

# MODEL PBE-H

## PRESSURE BUILD / ECONOMIZER REGULATOR

### SECTION I

#### I. DESCRIPTION AND SCOPE

Model PBE-H is a pressure reducing regulator used to control pressure in gas storage tanks. Available in bronze construction with brass and stainless steel trim, 1/2"(DN15) FNPT connections. Suitable for liquid and gaseous service. Refer to Technical Bulletin PBE-H-TB for specific design conditions and selection recommendations.

### SECTION II

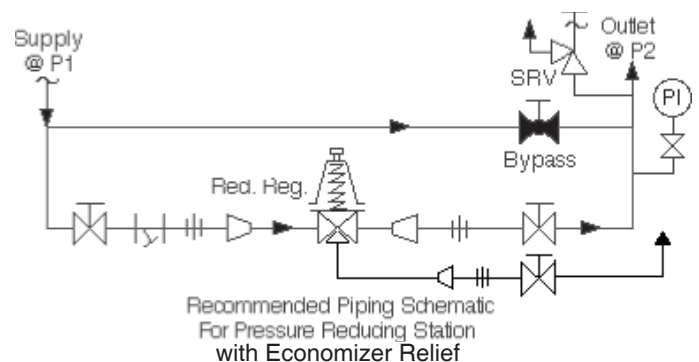
#### II. INSTALLATION



#### 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.

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 safety 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 piping of all foreign material including chips, welding scale, oil, grease and dirt before installing the regulator. Strainers are recommended.
7. In placing thread sealant on pipe ends prior to engagement, ensure that excess material is removed and not allowed to enter 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.
10. Recommended installation is with spring chamber hanging directly below the body in a vertical downwards orientation. Allows water to drain; etc.
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 THRU 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. 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 for view of basic unit and item number listing of parts.

#### B. Diaphragm Replacement:

1. Secure body cap (16) in a vise with the spring chamber (2) oriented upwards.



#### CAUTION

To prevent damage to body cap, use soft jaws when securing the body in a vise.



#### 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.

2. Relax range spring (6) by turning adjusting screw (3) CCW until removed from spring chamber (2).
3. Draw or embed a match mark between body casting (1) and spring chamber casting (2) across the flange area.
4. Remove all diaphragm nuts (21) & bolts (20).
5. Remove spring chamber, spring button (5), range spring (6) and pressure plate (10).
6. Remove diaphragm(s) (11) and diaphragm gasket (12). Depending on outlet pressure level, multiple metal diaphragms may be "stacked". **NOTE:** If a composition diaphragm is used there is no gasket.

7. Inspect pressure plate (10) to ensure no deformation due to over-pressurization. If deformed, replace
8. Clean body (1) diaphragm flange surface. Do not scratch diaphragm gasket seating surface. **NOTE:** Regulators originally supplied as "oxygen clean", maintenance must include a level of cleanliness equal to Cashco's cleaning standard #S-1134. Contact factory for details.
9. Place diaphragm gasket (12) on body (1) flange. Lay diaphragm(s) (11) on top of gasket. Visually center pressure plate (10) onto diaphragm(s) and set range spring (6) around raised hub of pressure plate.
10. Apply Christolube or equivalent to depression of spring button (5) where adjusting screw (3) makes contact. Set spring button on top of range spring (6); ensure spring button is laying flat on top of spring.
11. Aligning the matchmarks from step 3 previous, place spring chamber (2) over the above stacked parts. Install all bolts (20) and nuts (21) hand tight. Mechanically tighten bolting in a star pattern that allows spring chamber (2) to be pulled down evenly. Tighten to 15-18 ft-lbs (20-24 N-m) torque.
12. Apply Christolube or equivalent to threads of adjusting screw (3) and install adjusting screw with locknut (4) into the spring chamber (2).

#### C. Trim Replacement:

1. Trim inspection requires that the diaphragm(s) be removed. Refer to Section VI.B. Steps 1-8.
2. Lift the pusher plate (25) up to inspect seating surface on the pusher plate and the seating surface of the piston (17) assembly. If either seat surface shows signs of erosion/wear, the pusher plate and piston assembly (17) should be replaced. Remove pusher plate spring (23).
3. To remove piston assembly, secure body (1) in a vise with the body cap (16) oriented upwards.



#### CAUTION

To prevent damage to the body, use soft jaws when securing body in a vise. Position body so that vise does not close over the inlet and the outlet connections.

4. Rotate body cap (16) CCW to remove from body.
5. Remove piston spring (18), piston spacer (24), piston assembly (17) and cylinder (26). Remove screen filter (19) if Opt.-21. Inspect TFE seating surface on the piston assembly (17). **NOTE:** *The piston (17) assembly can not be dis-assembled. If the TFE seat is damaged, replace the entire piston assembly.*
6. Remove the cylinder gasket (27) and clean contacting surface of body (1).
7. Clean body (1) cavity and all parts to be reused. **NOTE:** *Regulator originally supplied as "oxygen clean", maintenance must include a level of cleanliness equal to Cashco's cleaning standard #S-1134. Contact factory for details.*
8. To re-install trim, position gasket (27) around small end of the cylinder (26). Insert small end of cylinder (with gasket) down inside center of body. If unit includes Option -21 -- slide screen filter (19) around the cylinder O.D.
9. Slip the u-cup seal (22) (open end of cup facing towards the large O.D. of the piston) over the lower end of the piston assembly and into the groove.
10. Slide the piston assembly into the cylinder, TFE seat end in first. **NOTE:** *Piston should move freely up and down within the cylinder. Place the spring spacer (24) over the end of the piston assembly. Ensure the "flat" surface side of spring spacer is up.*
11. Center the piston spring (18) on top of the spacer.
12. Apply Formula 8 thread sealant to the body cap (16) male threads. Carefully position the body cap over the piston spring and engage the threads. **NOTE:** *While engaging the threads - may encounter minimum resistance from upward force of the piston spring. With hand pressure continue to press body cap down evenly until threads are fully engaged. Tighten to 100 ft.lbs. (135 N-m). These two parts seal metal-to-metal with no gasket.*
13. Re-orient body assembly in vise and secure by the body cap, (body cap oriented down).
14. Center the pusher plate spring (23) around the exposed upper end of the piston assembly. Place the raised surface side of the pusher plate (25) down on the pusher plate spring. Ensure that the half round seat surface of the pusher plate rests in the upper end of the piston assembly.
14. Reinstall diaphragm, spring, etc. per Section VI.B. Step 9-12.

