ISO Registered Company

MODEL DA0

DIRECT-ACTING, PRESSURE LOADED PRESSURE REDUCING REGULATOR for STEAM APPLICATIONS

SECTION I

I. DESCRIPTION AND SCOPE

Model DA0 is a pressure reducing regulator used to control downstream (outlet or P2) pressure. Sizes are 1/2" (DN15), 3/4" (DN20), 1" (DN25), 1-1/4" (DN32), 1-1/2" (DN40), 2" (DN50), 3" (DN80) and 4" (DN100). Refer to Technical Bulletin DA0-TB for design conditions and selection recommendations. (***NOTE:*** *This product was formerly identified as a Model D0; a Model DA0 and D0 are one and the same product.)*

This manual does not include instructions related to the various methods of pressure loading a Model DA0 main valve.

SECTION II

II. REFERENCES

Refer to Technical Bulletin DA0-TB and DAG-TB for technical specifications for this regulator.

ABBREVIATIONS

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

SECTION III

III. 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.

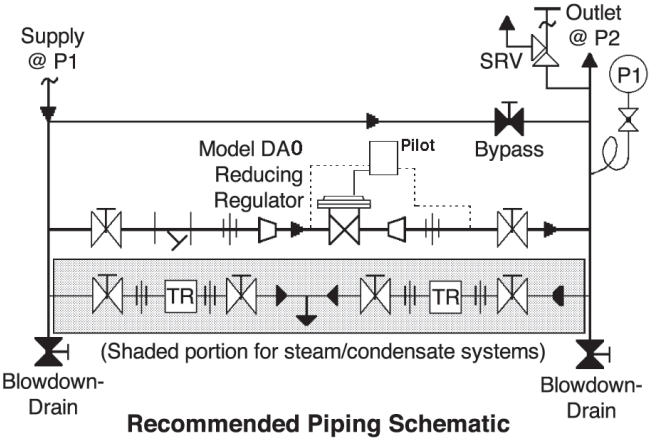
1. Regulator may be rotated around pipe axis 360 degrees. For ease of maintenance, the recommended position is with the cover dome (25) upwards.
2. Provide space below, above, and around regulator for removal of parts during maintenance.
3. Install block valves and pressure gauges to provide means for 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. Steam traps should be installed before and after the regulator to provide proper drainage.
5. Install the regulator with the flow in the direction of the arrow cast or stamped into the body.
6. For best performance, it is recommended that the piping upstream and downstream of the regulator be straight and free from any restrictions or bends, which can cause turbulence, for a minimum length of approximately fifteen to twenty pipe diameters.
7. Pipe size should be given special consideration, particularly downstream of the regulator, to ensure that the steam velocity does not exceed industry or customer guidelines. Reference DAG-TB, Table DAG-11 for recommendations for applying external pressure sensing.
8. External sensing, uses an external control line. This line is connected from the 1/4" (DN8) NPT tap on the side of the pilot body to a pressure tap downstream of the regulator. Use 1/4" or 3/8" (DN8 or 10) outer diameter tubing or 3/8" (DN10) pipe having an inner diameter equivalent to Schedule 40 pipe. For condensable vapors (i.e. steam), slope the external sensing line downward 2 to 5 degrees to the outlet piping and prevent water pockets, which allows the diaphragm chamber to always be self draining.

⚠ 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.

⚠ 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.



Recommended Piping Schematic For Pressure Reducing Station

SECTION IV

IV. PRINCIPLE OF OPERATION

1. The pilot receives steam from the upstream tapping in the side of the main regulator body and passes it through to the cover dome. When a loading pressure – P_{Load} – is applied into the top of the cover dome, the outlet controlled pressure – P_2 – will balance at approximately .90 – .98 of the loading pressure - P_L. ***(NOTE:*** *Fluctuations in P_1 – Inlet Pressure will cause a deviation in P_2 – Outlet Pressure due to inverse sympathetic ratio effect.) See Section VIII.*
2. Movement occurs as pressure variations register on the stop plate. The registering pressure is the outlet, P_2, or downstream pressure. The loading pressure fluid opposes plug movement. As outlet pressure drops, the loading pressure pushes the stop plate down, opening the port; as outlet pressure increases, the plug pushes up and the port opening closes.
3. 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.

