MODEL 1465
PRESSURE REDUCING REGULATOR

SECTION I

I. DESCRIPTION AND SCOPE

The Model 1465 is a high pressure reducing regulator designed primarily for analytical sampling and low flow applications. Size is 1/4" (DN8). With proper trim utilization, the unit is suitable for liquid and gaseous service. Refer to Technical Bulletin 1465-TB for design conditions and selection recommendations. **NOT FOR DEAD END SERVICE.**

SECTION II

II. INSTALLATION

⚠ CAUTION

Do not dead end (no flow demand) downstream of the regulator. The inlet pressure will transmit past the metal seat (not positive shut-off) and equalize on the downstream. This will lead to diaphragm failure, regulator malfunction, and possible damage to system instrumentation downstream.

⚠ CAUTION

For welded installations, all internal trim parts, seals and diaphragm(s) must be removed from regulator body prior to welding into pipeline. The heat of fusion welding will damage non-metallic parts if not removed. ***NOTE:*** *This does not apply to units equipped with extended pipe nipples.*

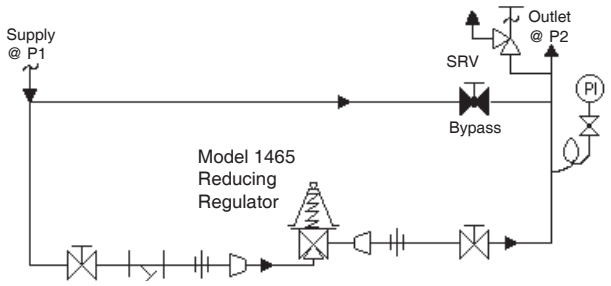
1. An inlet block valve should always be installed.

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 relief device if the inlet pressure could exceed the pressure rating of any downstream equipment or the maximum outlet pressure rating of the unit.



Recommended Piping Schematic
for Pressure Reducing Station

⚠ CAUTION

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

6. Clean the 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 the regulator upon startup.

8. Flow Direction: Install in accordance with the flow direction arrow cast on the body. The inlet pressure is connected to the bottom connection and the outlet (reduced) pressure is connected to the side connection. When installing, hold by the body (1) hex to keep the regulator firm.

9. Basic Regulator - (Refer to Figure 1): Regulator may be installed in any position in relation to the pipe. Recommended position is with spring chamber vertical upwards. Orient such that the spring chamber vent hole does not collect rainwater or debris.

10. Regulators are not to be direct buried underground.

11. For insulated piping systems, recommendation is to not insulate the regulator.

⚠ CAUTION

DO NOT HYDROSTATIC TEST THROUGH AN INSTALLED UNIT; ISOLATE REGULATOR FROM TEST. The upper range spring pressure level listed on the nameplate is the recommended "upper operative limit" for the sensing diaphragm (see Section IV. Startup, Number 7). 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.

SECTION III

III. PRINCIPLE OF OPERATION

1. Movement occurs when the inlet pressure passes by the seat causing a distributive force on the underside of the diaphragm. This, in turn, opposes the point force of the range spring causing upward movement of the diaphragm, allowing the plug to seat. When set pressure decreases, due to demand, the distributive force beneath the diaphragm lessens - allowing the range spring to open the seat and regulate pressure.

2. A complete diaphragm failure will cause the regulator to fail open.

SECTION IV

IV. START-UP

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 (10) by turning the adjusting screw (12) counter clockwise (CCW) a minimum of three (3) full revolutions. This reduces the outlet (downstream) pressure setpoint. ***NOTE:*** *If the Option -2 or -22 is utilized, the adjusting screw (12) and locknut (13) are replaced with a knob (18) and locknut (13). With Option -2 +80 or -22 +80, the adjusting screw (12) and locknut (13) are replaced with a handwheel subassembly (20) and locknut (13).*

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. Ensure proper steam trap operation if installed. 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 inlet (upstream) block valve observing the outlet (downstream) pressure gauge. Determine if the regulator is flowing. If not, slowly rotate the regulator adjusting screw (12) 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 setpoint by turning the adjusting screw (12) CW to increase outlet pressure or CCW to reduce outlet pressure.