## 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. Excessive pressure downstream.

Possible Causes	Remedies
A. Regulator not closing tightly.	A. Inspect the seating. Clean 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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#### **NEW REPLACEMENT UNIT:**

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



#### **CAUTION**

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

#### **PARTS "KIT" for FIELD REPAIR:**

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

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

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

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

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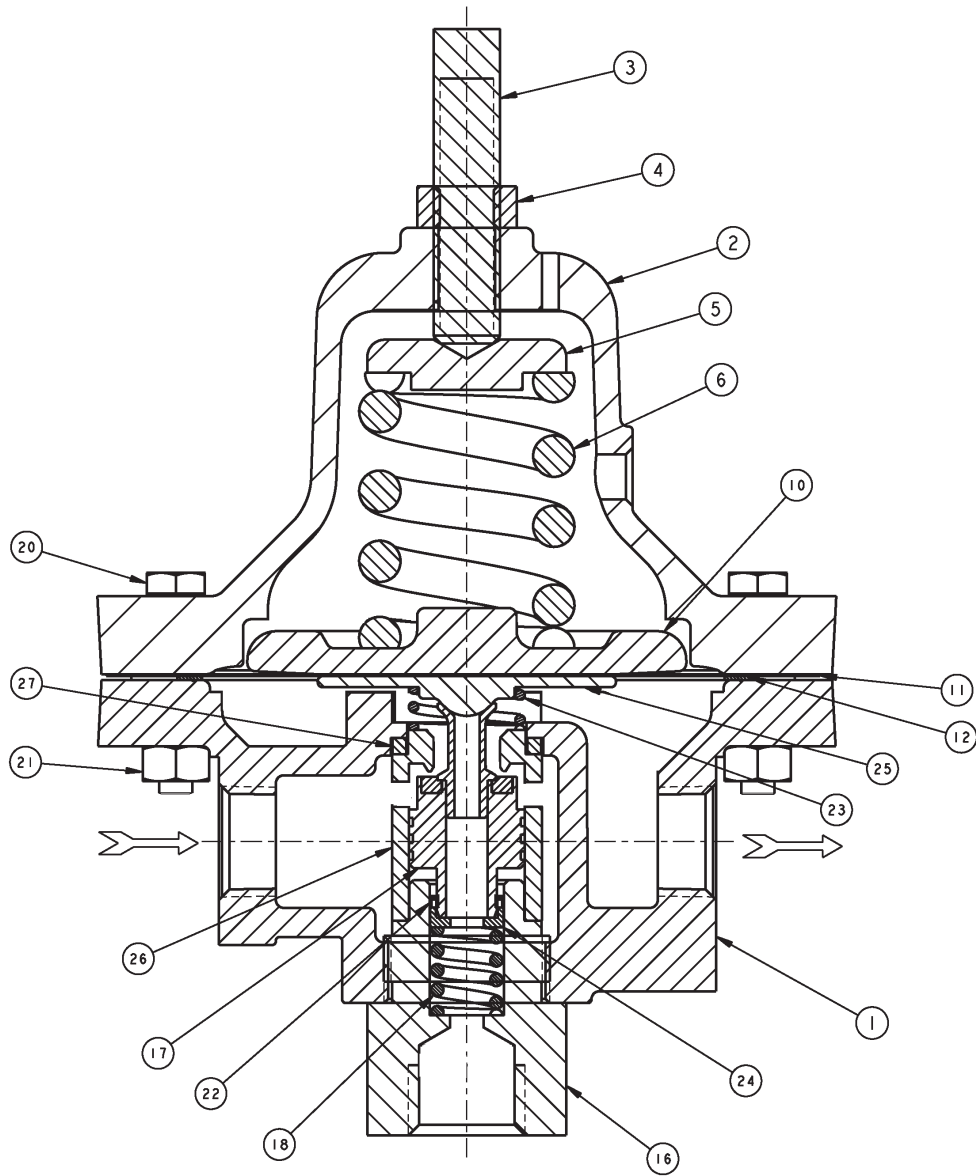


Figure 1

<u>Item No.</u>	<u>Description</u>	<u>Repair Parts Kit B</u>	<u>Item No.</u>	<u>Description</u>	<u>Repair Parts Kit B</u>
1	Body		18	Piston Spring -----	##
2	Spring Chamber		19 *	Inlet Screen	
3	Adjusting Screw		20	Flange Bolts	
4	Locknut		21	Nuts	
5	Spring Button		22	U-cup Seal -----	##
6	Range Spring		23	Pusher Plate Spring	
10	Pressure Plate		24	Piston Spring Spacer	
11	Diaphragms -----	##	25	Pusher Plate	
12	Diaphragm Gasket -	##	26	Cylinder -----	##
16	Body Cap		27	Cylinder Gasket -----	##
17	Piston -----	##			

\* Item not shown

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