2. Adjust the loading system pressure control device so that main regulator is trying to be controlled at 0 psig pressure. (For spring loaded pilots, relax the range spring compression by turning the adjusting screw CCW.)
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.*

⚠ CAUTION

Do not walk away and leave a bypassed regulator unattended!

4. Crack open the outlet (downstream) block valve to approximately 10% full open.
5. Slowly open the inlet (upstream) block valve to about 25% open. Adjust the loading system pressure control device setpoint pressure upwards until the main valve is flowing. Observe the outlet pressure gauge to ensure not over pressurizing.
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 inlet block valve and go to Step 2. Close bypass valve approximately 25%, and repeat procedure.
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 adjusting the loading system pressure control setpoint to the desired outlet pressure level.

10. Reduce system flow to a minimum level and observe pressure set point. Outlet pressure will rise from the set point of Step 9 for a Model DA0. 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. Shutoff auxiliary loading pressure source, if supplied. For spring loaded pilots, relax the range spring by turning the adjusting screw CCW until adjusting screw is removed.

3. Allow sufficient time for the line pressure downstream of the inlet block valve to bleed down.

4. Shutoff the outlet block valve.

5. Relieve the trapped upstream and downstream pressure and loading pressure.

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

SECTION VII

VII. MAINTENANCE

A. General:

⚠ 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. The regulator may be serviced without removing the regulator from pipeline. The regulator is designed with quick-change trim to simplify maintenance.

2. Record the nameplate information to requisition repair parts for the regulator. The information should include: size, Product Code and Serial Number.

3. Refer to Section X 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.

5. The Inner Trim is removed and replaced in the body (23) as an assemblage of parts. The Inner Trim Assembly, hereinafter called **ITA**, consists of the following parts:

Item No.	Part Description
7	Nut
10	Stop Plate
13	Guide Bearing/Piston
14	Lower and Upper Static Stem Seal
15	Cage O-ring Seal
16	Wiper
17	Wiper Washer
19	Cage
20	Plug
21	Seat Ring
27	Dynamic Side Seal

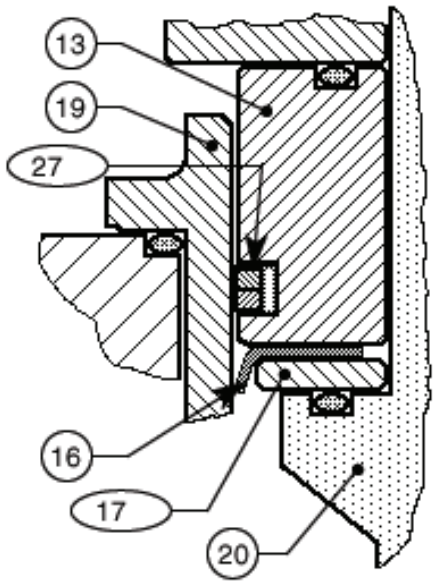


Figure 1: Dynamic Side Seals

⚠ 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.

B. Main Valve Disassembly:

1. Shut down system in accordance Section VI.

2. Disconnect the external piping line(s) connecting pilot to main regulator.

3. Though it is possible to disassemble the main unit while installed in a pipeline, it is recommended that maintenance be done in a shop when possible. The descriptions hereafter will assume shop disassembly. Remove regulator from pipeline.

4. Place the body in a vise with the cover dome (25) oriented upwards.

5. Loosen the flange bolts (11) and nuts (12) uniformly and remove.

6. Place matchmarks on body (23) and cover dome (25) flanges. Remove cover dome and gasket (13).

7. Evenly loosen the three cage cap screws (18) in single revolution increments. ***NOTE:*** *Regulator contains a lower spring (22); the ITA should rise as the cage cap screws are evenly backed out. A downwards holding force should be applied to the top of the piston-guide bearing (13) to prevent the ITA from popping up as the last threads of the cage cap screws are backed out.*

8. Remove the ITA by pulling up on the plug (20). Set ITA aside.

9. Remove spring (22) from within the body (23).

10. Remove cage o-ring seal (15).

11. Remove body (23) from vise. Clean all reusable metal parts according to owner's procedures.

C. Disassembly of the ITA:

1. To disassemble the ITA, hold the lower part of the plug (20) in a bench vise; Do not hold on the machined surface in the plug's (20) spindle area. ***NOTE:*** *The spindle "slides" in the "pressed-in-place" lower guide bushing (24) and the surface can not be marred.*

