ISO Registered Company

MODEL C-PRV
PRESSURE REDUCING REGULATOR

SECTION I

I. DESCRIPTION AND SCOPE

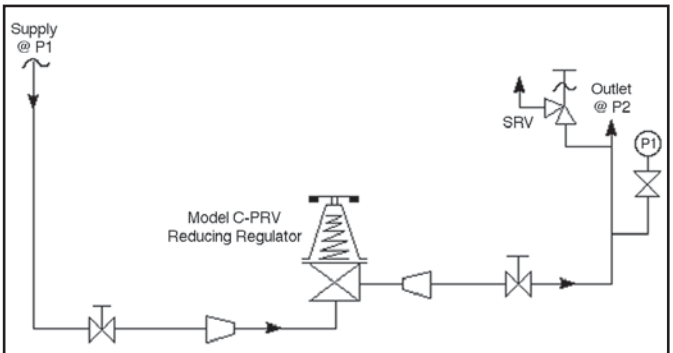
Model C-PRV is a pressure regulator used to control downstream (outlet or P_2) pressure. Inlet and outlet sizes are 1", 1-1/2", 2" and 3" with Tri-Clamp® fitting connections. This regulator is only suitable for liquids and gases at temperatures less than 300°F (149°C). Refer to Technical Bulletin C-PRV-TB for specific design conditions.

SECTION II

II. INSTALLATION

A. General:

1. An inlet block valve should always be installed upstream of the regulator.
2. An outlet pressure gauge should be located approximately ten pipe diameters downstream and within sight.
3. All installations should include a downstream relief device if the inlet pressure could exceed the pressure rating of any downstream equipment.
4. Flow Direction: Install so flow enters through the bottom connection and exits the side connection.
5. Install with spring chamber (2) in the vertical up position to allow for proper draining.



Recommended Piping Schematic for Pressure Reducing Station

⚠ CAUTION

Installation of adequate overpressure protection is recommended to protect the regulator from overpressure and all downstream equipment from damage in the event of regulator failure.

SECTION III

III. PRINCIPLE OF OPERATION

A. General:

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 the 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

⚠ CAUTION

The Model C-PRV should never be used as a shutoff device.

SECTION IV

IV. START-UP

A. General:

1. Ensure that lock-open pin (10) and hitch pin (15) are in proper position. See Section VII.
2. Confirm that the proper range spring is indicated to be within the regulator by inspection of the unit's nameplate. Apply setpoint pressures that are only within the stated range.

3. When stating direction of rotation of the nut or handle (6), the view is with respect to looking down towards the spring chamber or its' normal location.

4. Start with the block valve closed.

5. Relax range spring (7) by turning nut or handle (6) counter-clockwise (CCW) until rotation stops. Rotate nut or handle (6) clockwise (CW) three (3) full revolutions to maintain spring (7) to diaphragm assembly (16) contact. This reduces the outlet pressure setpoint.

6. Slowly open the inlet (upstream) block valve observing the outlet (downstream) pressure gauge. Determine if the regulator is flowing and the downstream equipment is operative. Rotate the regulator nut or handle (6) CW slowly until flow begins.

7. Continue to slowly open the inlet (upstream) block valve until fully open.

8. Develop system flow to a level near its expected normal rate and reset the regulator setpoint by turning the nut or handle (6) CW to increase outlet pressure or CCW to reduce outlet pressure.

SECTION V

V. SHUTDOWN

A. In all cases the regulator should be shutdown by slowly closing the inlet (upstream) block valve.

⚠ CAUTION

DO NOT DEAD-END FLOW DOWNSTREAM of the Model C-PRV as internals may be damaged.

SECTION VI

VI. MAINTENANCE

⚠ WARNING

SYSTEM UNDER PRESSURE. Prior to performing any inspection and cleaning, isolate the regulator from the system and relieve all pressure. Failure to do so could result in personal injury.

A. General:

1. Unit's lock-open feature allows this regulator to be cleaned in-line, see Section VII.

2. Maintenance procedures hereinafter are based upon removal of regulator unit from the pipeline where installed.

3. Owner should refer to owner's procedures for removal, handling, cleaning and disposal of nonreusable parts.

NOTE: *For those fluids which could create a potential hazard to personnel working on this unit, owner must provide an OSHA approved MSDS (Material Safety Data Sheet), and a signed statement attesting to the fact that the unit has been flushed out, for a specific period of time, using an OSHA acceptable neutralizing agent. The name of the agent, manufacturer's name and total concentration level must also be included for both the service medium as well as the neutralizing agent. Returns WILL NOT BE ACCEPTED by Cashco, Inc. without an MSDS form attached to the outside of shipping carton.*

4. Refer to Figure 3 for basic regulator item number reference ( ) and description.

B. Trim Replacement:

1. Secure the bottom portion of the plug (17) in a smooth jawed vise with the spring chamber (2) directed upwards and the face of the inlet flange of the body (1) resting on the vise.

