

MODEL 123-1+6+S DIFFERENTIAL BACK PRESSURE / RELIEF REGULATOR

SECTION I

I. DESCRIPTION AND SCOPE

The Model 123-1+6+S Differential is designed for high pressure liquid or gas applications to Cashco drawing nos. 32934 (NACE construction) and 32935 (Non-NACE construction). It is used to control differential upstream (inlet or P_1) pressure and a loading (P_{LOAD}) pressure to a rotating shaft seal. Sizes are 1/2", 3/4", 1", and 1-1/2" (DN15, 20, 25, and 40).



CAUTION

This is not a safety device and must not be substituted for a code approved pressure safety relief valve or rupture disc. NOT FOR STEAM SERVICE. NOT FOR OXYGEN SERVICE.

SECTION II

II. INSTALLATION

This unit was designed and is used almost exclusively on compressor and turbo expander seal systems. **REFER TO COMPRESSOR/EXPANDER MANUFACTURER'S MANUAL FOR DETAILED INSTALLATION, START-UP AND SHUTDOWN OF THIS UNIT.** Install regulator with Inlet (P_1) pressure coming in the side body (1) connection in accordance with the directional flow arrow cast on body (1).

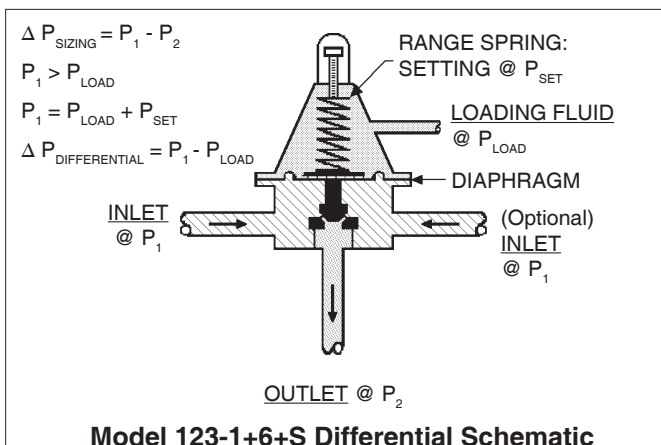
SECTION III

III. PRINCIPLE OF OPERATION

1. Movement occurs as pressure variations register on the diaphragm (3). The registering pressure is the inlet (P_1) or upstream pressure which registers on the "underneath" side of the diaphragm (3). The second pressure registered is the loading (P_{LOAD}) pressure in the spring chamber (2) "above" the diaphragm (3). The range spring (18) determines the differential pressure setpoint (P_{SET}). As inlet

(P_1) pressure drops, the range spring (18) pushes the diaphragm (3) down, closing the port; as inlet (P_1) pressure increases, the diaphragm (3) pushes up and the port opens. As the loading (P_{LOAD}) pressure varies, the inlet (P_1) pressure tends to follow. An increase in (P_{LOAD}) will increase inlet (P_1) pressure by nearly an equal amount; a decrease in (P_{LOAD}) will decrease the inlet (P_1) pressure.

2. A complete diaphragm (3) failure will cause the fluids to mix in the spring chamber (2) or loading pressure piping. Regulator action will "fail close" under a diaphragm (3) failure.
3. Under normal operating conditions, the inlet (P_1) pressure should be greater than the loading (P_{LOAD}) pressure by the range spring (P_{SET}) setpoint.



CAUTION

Limit any field hydrostatic test to 1-1/2 times the Maximum Pressure Rating (See Table 1). Ensure that the test pressure is applied uniformly to the body inlet, body outlet, and spring chamber.

TABLE 1

MAX OPERATING PRESSURES & TEMPERATURE RATING SPECIFICATIONS												
DESCRIPTION	NPT and 1500# ANSI Fig.				600# ANSI Fig.				900# ANSI Fig.			
	100°F (38°C)		400°F (205°C)		100°F (38°C)		400°F (205°C)		100°F (38°C)		400°F (205°C)	
	psig	(Barg)	psig	(Barg)	psig	(Barg)	psig	(Barg)	psig	(Barg)	psig	(Barg)
Max. Pressure for CS Body/Spg. Ch.	1500	(103)	1500	(103)	1480	(102)	1270	(88)	1500	(103)	1500	(103)
Max. Pressure for SST Body/Spg. Ch.	1500	(103)	1500	(103)	1440	(99)	995	(69)	1500	(103)	1500	(103)
Operating Temperature Range -20°F (-28°C) to +400F (+204C)												

SECTION IV

IV. STARTUP

REFER TO THE COMPRESSOR/EXPANDER MANUFACTURER'S MANUAL FOR DETAILED STARTUP OF THIS UNIT.