10. Reduce system flow to a minimum level - observe setpoint. Outlet pressure will rise from the setpoint of Step 9. The maximum rise in outlet pressure on decreasing flow should not exceed the stated upper limit of the range spring (10) by greater than 10%; i.e. 5-30 psig (.34-2.1 Barg) range spring, at low flow the outlet pressure should not exceed 33 psig (2.3 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 leave a bypassed regulator unattended.

2. If the regulator and system are to both be shutdown, 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 from the pipeline where installed.

2. Owner should refer to owner's procedures for removal, handling, cleaning and disposal of non-reusable parts, i.e. O-rings, etc.

3. Refer to Figure 1 for the standard regulator and its options.

B. Diaphragm Replacement:

1. Securely install the body (1) in a vise with the spring chamber (2) directed upwards.

⚠ WARNING

SPRING UNDER COMPRESSION. Prior to removing spring chamber, relieve spring compression by backing out the adjusting screw or handwheel. Failure to do so may result in flying parts that could cause personal injury.

2. Relax range spring (10) by turning adjusting screw (12) CCW until removed from spring chamber (2). ***NOTE:*** *If the Option -2 or -22 is utilized, the adjusting screw (12) and locknut (13) are replaced with a knob (18) and locknut (13). With the Option -2 +80 or -22 + 80, the adjusting screw (12) and locknut (13) are replaced with a handwheel subassembly (20) and locknut (13).*

3. Loosen spring chamber (2) by placing wrench on "flats" and rotating CCW. **DO NOT** use the flats on either side of the vent hole.

4. Remove spring chamber (2), spring button (11), and range spring (10). ***NOTE:*** *For units with Option -80 (spring ranges 270-400 psig (18.6-27.6 Barg) and 360-500 psig (24.8 -34.5 Barg)) also remove the thrust bearing (15), upper bearing washer (16), and lower bearing washer (17). Inspect threads of spring chamber (2) for cleanliness.*

5. Remove pressure plate (9) and inspect to ensure no deformation due to over-pressurization. If deformed, replace.

6. Remove diaphragm(s) (8), O-ring (7) and pusher plate (6). Inspect pusher plate (6) to ensure no deformation due to over-pressurization. If deformed, replace. Discard O-ring (7) and diaphragm(s) (8).

7. Clean body (1) and body recess according to owner's procedures. ***NOTE:*** *On regulators originally supplied as "oxygen clean", Option 1465-55, maintenance must include a level of cleanliness equal to Cashco's cleaning Standard #S-1134. Contact factory for details.*

8. Install new O-ring (7) and diaphragm(s) (8). ***NOTE:*** *Refer to the quantity of diaphragm(s) (8) incorporated in the bill of materials listing. Depending on outlet pressure level, multiple metal diaphragms may be "stacked".*

9. Visually center pressure plate (9) on diaphragm(s) (8). Place the range spring (10) on to the retainer hub of the pressure plate (9).

10. Place multi-purpose, high temperature grease into the depression of the spring button (11) where adjusting screw (12) bears. Set spring button (11) onto range spring (10); ensure spring button (11) is laying flat. ***NOTE:*** *For units with Option -80 (spring ranges 270-400 psig (18.6-27.6 Barg) and 360-500 psig (24.8-34.5 Barg) position spring button (11), thrust*

bearing (15), upper bearing washer (16), and lower bearing washer (17) on top of the range spring (10).

11. Apply an appropriate lubricant to the threads of the spring chamber (2). Reverse Steps B.2 and B.3 to complete assembly. Tighten spring chamber (2) to body (1) with a **30-35 Ft-lbs torque value**.

12. Pressurize with air and spray with liquid leak detector to test around body (1) and spring chamber (2) for leakage. Ensure that an outlet pressure is maintained during this leak test of at least mid-range spring level; i.e. 125-200 psig (8.6-13.8 Barg) range spring, 163 psig (11.2 Barg) test pressure minimum.

C. Trim Inspection:

1. Trim inspection requires that the diaphragm(s) be removed. Refer to previous procedure Section VI.B, steps 1 through 7.

2. Remove body (1) from vise and secure a screwdriver, tool end up, in vise. Set body (1) so as to engage screwdriver into slotted end of the plug (3) from the body (1) inlet connection and hold firm.

