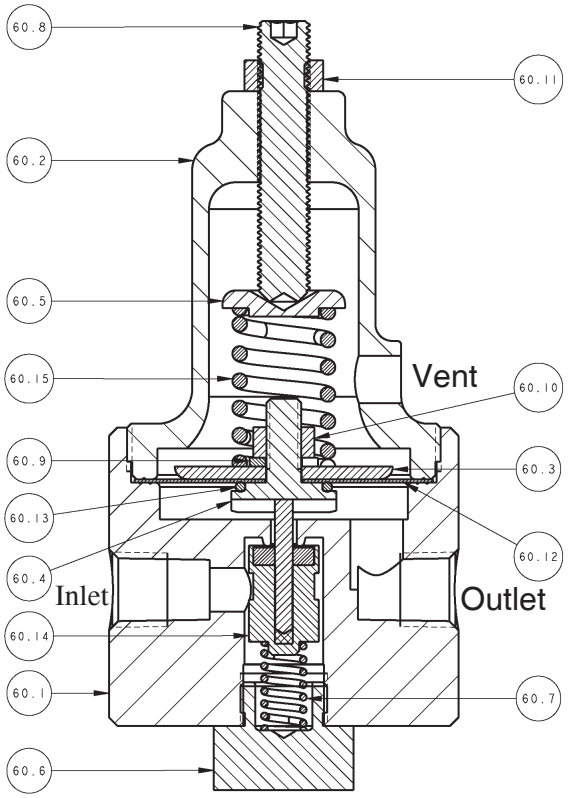
DETAIL A

Pilot Assembly

Item No.	Description
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

Item No.	Description	
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



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 94/9/EC: Explosive Atmospheres and Cashco Inc. Regulators

NOTICE

Only for Product Codes wherein hazard category ATEX has been selected.

These valves satisfy the safety conditions according to EN 13463-1 and EN 13463-5 for equipment group IIG 2 c.

Caution: Because the actual maximum temperature depends not on the equipment itself, but upon the fluid temperature, a single temperature class or temperature cannot be marked by the manufacturer.

Specific Precaution to Installer: Electrical grounding of valve must occur to minimize risk of effective electrical discharges.

Specific Precaution to Installer: Atmosphere vent holes should be plugged to further minimize the risk of explosion.

Specific Precaution to Maintenance: The Valve Body/ Housing must be regularly cleaned to prevent buildup of dust deposits.

Specific Precaution to Maintenance: Conduct periodic Continuity Check between Valve Body/ Housing and Tank to minimize risk of electrical discharges.

Attention: When repairing or altering explosion-protected equipment, national regulations must be adhered to. For maintenance and repairs involving parts, use only manufacturer's original parts.

ATEX requires that all components and equipment be evaluated. Cashco pressure regulators are considered components. Based on the ATEX Directive, Cashco considers the location where the pressure regulators are installed to be classified Equipment-group II, Category 3 because flammable gases would only be present for a short period of time in the event of a leak. It is possible that the location could be classified Equipment-group II, Category 2 if a leak is likely to occur. Please note that the system owner, not Cashco, is responsible for determining the classification of a particular installation.

Product Assessment

Cashco performed a conformity assessment and risk analysis of its pressure regulator and control valve models and their common options, with respect to the Essential Health and Safety Requirements in Annex II of the ATEX directive. The details of the assessment in terms of the individual Essential Health and Safety Requirements, are listed in Table 1. Table 2 lists all of the models and options that were evaluated and along with their evaluation.

Models and options not listed in Table 2 should be assumed to not have been evaluated and therefore should not be selected for use in a potentially explosive environment until they have been evaluated.

Standard default options for each listed model were evaluated even if they were not explicitly listed as a separate option in the table. Not all options listed in the tables are available to all models listed in the tables. Individual TB's must be referenced for actual options.

When specifying a regulator that is to be used in a potentially explosive environment one must review the evaluations in Table 1 and 2 for the specific model and each and every option that is being specified, in order to determine the complete assessment for the unit.

A summary of the models and options found to have an impact on ATEX assessment due to potential ignition sources or other concerns from the ATEX Essential Health and Safety Requirements, are listed below.

1. The plastic knob used as standard on some models, (P1, P2, P3, P4, P5, P7, 3381, 4381, 1171, and 2171) is a potential ignition source due to static electricity. To demonstrate otherwise, the knob must be tested to determine if a transferred charge is below the acceptable values in IEC 60079-0 Section 26.14 (See items 25, 27, and 28 in Appendix A). Until the plastic knob has been shown to be acceptable, then either the metal knob option, or a preset outlet pressure option is required to eliminate this ignition source (See items 45 and 64 in Tables).

2. The pressure gauges offered as options on a few of the regulator models (DA's, P1-7, D, 764, 521), use a plastic polycarbonate window that is a potential ignition source due to static electricity. To demonstrate that the gauges are not a potential source of ignition, the gauges would need to be tested to determine if a transferred charge is below

indicating the gauge is compliant with the ATEX Directive (See items 26, 27, and 28 in Appendix A). Until compliance is determined, regulators should not be ordered with pressure gauges for use in potentially explosive environments.

3. Tied diaphragm regulators with outlet ranges greater than 100 psig should be preset to minimize the risk that improper operation might lead to an outboard leak and a potentially explosive atmosphere (See item 6 in Table 1).

4. 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 regulator with the self- relieving option in a flammable gas system could create an explosive atmosphere in the vicinity of the regulator.

5. Regulators with customer supplied parts are to be assumed to not have been evaluated with regard to ATEX and thus are not to be used in a potentially explosive environment unless a documented evaluation for the specific customer supplied parts in question has been made. Refer to Table 1 for all models and options that have been evaluated.

Product Usage

A summary of ATEX related usage issues that were found in the assessment are listed below.

1. Pressure regulators and control valves must be grounded (earthed) to prevent static charge build-up due to the flowing media. The regulator can be grounded through any mounting holes on the body with metal to metal contact or the system piping can be grounded and electrical continuity verified through the body metal seal connections. Grounding of the regulator should follow the same requirements for the piping system. Also see item 30 in Table 1.

2. The system designer and users must take precautions to prevent rapid system pressurization which may raise surface temperatures of system components and tubing due to adiabatic compression of the system gas.

3. Heating systems installed by the user could possibly increase the surface temperature and must be evaluated by the user for compliance with the ATEX Directive. User installation of heating systems applied to the regulator body or system piping that affects the surface temperature of the pressure regulator is outside the scope of this declaration and is the responsibility of the user.

4. 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 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 rise under any operating conditions. If a process gas temperature rise is possible under operating conditions, then the system designer must investigate whether the regulator body and downstream piping may increase in temperature enough to create a potential source of ignition.

The process gas expansion is typically modeled as a constant enthalpy throttling process for determining the temperature change. A Mollier diagram (Pressure – Enthalpy diagram with constant temperature, density, & entropy contours) or a Temperature – Entropy diagram with constant enthalpy lines, for the process gas, can be used to determine the temperature change. Helium and hydrogen are two gases that typically increase in temperature when expanding across a regulator. Other gases may increase in temperature at sufficiently high pressures.

Product Declaration

If the above issues are addressed by selecting options that do not have potential sources of ignition, avoiding options that have not been assessed, and by taking the proper usage issue precautions, then Cashco regulators can be considered to be a mechanical device that does not have its own source of ignition and thus falls outside the scope of the ATEX directive.