MODEL 5381
PRESSURE REDUCING SANITARY REGULATOR

SECTION I

I. DESCRIPTION AND SCOPE

Model 5381 is a pressure reducing regulator used to control downstream (outlet or P_2) pressure. Inlet and outlet size is 1/2" (DN15) with Tri-Clamp® connections. The 5381 incorporates a stainless steel body. Refer to Technical Bulletin 5381-TB for specific design conditions and selection recommendations.

SECTION II

II. INSTALLATION

⚠ CAUTION A

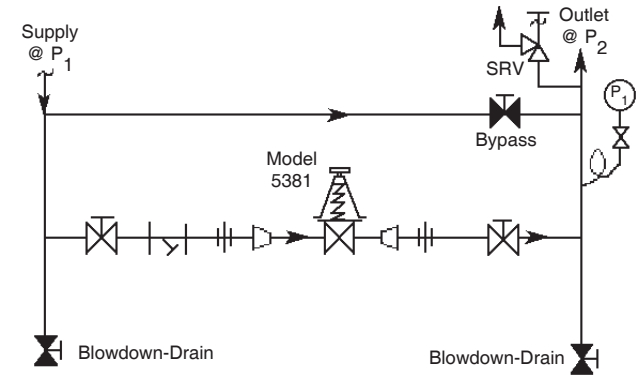
Installation of adequate overpressure protection is recommended to protect the regulator and all downstream equipment from damage in the event of regulator failure.

1. An inlet block valve should always be installed upstream of the regulator.

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.

⚠ CAUTION B

The maximum outlet pressure is listed on the nameplate as the upper range spring pressure level, and is the recommended "upper operative limit" for the sensing diaphragm (see Section IV. Startup, Step 7). Higher pressures could damage the diaphragm. (Field hydrostatic tests frequently destroy diaphragms. DO NOT HYDROSTATIC TEST THRU AN INSTALLED UNIT; ISOLATE FROM TEST.)



Recommended Piping Schematic
For Pressure Reducing Station

3. An outlet pressure gauge should be located approximately ten pipe diameters downstream, and within sight.

4. 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.

5. Flow Direction: Install so the flow direction matches the arrow stamped on the regulator body.

6. Install in well drained horizontal pipe, properly trapped with spring chamber (2) in the vertical position to allow for proper draining.

SECTION III

III. PRINCIPLE OF OPERATION

1. Movement occurs as pressure variations register on the diaphragm. The registering pressure is the outlet, P_2, or downstream pressure. The range spring opposes diaphragm movement. As outlet pressure drops, the range spring pushes the diaphragm down, opening the port; as outlet pressure increases, the diaphragm pushes up and the port opening closes.
2. A complete diaphragm failure will cause the regulator to fail open.

SECTION IV

IV. STARTUP

1. Start with the block valves closed. A bypass valve may be used to maintain outlet pressure in the downstream system without changing the following steps.
2. Relax the range spring by turning the T-handle adjusting screw counter clockwise (CCW) a minimum of three (3) full revolutions. This reduces the outlet (downstream) pressure set point.
3. If it is a "hot" piping system and equipped with a bypass valve, slowly open the bypass valve to pre-heat the system piping and to allow slow expansion of the piping. Assure proper steam trap operation if installed. Closely monitor outlet (downstream) pressure via gauge to assure not over-pressurizing. ***NOTE:*** *If no bypass valve is installed, extra caution should be used in starting up a cold system; i.e. do everything slowly.*
4. Crack open the outlet (downstream) block valve.
5. Slowly open the inlet (upstream) block valve observing the outlet (downstream) pressure gauge. Determine if the regulator is flowing. If not, slowly rotate the regulator T-handle adjusting screw clockwise (CW) until flow begins.
6. Continue to slowly open the inlet (upstream) block valve until fully open.
7. Continue to slowly open the outlet (downstream) block valve, especially when the downstream piping system isn't pressurized. If the outlet (downstream) pressure exceeds the desired pressure, close the block valve and go to Step 2, then return to Step 4.
8. When flow is established steady enough that the outlet (downstream) block valve is fully open, begin to slowly close the bypass valve if installed.
9. Develop system flow to a level near its expected normal rate, and reset the regulator set point by turning the T-handle adjusting screw CW to increase outlet pressure, or CCW to reduce outlet pressure.
10. Reduce system flow to a minimum level and observe set point. Outlet pressure will rise from the set point of Step 9. The maximum rise in outlet pressure on decreasing flow should not exceed the stated upper limit of the range spring by greater than 10%; i.e. 20-80 psig (1.38-5.52 Barg) range spring, at low flow the outlet pressure should not exceed 88 psig (6.07 Barg), if it does, consult factory.