3. Remove pusher plate (6). Looking down into the body (1) cavity, use a slotted tool to push down on the spring seat (5) and slip sideways to disengage (through slot) from plug (3).
4. Remove spring seat (5) and plug spring (4).

5. Grasp plug (3) while carefully lifting body (1). Remove plug (3) from body (1) inlet, taking care not to allow plug (3) to drop out.

6. Inspect integral seat in body (1). If seat shows erosion or wear, replace regulator.

7. Clean debris from within body (1) cavity. Clean parts to be reused according to owner's procedures. ***NOTE:*** *On regulators originally supplied as "oxygen clean", Option 1465-55 maintenance must include a level of cleanliness equal to Cashco's cleaning spec. #S-1134. Contact factory for details.*

8. Inspect spring seat (5), plug spring (4) and plug (3). If worn, nicked or depressed, replace regulator.

9. Lap plug (3) with lapping compound by inserting it back up into the body (1) inlet and hold firm. Engage a screwdriver into the slotted end of the plug (3) from the body (1) inlet and rotate plug (1) back and forth in a circular motion. Do not overlap. Clean lapping compound on plug (3) and in body (1).

10. Reverse steps 1 through 5 for reassembly. ***NOTE:*** *When reassembling plug (3), plug spring (4), and spring seat (5), be sure that this "assembly" is centered into the body (1) cavity to ensure proper seating of plug (3).* Apply an appropriate lubricant to the threads of the spring chamber (2). Tighten spring chamber (2) to body (1) with a 30-35 Ft-lbs torque value.

11. Bench test unit for suitable operation. ***NOTE:*** *Regulators are not tight shut off devices. Even if pressure builds up beyond setpoint, a regulator may or may not develop bubble tight shut off.*

12. Pressurize with air and spray with liquid leak detector to test around body (1) and spring chamber (2) for leakage. Ensure that an outlet pressure is maintained during this leak test of at least mid-range spring level; i.e. 125-200 psig (8.6-13.8 Barg) range spring, 163 psig (11.2 Barg) test pressure minimum.

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. Cavitation	B. Use multiple 1465's in series to stage the pressure drops. Refer to 1465 Technical Bulletin for water cavitation chart.

2. 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.

3. 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. Plugged trim.	B. Remove regulator from line and check for debris in inlet connection.
C. Incorrect range spring(screwing in CW of adjusting screw does not allow bringing pressure level up to proper level).	C. Replace range spring with proper higher range. Contact factory.
D. Too much droop	D1. Review droop expected. D2. Contact factory.
E. Cavitation	E. Use multiple 1465's in series to stage the pressure drops. Refer to 1465 Technical Bulletin for water cavitation chart.

4. Excessive pressure downstream.

Possible Causes	Remedies
A. Regulator not closing tightly.	A. Inspect the seating. Check the plug (3), plug spring (4), and spring seat (5) are centered in body (1) cavity. Replace regulator should these steps not remedy.
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 enter, re-orient regulator.

5. Sluggish operation.

Possible Causes	Remedies
A. Fluid too viscous.	A. Heat fluid. Contact factory

6. Excessive seat leakage.

Possible Causes	Remedies
A. Foreign matter on seating surface, erosion of seating surface.	A. Inspect and clean seat. If seat eroded, replace regulator.
B. Cavitation	B. Use multiple 1465's in series to stage pressure drops. Refer to 1465 Technical Bulletin for water cavitation chart.

7. Leakage out of threaded connection between body and spring chamber.

Possible Causes	Remedies
A. Insufficient spring chamber torque.	A. Tighten spring chamber on body using sufficient torque.
B. Damaged o-ring	B. Replace o-ring.

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.