1. On initial start-up with your system operating at normal conditions, check the differential gauge to ensure the desired differential pressure is being maintained. If not, go to step 2 and make one final adjustment. (This should only be necessary on first start-up.) **NOTE: It is crucial that the adjusting screw (17) threads not be damaged. Do not use pliers or locking pliers on the adjusting screw (17).**
 - a. Loosen the closing cap (22) by turning CCW 3-4 complete revolutions. Loosen lock nut (9) by turning CCW until it is tight (double-nutted) against closing cap (22). Now the differential setting may be adjusted by turning the closing cap (22) CW to increase differential or CCW to decrease. After desired setting is reached, loosen lock nut (9) from closing cap (22) and tighten each securely to spring chamber (2).
 - b. Remove closing cap (22) from adjusting screw (17) by turning CCW. Loosen lock nut (9) by turning CCW. Turn the adjusting screw (17) CW to increase differential pressure or CCW to decrease. Tighten lock nut (9) and replace closing cap (22).
2. To adjust differential setting, use one of these two methods:
 - a. Loosen the closing cap (22) by turning CCW 3-4 complete revolutions. Loosen lock nut (9)

SECTION V

V. SHUTDOWN

REFER TO THE COMPRESSOR/EXPANDER MANUFACTURER'S MANUAL FOR DETAILED SHUTDOWN OF THIS UNIT.

SECTION VI

VI. MAINTENANCE

WARNING

SYSTEM UNDER PRESSURE. Prior to performing any maintenance, isolate the regulator from the system and relieve all pressure(s). 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 5 for differential regulator cutaway drawing.

WARNING

SPRING UNDER COMPRESSION. Prior to removing spring chamber subassembly (2), relieve range spring (18) compression by backing out the adjusting screw (17). Failure to do so may result in flying parts that could cause personal injury.



CAUTION

DO NOT ATTEMPT TO REMOVE ADJUSTING SCREW (6) FROM TOP OF SPRING CHAMBER (2). The adjusting screw (6) is threaded up from inside the spring chamber (2) and the CCW rotation used to relieve range spring (14) tension will come to a stop. At the stopping point, do not apply any torque to adjusting screw (6) or damage may occur and render the unit inoperable. See Figure 1.

B. Disassembly:

1. Securely install the body (1) in a vise with the spring chamber (2) directed upwards.
2. Remove closing cap (22).
3. Loosen sealing locknut (9) by rotating CCW. Relax range spring (18) by turning adjusting screw (17) CCW.
4. Draw or embed a match mark between body (1) casting and spring chamber (2) subassembly along flanged area.
5. Remove all body flange hardware (7,8,30,41,42).
6. Remove spring chamber (2) and connected parts, range spring (18) and spring button (19).



CAUTION

When body flange hardware (7,8,30,41,42) is removed from this unit it should always be replaced with new. The new hardware (7,8,30,41,42) must have the proper grade specification identification markings and meet the following standards:

1. All cap screws (7,30) and flange stud nuts (8) must have "heavy hex heads".
2. All studs (41,42) and cap screws (7,30) must comply with or exceed the requirements of ASTM-A-193, Grade B7.
3. All flange stud nuts (8) must comply with or exceed the requirements of ASTM A-194, Grade 2H.

New body flange hardware (7,8,30,41,42) may be purchased from Cashco, Inc. or through the OEM.

7. Adjusting screw (17) o-ring inspection:

- a. With locknut (9) and closing cap (22) removed, turn adjusting screw (17) CW as far as possible by grasping the flats on top end. Carefully reach inside spring chamber (2) and grasp adjusting screw (17) by hand. Remove adjusting screw (17) by rotating CCW. See Figure 1A.