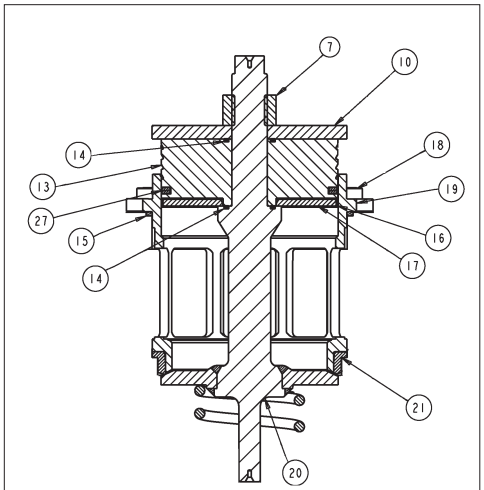


Figure 2: Assembled ITA,

2. Rotate diaphragm lock nut (7) CCW and remove.

3. Remove stop plate (10). Remove ITA from vise.

4. From below the cage (19) pull the plug (20) downwards out of the piston-guide bearing (13) and out thru the bottom of the cage.

5. Remove the piston-guide bearing (13) from the upper end of cage (19).

6. Examine the dynamic side seal (27) mechanism to determine 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.

7. Remove top seal (14) and dynamic side seal (27) and discard. ***NOTE:*** *Special care should be taken when using "tools" to remove the components to ensure that no scratches are imparted on to any portion of the piston-guide bearing (13) groove.*

8. Remove wiper seal (16)and wiper washer (17) from within cage (19).

9. Remove lower stem seal (14) from plug (20).

10. Remove seat ring (21) from bottom of cage; 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.

11. Clean all reusable metal parts according to owner's procedures.

D. Inspection of Parts:

1. After inspection remove from the work area and discard the old “soft goods” parts (i.e. o-rings, 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. Plug (20);
      1. 16 rms finish on its seating surface for tight shutoff.
      2. No major defects on bottom guide spindle.
   b. Cage (19);
      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 in bore.
      2. Max 0.015 inch (0.38 mm) clearance between plug (20) spindle and lower guide bushing (24).

4. Staging Material for Reassembly.
   a. Inspect and clean parts, as necessary, from the spare parts kit.
   b. Lay out all the regulator parts and check against the bill of material.

E. Reassembly of the ITA:

1. When replacing the wiper seal (16), the replacement wiper seal (16) is “pre-formed”. It may, however, require re-forming. Under normal circumstances, this step may not be required. If needed, reform the wiper seal (16) by pressing the temporary assembly of parts into the cage (19) backwards as shown in Figure 3. The wiper seal (16) is best left in this position overnight (minimum of two (2) hours) prior to final reassembly.

2. After re-forming the wiper seal, remove parts (13, 16, 17) from cage (19) and disassemble this temporary assembly.

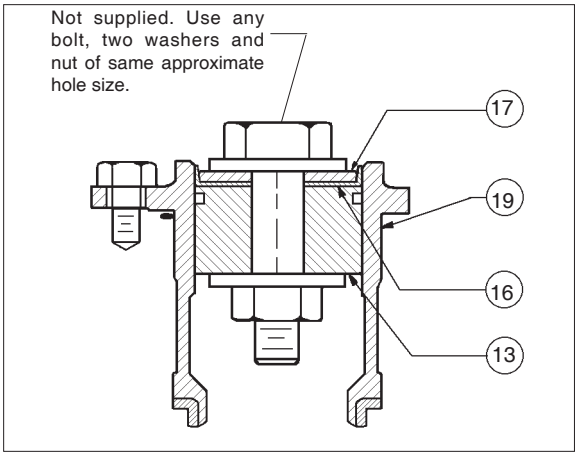


Figure 3: Temporary Wiper Seal Assembly

3. Place wiper washer (17) into “cup” of wiper seal (16). Holding these parts between thumb and forefinger, insert into cage (19) at an approximate 45° angled approach with wiper washer (17) on bottom, wiper seal (16) on top with turned-down lip of wiper seal entering cage first. Rotate wiper seal and wiper washer to a level position approximately half way down into cage. Allow wiper washer to rest on bottom of cage.

4. Stretch the corrugated, metal, piston ring energizer of the dynamic seal (27) over the lower circumference of piston-guide bearing (13). Using thumbs, work the energizer into the bearing groove.