SECTION V

V. SHUTDOWN

1. On systems with a bypass valve, and where system pressure is to be maintained as the regulator is shut down, slowly open the bypass valve while closing the inlet (upstream) block valve. Fully close the inlet (upstream) block valve. (When on bypass, the system pressure must be constantly observed and manually regulated. Close the outlet (downstream) block valve.

CAUTION C

Do not walk away and leave a bypassed regulator unattended.

2. If the regulator and system are to both be shut down, slowly close the inlet (upstream) block valve. Close the outlet (downstream) valve only if regulator removal is required.

VI. MAINTENANCE

WARNING 1

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

A. General:

1. Maintenance procedures hereinafter are based upon removal of the regulator unit from the pipeline where installed.
2. Owner should refer to owner's procedures for removal, handling, cleaning and disposal of nonreuseable parts, i.e. gaskets, etc.
3. Refer to Figure 2 for basic regulator, item number reference ( ).

B. Diaphragm Replacement:

CAUTION D

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

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

WARNING 2

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

2. Relax range spring (17) by turning T-handle adjusting screw (8) CCW until removed from spring chamber (2).
3. Loosen spring chamber (2) by placing wrench on “flats” and rotating CCW making sure **not** to use the flat where the vent hole is located.
4. Remove spring chamber (2), range spring (17), spring button (5) and diaphragm gasket (14).
5. Remove the diaphragm subassembly consisting of the pressure plate nut (10), lock washer (9), pressure plate (3), diaphragm (13), pusher plate O-ring (15) and pusher plate (4). ***NOTE:*** *Refer to the quantity of diaphragms (13) incorporated per the bill of materials listing. Depending on outlet pressure level, multiple metal diaphragms may be “stacked”.*

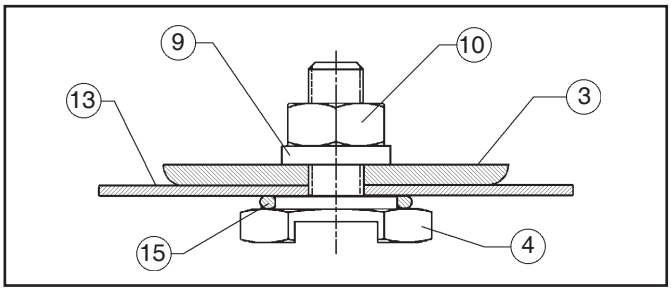


Figure 1: Diaphragm Subassembly

6. Loosen pressure plate nut (10) and separate all parts (3, 4, 9, 13 & 15) of the diaphragm subassembly.
7. Inspect pressure plate (3) to assure no deformation due to over-pressurization. If deformed, replace.
8. Remove diaphragm(s) (13), and diaphragm O-ring (24).
9. Clean body (1) and diaphragm (13) flange in accordance with Owner's cleaning procedures. Do not scratch diaphragm O-ring seating surface ***NOTE:*** *Maintenance must include a level of cleanliness equal to Cashco cleaning standard #S-1576. Contact factory for details.*
10. Reassemble diaphragm subassembly by placing pusher plate O-ring (15), diaphragm(s) (13), pressure plate (3) and lock washer (9) over the threaded post of pusher plate (4). Assure the pressure plate (3) is placed with curved outer rim down next to the diaphragm (13) surface. Tighten pusher plate nut (4) to the following torque values:

Sizes	Diaphragm	Torque Value	
ALL	Metal	60 in/lbs.	(6.8 Nm)
	Composition	15 in/lbs.	(1.7 Nm)

11. Place diaphragm O-ring (24) into body (1) recess. Insert diaphragm subassembly into the body (1). Place diaphragm gasket (14) into recess of body (1) on top of the diaphragm(s) (13).