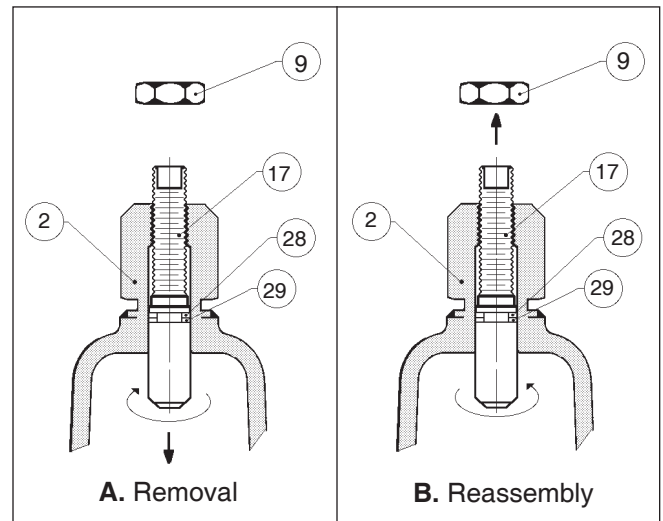


Figure 1: Adjusting screw (17) o-ring inspection.

- b. Inspect the backup ring (28) and quad ring (29) for wear. If nicked or torn - replace. **NOTE:** Make certain the teflon backup ring (28) will insert into spring chamber (2) first, before the quad ring (29). (See Figure 7 blow-up illustration). Make sure the quad ring (29) is on straight with no twist. Use a good grade lightweight grease on the ring seals (28,29).
 - c. Lubricate adjusting screw (17) threads. Carefully reinstall adjusting screw (17) up into the spring chamber (2) by rotating adjusting screw (17) CW until top of adjusting screw (17) protrudes from top of spring chamber (2) (See Figure 1B.). **NOTE:** Care should be taken when holding and rotating adjusting screw (6) so the quad ring (29) and backup ring (28) are not inadvertently nicked or torn. Grasp top of adjusting screw (17) and turn CCW until rotation stops (**see CAUTION C**).
 - d. Loosely install the lock nut (9) and closing cap (22).
8. Lift up and remove the diaphragm subassembly consisting of the piston (14), piston nut (6), diaphragm (3), diaphragm covers (24) (NACE unit only, Cashco Dwg. 32934), pressure plate (20), pusher plate (21), sealing washer (27), pressure plate o-ring (31) and pusher plate o-ring (34). Remove the flange o-ring (32).
 9. Loosen piston nut (6) and separate all parts (3,24 (NACE units only), 14,20,21,27,31,34) of the diaphragm (3) subassembly.

10. Inspect pressure plate (20) and pusher plate (21) to assure no deformation due to over-pressurization. Inspect diaphragm (3). If deformed, replace.
11. Remove cylinder subassembly (12) by rotating CCW. **NOTE:** For 1-1/2" (DN40) body reduced orifice only, also remove the cylinder bushing (33) at this time. See Figure 6.
12. Inspect cylinder seat (12.2). If seat shows erosion or wear, the entire cylinder/seat assembly (12) must be replaced.
13. Remove body (1) from vise.
14. Clean all parts to be reused according to owner's procedures. Use special care cleaning the flat mating surfaces of the body (1), cylinder (12) and cylinder bushing (33) shoulders (1-1/2" (DN40) size only) as these pressurized joints are metal-to-metal.

C. Reassembly:

1. Place body (1) back into vise.
2. a. For standard orifice: Lubricate the cylinder (12) threads lightly with thread sealant, insert the cylinder (12) into the body (1) and screw CW until finger tight. Impact the cylinder (12) into the body (1).
- b. For 1-1/2" (DN40) body reduced orifice ONLY: Lubricate cylinder (12) and cylinder bushing (33) threads lightly with thread sealant. Screw the cylinder (12) into the cylinder bushing (33) until finger tight. Then screw the cylinder (12) and cylinder bushing (33) "subassembly" into the body (1) until finger tight. Impact this cylinder (12)/cylinder bushing (33) "assembly" into the body (1). See Figure 6.
3. Place diaphragm flange o-ring (32) on body (1) flange.
4. Place piston (14) in a vise with threaded post portion directed upwards, grasping on the hexagonal surface.
5. Position properly oriented pusher plate (21) over piston (14) post.