5. Carefully stretch and slip one of the piston ring seals over the lower circumference of piston-guide bearing (13), taking care not to “cut” the piston ring seal. Using thumbs, work the piston ring seal into the groove of the bearing. Repeat this procedure with a second piston ring seal. ***NOTE:*** *A piston ring assembly (PRA) (27), consists of one metal corrugated energizer and two piston ring seals*

6. Position piston-guide bearing (13) over and into upper end of cage (19) until the lower piston ring seal touches the upper lip of the cage. While gently applying force to press the piston-guide bearing into the cage, simultaneously use fingers to lightly circumferentially press the first piston ring seal inwards into the piston-guide bearing groove until the first

piston ring seal “slips inside” the cage (19). Repeat process for second piston ring seal .

7. Place properly oriented seat ring (21) onto its shoulder at the lower end of cage (19).

8. Install new lower stem o-ring seal (14) into groove of plug (20).

9. Insert plug (20) upwards through lower end of cage (19) and through the center hole in piston-guide bearing (13), wiper washer (17) and wiper seal (16). Hold plug (20) and cage (19) assembly together.

10. Place the second new upper stem o-ring seal (14) into groove of guide bearing (13). Position stop plate (10) on top of stem seal and guide bearing.

11. Thread nut (10) over the upper end of plug (20) and tighten hand tight.

12. Place this assembly of parts into vise, use the "flats" on the lower part of the plug to secure tight. Use torque value as follows:

Body Size in (DN)	Torque Value Ft-lbs (N-m)
1/2" - 1" (15 - 25)	60 - 70 (81 - 95)
1 1/4" - 2" (32 - 50)	120 - 130 (163 - 176)
2 1/2" - 4" (65 - 100)	110 - 120 (149 - 163)

13. This completes ITA reassembly.

F. Main Reassembly:

1. Place body (23) in a vise.
2. Lower spring (22) into the body (23) and center around the bushing.

3. Position the cage o-ring seal (15) down in the body groove.

4. With the ITA held manually in the closed position, carefully insert ITA into body (23). ***NOTE:*** *Lower spring (22) must be compressed to allow the cap crews (18) to engage the threads in the body.*

5. Properly align all three cage bolt holes with holes in the body. There is only one circumferential location possible for this alignment. Use hand to apply downward force to the top of the cage (19) until the ITA is lowered sufficiently to engage the cage cap screws (18) into the body (23). To secure cap screws tight, rotate cap screws CW in equal increments in one-half revolution increments to pull down the ITA evenly, taking care NOT TO “ANGLE” the ITA in the BODY. Torque cap screws to 13-15 ft-lbs (17.6-20.3 N-m).

6. Install new gasket (37) onto body (23) flange.

7. Aligning matchmarks and flange bolt holes, place cover dome (25) onto body (23).

8. Install all flange bolts (11) and nuts (12) with nameplate (99) located under one bolt head..

9. Tighten the body bolting (11,12) evenly 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)
2 1/2" - 4" (65 - 100)	45 - 50 (61 - 69)

G. Pressure Testing:

1. If a hydrostatic pressure test is performed, pressure must be applied to all three of cover dome (25), inlet and outlet of body at the same level.
   DO NOT HYDROSTATICALLY TEST WITHOUT COVER DOME PRESSURIZED. NOT ADHERING WILL DO PHYSICAL DAMAGE TO INTERNALS THAT COULD RENDER THE UNIT INOPERABLE.

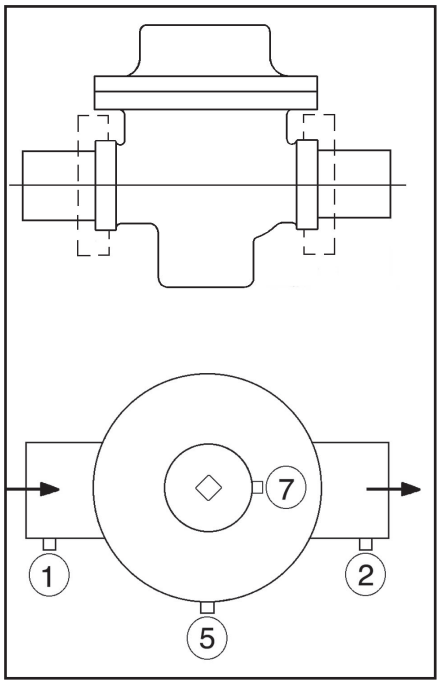


Figure 4: Location of Auxiliary Ports

2. Inboard Leakage Test.
   a. Release all loading pressure in cover dome.
   b. Pressurize inlet to 30 psig (2.1 Barg) with air, GN_2.
   c. Tube outlet to a beaker of water to observe number of escaping gas bubbles.