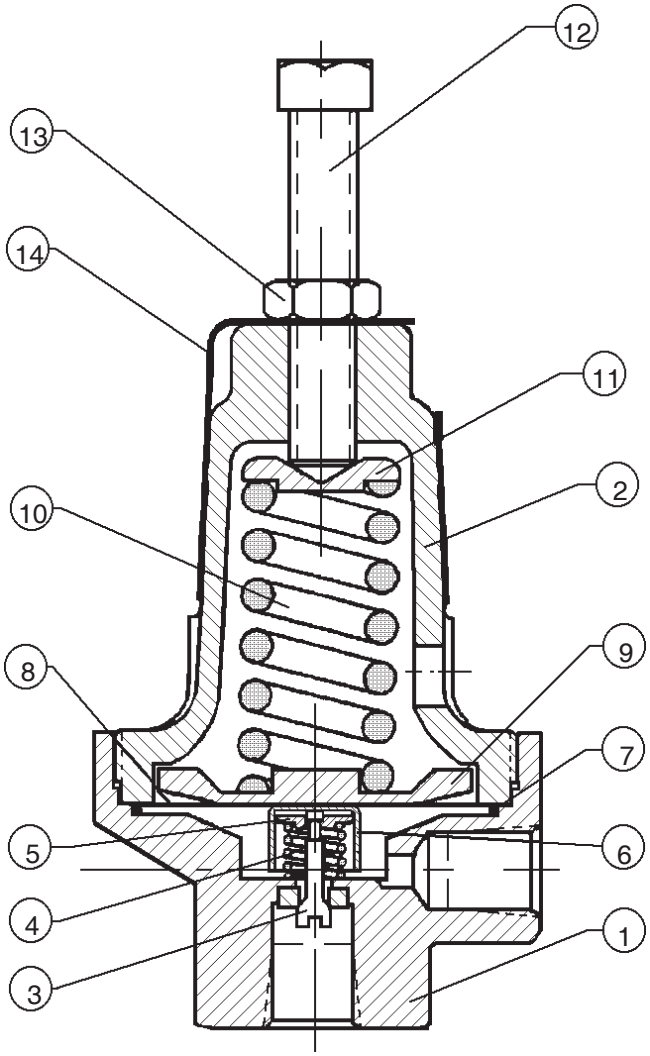
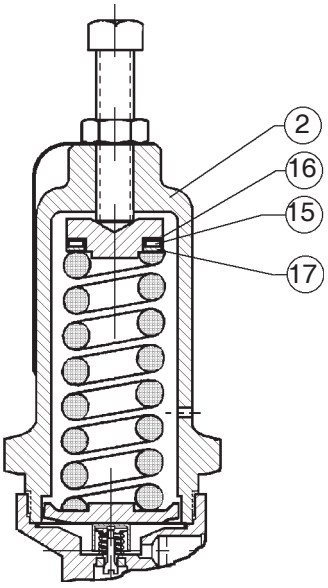


Figure 1: Basic Model 1465

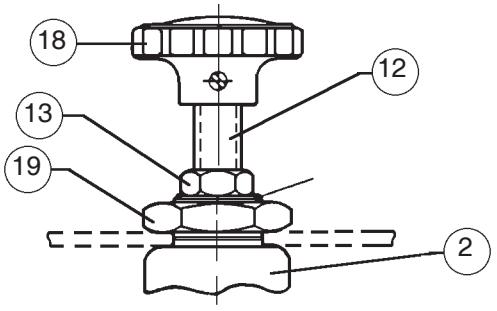


Option -80, High Pressure
Spring Chamber Construction

Item Number	Description
1	Body Subassembly
2	Spring Chamber
3	Plug
4	Spring
5	Spring Seat
6	Pusher Plate
7	O-ring
8	Diaphragm
9	Pressure Plate
10	Range Spring
11	Spring Button
12	Adjusting Screw
13	Adjusting Screw Lock Nut
14	Name Plate
15	Thrust Bearing
16	Upper Bearing Washer
17	Lower Bearing Washer
18	Knob
19	Mounting Nut

ITEM NUMBERS NOT SHOWN

20	Handwheel Subassembly
21	Pin



Option -22 Panel Mounting (hand-wheel portion is same for Option -2 Handwheel)

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.

Cashco, Inc.
P.O. Box 6
Ellsworth, KS 67439-0006
PH (785) 472-4461
Fax. # (785) 472-3539
www.cashco.com
email: sales@cashco.com

Cashco GmbH
Handwerkerstrasse 15
15366 Hoppegarten, Germany
PH +49 3342 30968 0
Fax. No. +49 3342 30968 29
www.cashco.com
email: germany@cashco.com

Cashco do Brasil, Ltda.
Al.Venus, 340
Indaiatuba - Sao Paulo, Brazil
PH +55 11 99677 7177
Fax. No.
www.cashco.com
email: brazil@cashco.com

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