6. Place pusher plate o-ring (34) into recess of pusher plate (21). Lubricate with good grade lightweight grease.
7. Place diaphragm (3) and diaphragm covers (24) (NACE construction only) according to following instructions:
 - a. NACE variation only (Cashco Dwg. #32934): Place one of the two diaphragm cover(s) (24) over piston (14) post. Place diaphragm (3) and second diaphragm cover (24) over piston (14) post.
 - b. NON-NACE variation only (Cashco Dwg. #32935): Place diaphragm (3) over piston (14) post.
8. Place pressure plate o-ring (31) into recess of pressure plate (20). Lubricate with a good grade lightweight grease. Position pressure plate (20) over the piston (14) post.
9. Place the sealing washer (27) (metal side up) over the piston (14) post.
10. Thread piston nut (6) onto piston (14) post. Torque to the following value:
All sizes: 45-50 Ft-lbs (61-68 N-m).
11. Release the piston (14) from vise. Insert the piston/diaphragm subassembly into the body (1) with piston (14) engaging the cylinder (12). Align diaphragm (3) and body (1) bolt holes.
12. Place the range spring (18) onto the retainer hub of the pressure plate (20).
13. Place multipurpose, high temperature grease into depression of spring button (19) where adjusting screw (17) bears. Set spring button (19) onto range spring (18); ensure spring button (19) is laying flat.
14. Aligning matchmarks, place spring chamber (2) over the stacked parts. Rotate adjusting screw (17) CW into spring chamber (2) until contact is made with the spring button (19). NOTE: Contact will begin to lift the spring chamber (2) up from body (1). Relax adjustment screw (17) so that spring chamber (2) and body (1) just make contact. (This will keep the range spring (18) from falling over while the body (1) and spring chamber (2) are bolted back together).

15. Using "NEW" studs (41,42) and nuts (8) (**see CAUTION D**), thread one nut (8) onto each stud (41,42) approximately 1.25" (32 mm). Drop the studs (41,42) with nuts (8) through holes in spring chamber (2). (This will assist in keeping the spring chamber (2) centered on valve body (1) and prevent parts from moving during reassembly).

Using "match marks" made in Step B.4 as a guide, replace spring chamber (2) onto body (1). Thread lower nuts (8) onto studs (41,42) and tighten by hand. Adjust length of studs (41,42) by using the top nut (8) to allow at least 3-4 threads protruding from the lower nut (8).

Torque body flange hardware (7,8,30,41,42) using small increments in a 180° alternating pattern until flange mating surfaces of body (1) and spring chamber (2) are metal to metal. This creates a "fixed compression" on the diaphragm (12) and o-ring seal (32). Recommended torque values are listed in Table 2.

TABLE 2

BODY SIZE		ITEM NO.	THREAD SIZE	TORQUE VALUE	
in	(DN)			Ft-lbs	(N-m)
1/2" - 1-1/2"	(15-40)	7, 8, 30, 41, 42	7/16-20	32-36	(43-49)

D. Bench test for suitable operation (Test Fluid: Air or compressed gas).

1. Check for desired differential spring setting and regulator performance (with no loading pressure):
 - a. Close No. 1, No. 2, and No. 4 shut-off valves. Open No. 3 and No. 5 shut-off valves.
 - b. Apply inlet (P_1) pressure to No. 1 shut-off valve (10-15 psig (.69-1.0 Barg) above desired differential spring setting). Crack open No. 1 shut-off valve and check for valve opening at desired differential setting. Refer to SECTION IV-2. if range spring (18) adjustment is required.
 - c. Check for performance. **NOTE:** A metal seat will experience a slight seat leakage. Seat leakage should be quantified at 40% deviation from setpoint. For example: For a 15 psid (1.0 Bard)