⚠ WARNING

SPRING UNDER COMPRESSION. Prior to removing the clamp (13), relieve spring (7) compression. Failure to do so may result in flying parts that could cause personal injury.

2. Relax range spring (7) by turning nut or handle (6) CCW until rotation stops. Count and record the number of revolutions in the box below.

Number of revolutions required to relax range spring: _____

3. Remove socket head set screw (27) CCW from end of guide post (18).

4. Remove hitch pin (15) and lift up nut or handle (6) to remove.

⚠ CAUTION

Do not apply spring load or operate regulator <u>with hitch pin (15) removed</u> from top of guide post (18). Premature diaphragm failure will result.

5. Loosen thumbclamp screw (13) and remove. **<u>For Opt-80:</u>** 2 piece clamp (13A): Loosen and remove clamp nuts (13B), washers (13D), bolts (13C) and clamps (13A). See Figure 1.

6. Place matchmarks between body (1) and spring chamber(2) to assist in final orientation when reassembled.

7. Lift spring chamber (2) vertically up and off guide post (18) and body (1) and set aside. *NOTE alignment of spring button (4) tab (ears) with slot guides inside spring chamber (2).*

8. Remove bearing seal (22). Lift up to remove adjusting screw assembly (5), spring button (4) and spring (7) off guide post (18).

9. Grasp cap (5.1) of adjusting screw assembly with hand and lift up to separate cap (5.1) from (5.3) to reveal and remove two u-cup seals (5.4). Do Not remove dowel pin (5.2).

10. Install two new guide seals (5.4) in adjusting screw cap (5.1). ***NOTE:*** *There are two sizes of u-cup seals - install the seal with the bigger diameter spring first, open face into the wall of the cap recess.* Ensure that the u-cup is pressed all the way in. *Install the second u-cap seal, open face exposed to face of adjusting screw (5.3).* Look into the hole to confirm that the white seal material is showing and not the spring material. (Spring side of u-cup should be visible.

11. Slide adjusting screw cap (5.1) with new u-cup seals (5.4) and adjusting screw (5.3) together, use the dowel pin (5.2) for alignment. ***NOTE;*** *Top end of pin (5.2) should be flush with top surface of adjusting screw cap (5.1).* Place new seal (22) on adjusting screw cap (5.1). Set parts aside for final assembly later.

12. Remove set screw (19) rotate CCW. Rotate guidepost (18) CCW and remove.

    <u>For 1" Investment Cast Body:</u>
    a. Remove spacer (21).
    b. Remove set screw (24) CCW.

13. **<u>For Metal Seat:</u>** Place a wrench on flats of the adapter nut (20) and rotate CCW to remove. **<u>For Composition Seat:</u>** Use a wrench to secure the flats on the top of the stem (17.1). Place a wrench on flats of the adapter nut (20) and rotate CCW to remove.

14. Remove pressure plate (3), diaphragm (16) and diaphragm spacer (26). ***NOTE:*** *Correct orientation of spacer (26) has the side with the I.D. radius facing towards the clamping surface of the plug (17).*

15. Lift body (1) over end of plug (17).

16. Inspect seating surface of plug. **<u>For Metal Seat:</u>** Replace plug if surface is worn or damaged.
    <u>For Composition Seat:</u> Use a wrench to secure the flats on the top of the stem (17.1). Rotate the stem CCW to remove it. Remove seat disc (17.2) from tail piece (17.3).

17. Clean parts in accordance with owner's specifications.

⚠ CAUTION

Owner's cleaning solution must be compatible with regulator trim materials.

18. Secure bottom part of plug (17) or tailpiece (17.3) in a smooth jawed vise. Set body (1) over top of plug. Ensure that the plug or seat of tail piece is in contact with the seating area of the body (1) and the face of the inlet flange of the body (1) is resting on the vise.

    <u>For Composition Seat:</u> Place a small amount of medium strength, Food Grade threadlocker on threaded end of stem (17.1). Insert threaded end of stem into tail piece, rotate CW tight fit.