   Inboard leakage path may be via plug/seat or dynamic side seal.

3. Pressure Containment Test.
   a. Pressurize inlet to 200 psig (13.8 Barg) and outlet and cover dome to 150 psig (10.3 Barg) with air or GN_2.
   b. Spray liquid lead detector and check all external leak points; i.e. plugged connections, and flange bolting.

4. Excessive leakage will require disassembly, examination of sealing elements, correction of problem, reassembly and retesting.

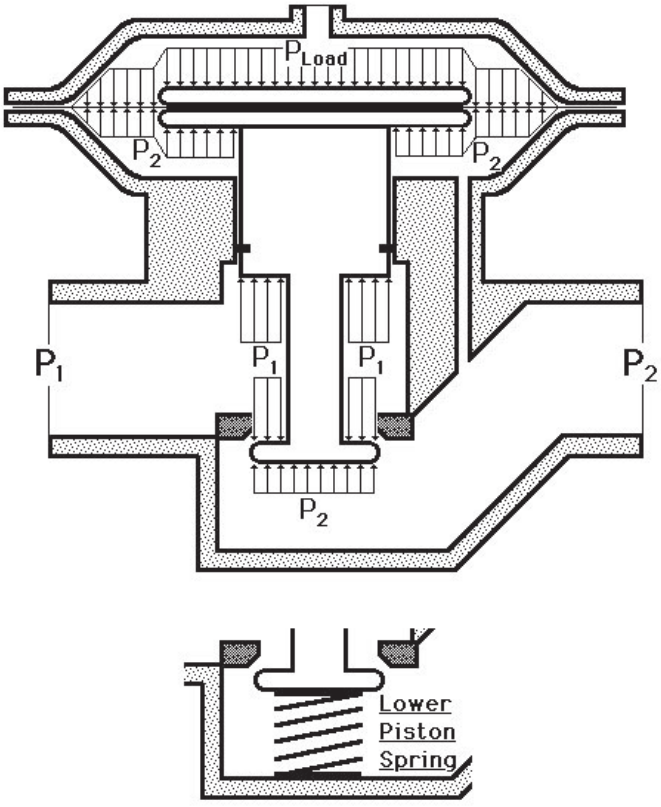
SECTION VIII

VIII. PRESSURE LOADING

1. Loading pressure can be supplied using various schemes. Please reference LOADING SYSTEMS on web-site for the schematics of these various schemes, including:
   - pressure unloading using BPV
   - pressure loading using PRV
   - pressure loading using pilot
   - pressure loading using I/P transducer
2. The Model DA0 exhibits a deviation in outlet controlled pressure when the inlet pressure varies; this "effect" is identified as ISR – Inverse Sympathetic Ratio. Its relative pressure effect can be calculated from the following equation.

LOADING PRESSURE FOR MODEL DA0

APPLIED PRESSURES



ISR FACTOR	
BODY SIZE in (DN)	ISR – %
1/2" - 1" (15 - 25)	3.0
1 1/4" - 1 1/2" (32 - 40)	4.0
2" (50)	2.0
2 1/2" - 4" (65 - 100)	5.4

PISTON SPRING		
LOWER PISTON SPRING RANGE psig (Barg)	ΔP Piston Spring psig (Barg)	LVPS psig (Barg)
none (none)	0 (0)	0 (0)
2 - 5 (.14 - .34)	3 (.21)	2 (.14)
1 - 2 (.07 - .14)	1 (.07)	1 (.07)
4 - 10 (.28 - 6.9)	6 (.41)	4 (.28)