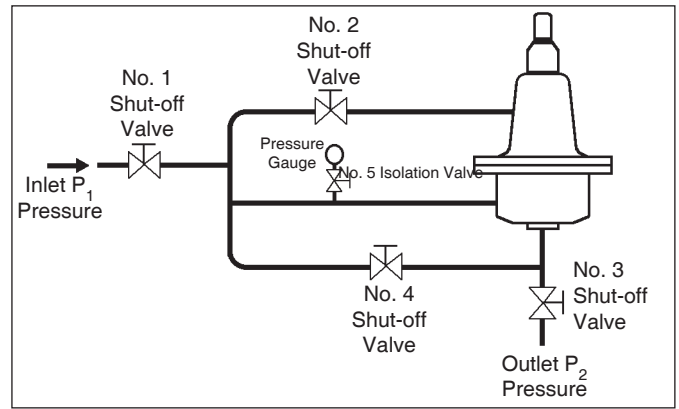


Figure 2: Recommended Bench Test Piping Schematic for 123-1+6+S

differential setting, check seat leakage at 40% below 15 psig (1.0 Barg); or 9 psig (.62 Barg). Seat leakage should be minimal (less than 20 SCFH). See SECTION VII-5. TROUBLE SHOOTING GUIDE if seat leakage is excessive.

2. Proof test to check for external leakage.
 - a. Close No. 1, No. 3, and No. 5 shut-off valves. Open No. 2 and No. 4 shut-off valves. Build inlet pressure to No. 1 shut-off valve to 1-1/2 times maximum inlet pressure, but not to exceed 1-1/2 times Maximum Pressure Rating (See Table 1).
 - b. Crack open No.1 shut-off valve and allow a pressure buildup simultaneously in the body (1) and spring chamber (2). Spray the entire regulator with a liquid leak detector and visually inspect for external leakage. Repair unit if leak is detected. See SECTION VI MAINTENANCE.
 - c. Shut off line pressure to No. 1 shut-off valve. Open No. 3 shut-off valve to relieve all pressure from the test valve and all shut-off valves.
3. Return to Section II for Installation and Section IV for Startup.

SECTION VII

VII. TROUBLE SHOOTING GUIDE

1. Erratic Operation; chattering	
Possible Causes	Remedies
A. Oversized regulator.	A1. Check actual flow conditions, resize regulator for minimum and maximum flow. A2. Increase flow rate. A3. Install next step higher range spring. Contact factory. A4. Before replacing regulator, contact factory.
B. Inadequate rangeability.	B1. Increase flow rate. B2. Decrease regulator pressure drop. B3. Install next step higher range spring. Contact factory.
C. Worn piston/cylinder; inadequate guiding.	C. Replace trim.
D. Unstable loading pressure.	D1. Stabilize loading pressure; i.e. pump, control, valve, etc. D2. Air in loading piping in liquid service. Vent as fully as possible.

2. Regulator inlet (upstream) pressure too high.	
Possible Causes	Remedies
A. Regulator undersized.	A1. Confirm by opening bypass valve together with regulator. A2. Check actual flow conditions, resize regulator; if regulator has inadequate capacity, replace with larger unit.
B. Plugged inlet strainer.	B. Remove strainer screen and clean; consider leaving screen out.
C. Plugged trim.	C. Remove trim and check for plugged holes in cylinder.
D. Incorrect range spring (screwing out CCW of adjusting screw does not allow bringing pressure level to a stable and proper level).	D. Replace range spring with proper lower range. Contact factory.
E. Too much proportional band (rise).	E1. Review Proportional Band (rise) expected. E2. Contact factory.
F. Restricted diaphragm movement.	F1. Ensure no moisture in spring chamber at temperatures below freezing. F2. Ensure no dust or debris entering vent opening. If rainwater or debris can enter, re-orient spring chamber.
G. Diaphragm failure.	G. Replace diaphragm.

3. Main valve fluid in loading fluid piping.	
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. Ensure not subjecting diaphragm to over-temperature conditions. B3. Upstream (inlet) pressure buildup occurring that overstresses diaphragms.

4. Sluggish operation.	
Possible Causes	Remedies
A. Plugged piston guides.	A. Remove trim and clean.
B. Fluid too viscous.	B. Heat fluid. Contact factory.
C. Diaphragm failure.	C. Replace diaphragm.

5. Excessive seat leakage.	
Possible Causes	Remedies
A. Foreign matter on seating surface.	A. Remove trim and clean.
B. Erosion/damage to seating surface.	B1. Relap seating surface. B2. Replace cylinder sub-assembly and piston.

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 (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.

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 Bill of Materials sheet that was provided when unit was originally shipped.

⚠ **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.