19. Install diaphragm spacer (26) on plug (17). Place new diaphragm (16) with convolution side facing up, onto plug (17) and fit it around the diaphragm spacer (26). Align tab on O.D. of diaphragm (16) with the tab slot cut in the body flange lip.

20. Lay pressure plate (3) on top of diaphragm (16).

21. Apply Emhart Bostic White Food Grade "Never Seeze" or equivalent to threaded end of plug (17). Thread adapter nut (20) onto plug (17) and tighten to 60 in-lbs of torque.

For 1" Investment Cast Body:

a. Install spacer (21).
b. Apply medium strength, Food Grade threadlocker set screw (24). Thread set screw into adapter nut (20) secure tight to "flat" on plug (17).
c. Apply Emhart Bostic White Food Grade "Never Seeze" or equivalent to the external threads of the adapter (20) and thread guide post (18) securely to the adapter.

22. Thread guide post (18) onto end of plug (17), tighten firmly into place.

23. Apply medium strength, Food Grade threadlocker to set screw (19). Thread set screw tight into guide post (18).

24. Position spring (7) over guide post (18) - resting flat on pressure plate (3).

25. Place spring button(4) with adjusting screw assembly (5) and bearing (22) down over guide post (18) into spring (7) cavity. Align one tab (ear) on spring button (4) directly above tab slot cut into the body flange lip.

    NOTE: *Apply a small amount of Emhart Bostic White Food Grade "NEVER-SEEZ®" or equivalent to threads of adjusting screw (5) .*

26. Align the two ribs inside the spring chamber (2) with the tabs (ears) on the spring button (4) and place the spring chamber (2) over assembled parts directly on body (1). Refer to step 6 previous for alignment of match marks for final orientation.

27. Position the Tri-Clamp (13) around the mating flanges of the body (1) and the spring chamber (2) with the threaded fastener aligned with the tab slot cut in the body flange lip. Clamp should be tightened to approximately 4 to 6 ft-lbs.

    a. **For Opt.-80:** Position the clamp (13) halves around the mating flanges of the body (1) and the spring chamber (2). Insert clamp bolts (13C), washers (13D) and tighten clamp nuts (13B) in alternating pattern. The clamp should be tightened to approximately 4 to 6 ft-lbs or 18-20 ft-lbs for Gylon Diaphragms.

NOTE: *Gap between clamp (13A) halves should be equal in size.* See Figure 1.

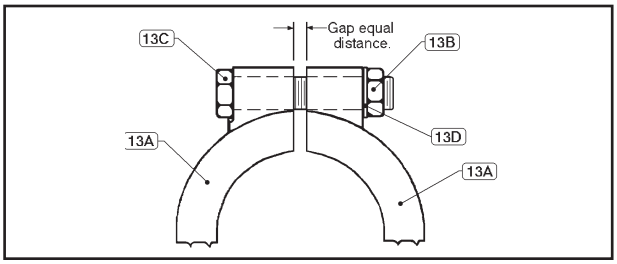


Figure 1: Clamp Arrangement.

28. Place nut or handle (6) onto square end of adjusting screw assembly (5).

29. Insert hitch pin (15) through hole near the top of the guide post (18). Apply medium strength, Food Grade threadlocker to set screw (27) and secure tight into the top of the guide post (18).

30. Return to Section II. for Installation, Section IV. for Start-up, and Section VII for cleaning procedure.

SECTION VII

VII. CLEANING PROCEDURE

A. Pre-Sanitation:

1. Owner should refer to owner's operating procedures for system shutdown to include relieving all system pressure.

2. Refer to Figure 3 for item number reference ().

3. Remove the lock-open pin (10) from the pin retainer hole in the spring chamber (2). (See Figure 2.)

4. System internal pressure must be at/near 0 psig (0 Barg). This will ensure plug (17) is fully open. ***NOTE: Do not change range spring (7) setting by rotating nut or handle (6).***

5. Insert pin (10), jostle nut or handle (6) lift up or push down to secure pin (10) thru adjusting screw (5).

B. Sanitation:

1. Flush, drain and sanitize system in accordance to owner's specifications.

⚠ CAUTION

Owner's cleaning solution must be compatible with regulator's trim materials.

NOTE: *CIP is limited to 50 psig (3.45 Barg) maximum cleaning solution pressure at 300°F (149°C).*
SIP is recommended to 20 psig (1.38 Barg) saturated steam pressure; can withstand 30 psig (2.07 Barg), but may reduce elastomer life expectancy.