SIZE / ORIENTATION – S/O Factor		
Body Size in (DN)	Orientation	
	Cover Dome on Top	Cover Dome on Bottom
1/2" - 1" (15 - 25)	1	-1
1 1/4" - 1 1/2" (32 - 40)	2	-2
2" (50)	2.5	-2.5
2 1/2" - 3" (65 - 80)	3	-3
4" (100)	4	-4

$$P_{LOAD} = \text{ISR Effect} + \frac{\text{Lower Piston Spring}}{\text{Compression Effect}} + \frac{\text{Lower Piston Spring}}{\text{Spring Preload}} + \frac{\text{Body Size}}{\text{Orientation Effect}}$$

$$P_{Load} = P_2 + [ISR \times (P_1 - P_2)] + \left[\frac{C_{V\,Req'd}}{C_{V\,Max}} \times \Delta P_{Piston\ Spr.}\right] + LVPS + S/O_{Factor}$$

Figure 8: Loading Pressure Formula

SECTION IX

IX. 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:

- Fluid (with fluid properties)
- Range of flow rate
- Range of inlet pressure
- Range of outlet pressure
- Range of fluid 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 size regulator.
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 restriction or bleed orifices. C2. Clean filter(s). C3. Clean loading pressure control device.
D. Faulty loading pressure control device.	D. Replace/repair loading pressure control device.
6. Leakage at body/cover flange.	
Possible Causes	**Remedies**
A. Body bolts not torqued properly.	A. Torque to proper value (see Section VII, F-11).
B. Pressures may be too high.	B. Consult factory.
7. Leakage across seat.	
Possible Causes	**Remedies**
A. Contamination (debris) in regulator.	A. Remove internals, clean, & 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 size regulator.
* Seat leakage may be diagnosed when a failure of the dynamic side seal has occurred. Inspect both potential internal leak paths.	

SECTION X

X. 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-□□□□□□□□□

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.