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

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POSITION OF MOUNTING BRACKET STUDS

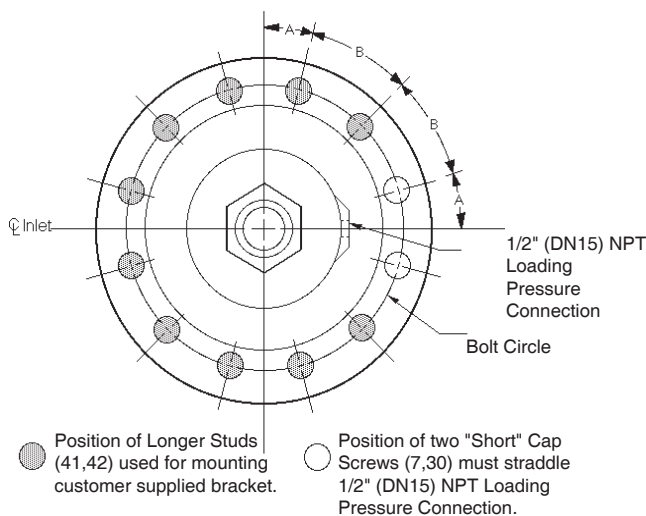


Figure 3: 1/2" & 3/4" (DN15 & DN20) Body Sizes

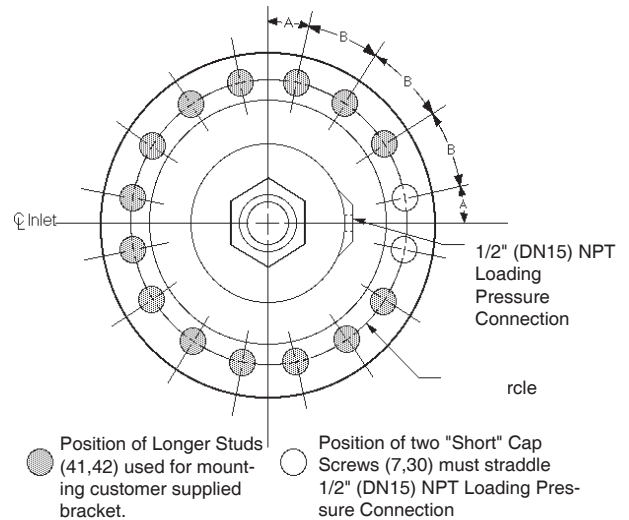


Figure 4: 1-1/2" (DN40) Body Size

Body Size		No. of 1/2" (12.7 mm) Dia. Bolt Holes	Bolt Circle		Position	
in	(DN)		in	(mm)	A	B
1/2", 3/4", 1"	(15, 20, 25)	12	6-1/4"	(159 mm)	15°	30°
1-1/2"	(40)	16	7-1/2"	(191 mm)	11.25°	22.5°