C. Post-Sanitation:

1. Prior to system start-up, remove the lock-open pin (10) from the adjusting screw (5) and insert it into the pin retainer hole. Unit is again operative at the setpoint established prior to cleaning.

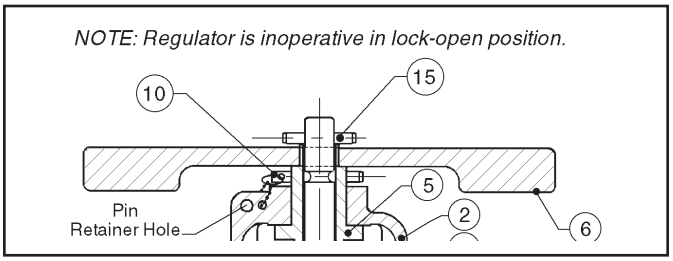


Figure 2: Spring Chamber in Lock-Open Position

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.

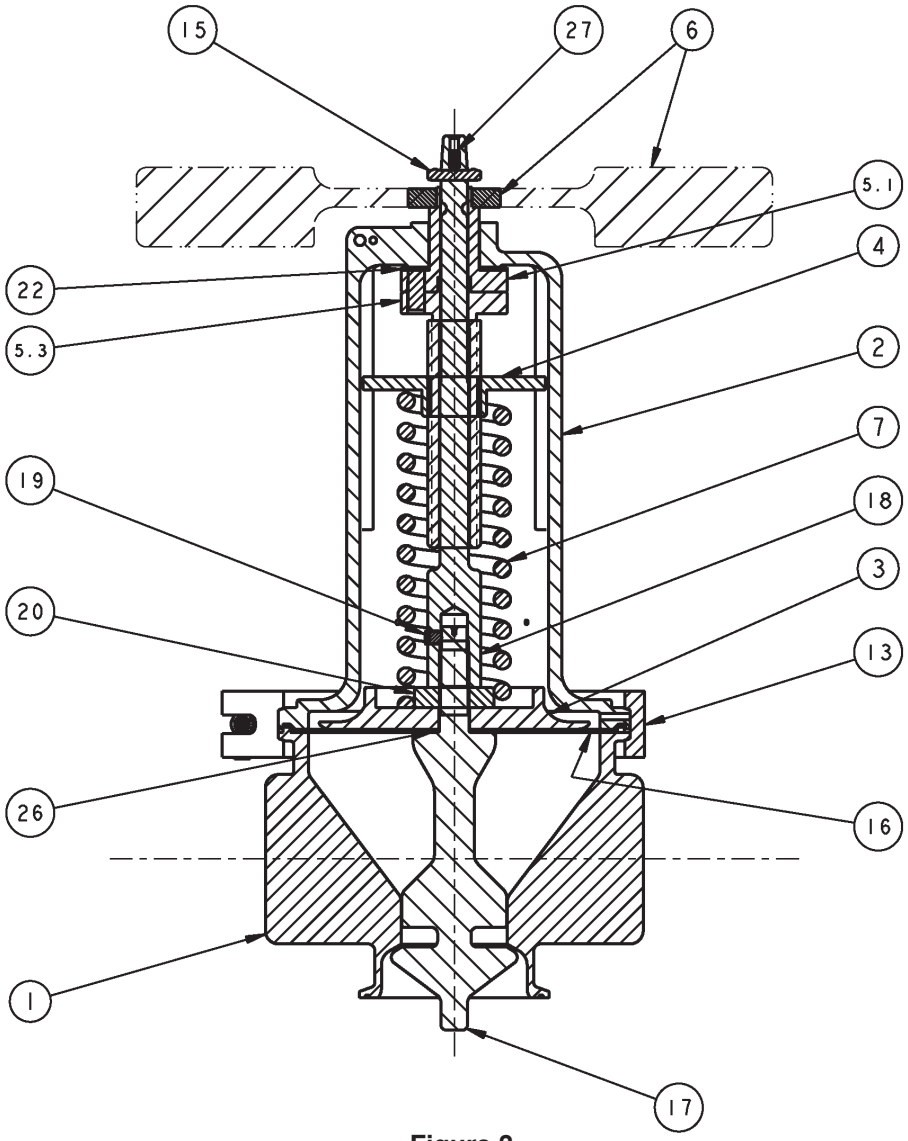
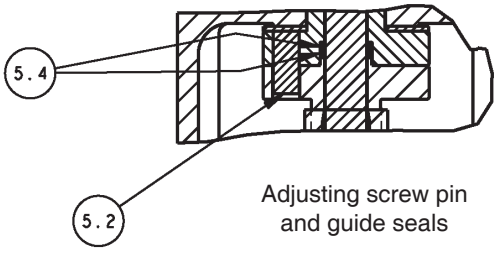
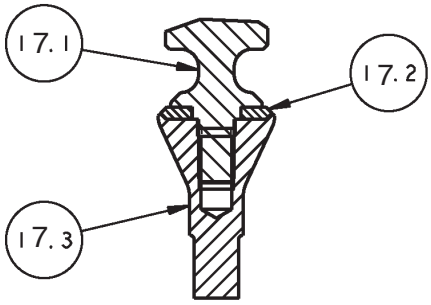