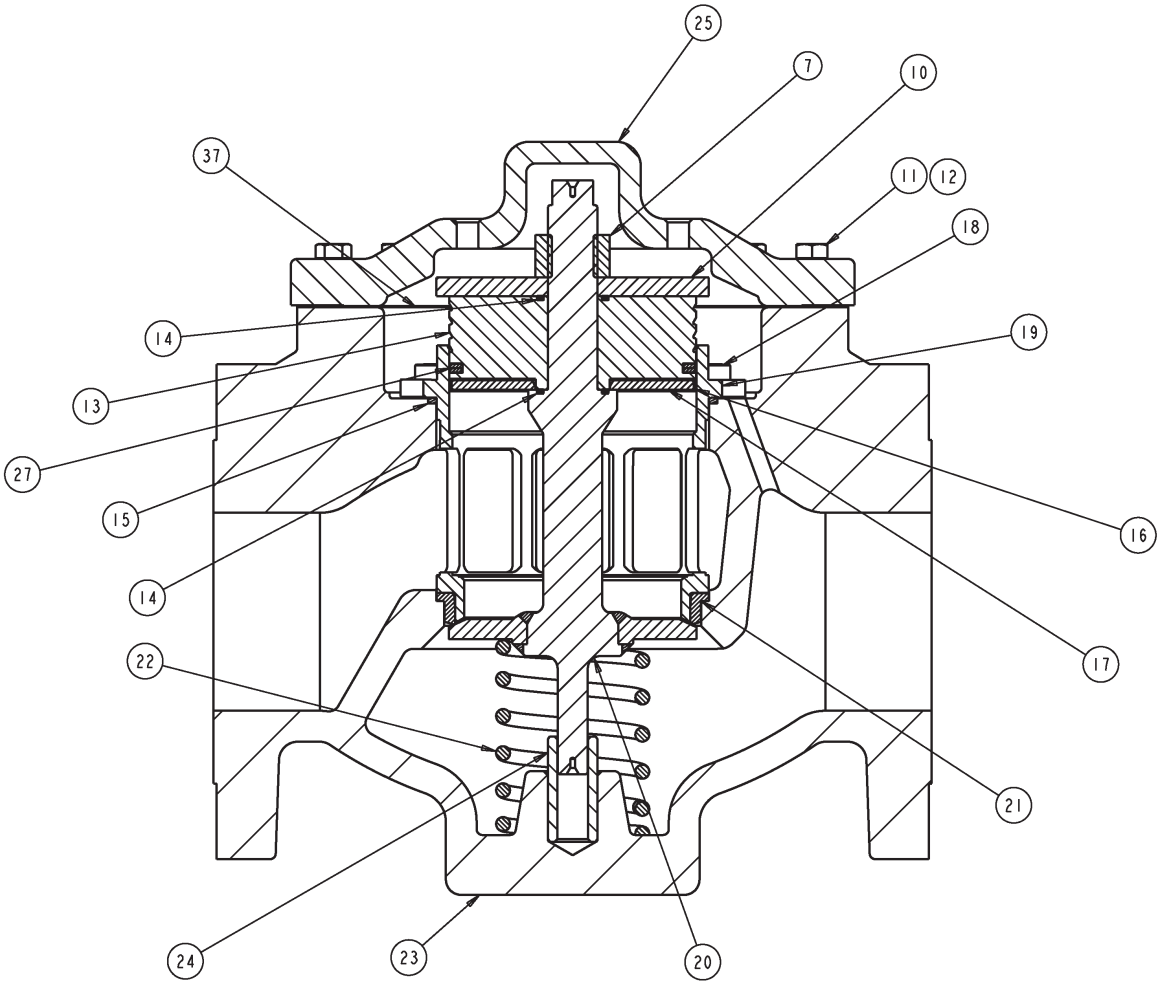


Figure 5

Item No.	Description
7	Nut
10	Stop Plate
11	Cap Screws
12	Nuts
13	Guide Bearing
14 *	Seal
15 *	Cage Seal
16 *	Wiper Seal
17	Washer
18	Cage Cap Screws
19	Cage

Item No.	Description
20 *	Plug
21 *	Seat
22	Spring
23	Body
24	Body Bushing
25	Cover Dome
27 *	Dynamic Seal (see Figure 1)
37 *	Gasket
90	Washer (on 1/2"- 2" sizes below No.7)

* Recommended Repair Parts.

IOM ADDENDUM:

ATEX DIRECTIVE 2014/34/EU and THE EQUIPMENT AND PROTECTIVE SYSTEMS INTENDED FOR USE IN POTENTIALLY EXPLOSIVE ATMOSPHERES REGULATIONS 2016

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 and given in Schedule 1 of The Equipment and Protective Systems Indented for Use in Potentially Explosive Atmospheres Regulations 2016. 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:

II 2 G
Ex h IIB T6... T1 Gb
1000ATEXR1 X

The 'X' placed after the technical file number indicates that the product is subject to specific conditions of use as follows:

1. The maximum surface temperature depends entirely on the operating conditions and not the equipment itself. The combination of the maximum ambient and the maximum process medium temperature shall be used to determine the maximum surface temperature and corresponding temperature classification, considering the safety margins described prescribed in EN ISO 80079-36:2016, Clause 8.2. Additionally, the system designer and users must take precautions to prevent rapid system pressurization which may raise the surface temperature of system components and tubing due to adiabatic compression of the system gas. Furthermore, the Joule-Thomson effect may cause process gases to rise in temperature as they expand going through a regulator. This could raise the external surface temperature of the regulator body and the downstream piping creating a potential source of ignition. Whether the Joule-Thomson effect leads to heating or cooling of the process gas depends on the process gas and the inlet and outlet pressures. The system designer is responsible for determining whether the process gas temperature may raise under any operating conditions.

2. Where the process medium is a liquid or semi-solid material with a surface resistance in excess of 1GΩ, special precautions shall be taken to ensure the process does not generate electrostatic discharge.

3. Special consideration shall be made regarding the filtration of the process medium if there is a potential for the process medium to contain solid particles. Where particles are present, the process flow shall be <1m/s (<3.3 ft/s) in order to prevent friction between the process medium and internal surfaces.

4. Effective earthing (grounding) of the product shall be ensured during installation.

5. The valve body/housing shall be regularly cleaned to prevent build up of dust deposits.

6. Regulators must be ordered with the non-relieving option (instead of the self-relieving option) if the process gas they are to be used with is hazardous (flammable, toxic, etc.). The self-relieving option vents process gas through the regulator cap directly into the atmosphere while the non-relieving option does not. Using regulators with the self-relieving option in a flammable gas system could create an explosive atmosphere in the vicinity of the regulator.

7. Tied diaphragm regulators with outlet ranges greater than 7 barg (100 psig) should be preset to minimize the risk that improper operation might lead to an outboard leak and a potentially explosive atmosphere.

8. All equipment must only be fitted with manufacturer's original spare parts.

9. Ensure that only non-sparking tools are used, as per EN 1127-1, Annex A.

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

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