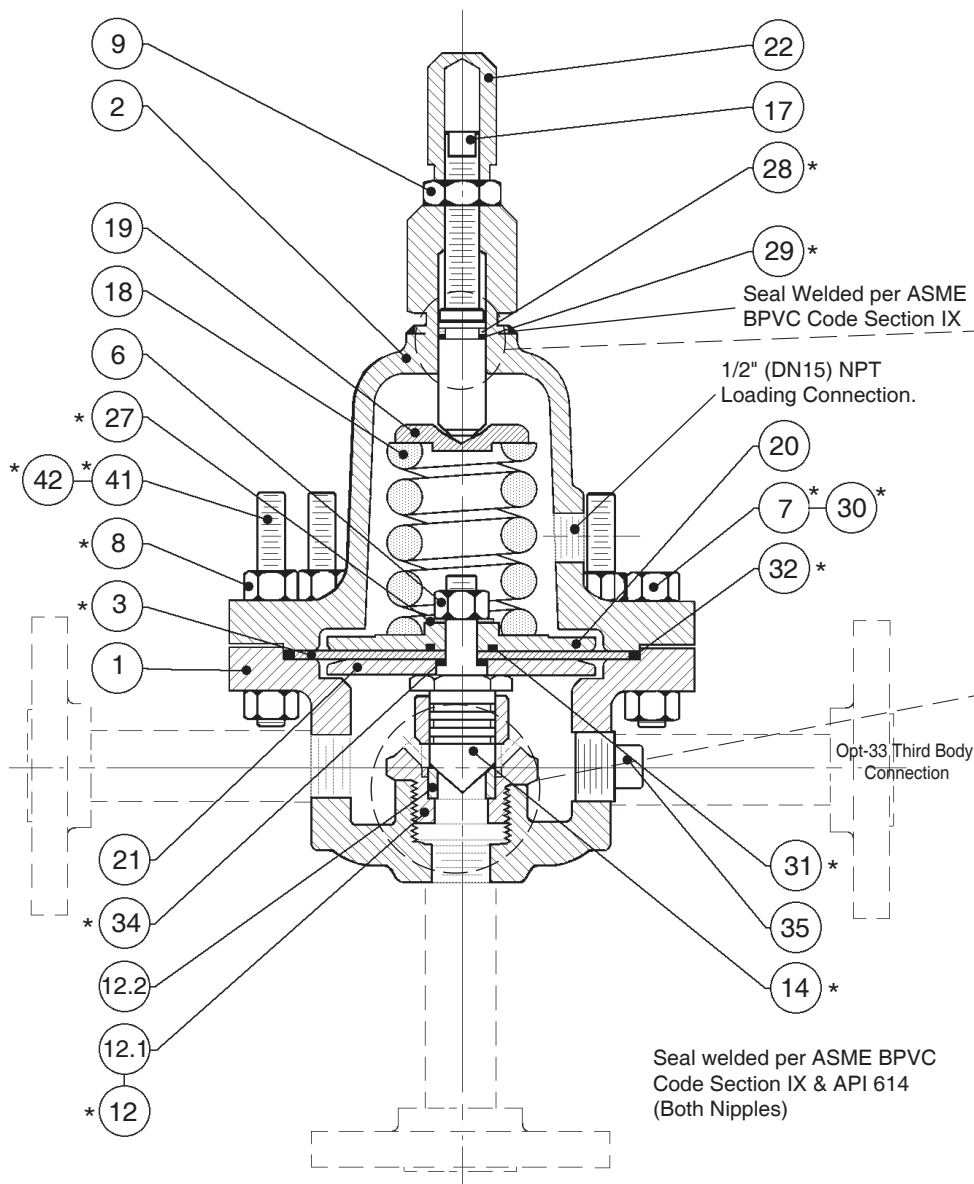


Figure 5: Model 123-1+6+S
(Non-NACE Construction)

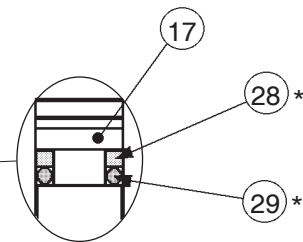


Figure 7: Orientation of Ring Seals (28,29)

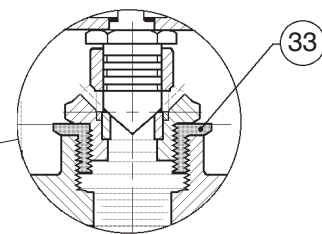


Figure 6: Cylinder Bushing (33)
(Used on 1-1/2\" (DN40) reduced orifice ONLY)

Item No.	Description	Repair Parts	Item No.	Description	Repair Parts
1	Body		20	Pressure Plate	
2	Spring Chamber		21	Pusher Plate	
3	Diaphragm	*	22	Closing Cap	
6	Piston Nut		24	Diaphragm Covers ¹	*
7	Cap Screw (Hex Head)	*	27	Sealing Washer	*
8	Nut (Hex)	*	28	Backup Ring	*
9	Lock Nut		29	Quad Ring	*
10	Name Plate (not shown)		30	Cap Screw (Hex head)	*
12	Cylinder Sub-Assembly	*	31	Pressure Plate O-ring	*
12.1	Cylinder		32	Diaphragm Flange O-ring	*
12.2	Seat		33	Cylinder Bushing (Used on 1-1/2\" Reduced Orifice only)	
14	Piston	*	34	Pusher Plate O-ring	*
17	Adjusting Screw		35	Pipe Plug	
18	Range Spring		41	Stud	*
19	Spring Button		42	Stud	*

¹ NACE Construction only (not shown).

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