Figure 3
Barstock Body shown above.
See the next page for Item Number Descriptions.



Adjusting screw pin
and guide seals



Composition Seat

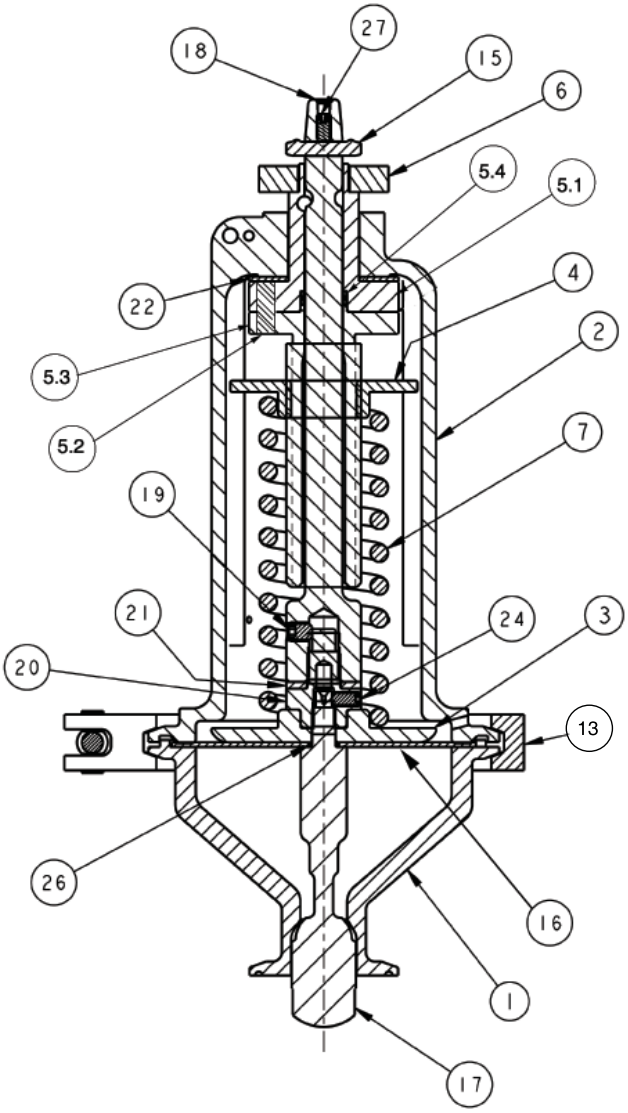


Figure 4
1" Investment Cast Red. Port shown above

NOTE: *This product is to be installed with the spring chamber in the vertical position.*

Item No.	Description
1	Body
2	Spring Chamber
3	Pressure Plate
4	Spring Button
5	Adjusting Screw
5.1	Adjusting Screw Cap
5.2	Pin
5.3	Adjusting Screw
5.4	U-Cup Seal (2 pcs.)
6	Nut - (Handle Opt-4)
7	Spring
13	Clamp
15	Pin (Cotterless Hitch)
16	Diaphragm

Item No.	Description
17	Plug
17.1	Stem
17.2	Seat
17.3	Tail Piece
18	Guide Post
19	Set Screw
20	Adapter / Nut
21	Guide (Spring) / Spacer (1" & 1-1/2" Red. Port Only)
22	Bearing (Soft Seal)
24	Set Screw (Investment cast only.) (Set Screw not needed for C-PRV with comp seat.)
26	Diaphragm Spacer
27	Set Screw

Not Shown:

Item No.	Description
8	Connector
9	Ball Chain
10	Quick Release Pin
11	Name Plate
12	Drive Screw
14	3A Symbol Plate
23	Diaphragm Cover
25	Diaphragm Gaskt (LG Trim)

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.

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