12. Place the range spring (17) over the pressure plate nut (10) of the diaphragm subassembly.

13. Apply a small amount of process compatible anti-seeze into depression of spring button (5) where adjusting screw (8) bears. Set spring button (5) onto range spring (17); ensure spring button (5) is laying flat.

14. Inspect body (1) and spring chamber (2) threads for debris. ***NOTE:*** *Apply a small amount of process compatible anti-seeze to spring chamber (2) threads to prevent galling.* Rotate the spring chamber (2) CW by hand into the threaded portion of the body (1) ensuring to not cross thread. Tighten spring chamber (2) to body (1) connection to a **30–35 Ft-lbs (41–47 Nm) torque value**.

15. Reinstall T-handle adjusting screw (8) with locknut (11) into the spring chamber (2).

16. Pressurize with air and spray 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. 20-80 psig (1.4–5.5 Barg) range spring, 50 psig (3.4 Barg) test pressure minimum.

C. Trim Replacement

CAUTION E

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

1. Install body (1) in a vise with the body cap (6) on top and the spring chamber (2) directed downwards.

2. Remove body cap (6) by rotating CCW.

3. Remove piston spring (7) and piston (16).

Note: *The seat and piston (16) guide are integral parts of the body (1) casting. Inspect integral seat and parts for excessive wear, especially at seating surfaces. Replace if worn, nicked or depressed. If integral seat is nicked, use seat lapping compound to remove.*

NOTE: *When piston (15) assemblies are used with comp seats, Cashco, Inc. does not recommend attempting to remove the comp seat. If composition seat is damaged, replace entire piston assembly.*

4. Clean flat mating surfaces of body (1) to body cap (6) shoulder. Be careful not to scratch either surface.

5. Clean debris from within the body (1) cavity. Clean all parts to be reused according to owner's procedures. ***NOTE:*** *Maintenance must include a level of cleanliness equal to Cashco cleaning standard #S-1576. Contact factory for details.*

6. Place the piston (16), stem first, into the body cap (6) cavity.

7. Place piston spring (7) over spring hub of the piston (16).

8. Apply a small amount of process compatible anti-seeze to the body cap (6) threads. Thread body cap (6) into body (1). Impact until body cap (5) is metal to metal against body (1) at the body cap (5) shoulder.

9. Bench test unit for suitable operation. ***NOTE:*** *Regulators are not tight shutoff devices. Even if pressure builds up beyond set point, a regulator may or may not develop bubble tight shutoff.* In general, tighter shutoff can be expected with composition seat.

10. Pressurize with air and spray liquid leak detector to test around body cap (6) and body (1) for leakage. Test pressure should be a minimum of 100 psig (6.9 Barg) at the inlet.

SECTION VII

VII. TROUBLE SHOOTING GUIDE

1. Erratic operation; chattering.

Possible Causes	Remedies
A. Oversized regulator; inadequate rangeability.	A1. Check actual flow conditions, re-size regulator for minimum and maximum flow. A2. Increase flow rate. A3. Decrease regulator pressure drop; decrease inlet pressure by placing a throttling orifice in inlet piping union. A4. Install next step higher range spring. Contact factory. A5. Before replacing regulator, contact factory.
B. Worn piston; inadequate guiding.	B. Replace trim (possible body replacement).
C. Weakened/broken piston spring.	C. Replace piston spring. Determine if corrosion is causing the failure.

2. Regulator can't pass sufficient flow.

Possible Causes	Remedies
A. Regulator undersized.	A1. Confirm by opening bypass valve together with regulator. A2. Check actual flow conditions, re-size regulator; if regulator has inadequate capacity, consult factory.
B. Incorrect range spring (screwing in CW of adjusting screw does not allow bringing pressure level up to proper level).	B. Replace range spring with proper higher range. Contact factory.
C. Too much droop.	C1. Review droop expected. C2. Contact factory.

3. Leakage through the spring chamber vent hole.

Possible Causes	Remedies
A. Normal-life diaphragm failure.	A. Replace diaphragm.
B. Abnormal short-life diaphragm failure.	B1. Can be caused by excessive chattering. See No. 1. to remedy chatter. B2. Can be caused by corrosive action. Consider alternate diaphragm material. B3. For composition diaphragms, assure not subjecting to over-temperature conditions. B4. Downstream (outlet) pressure buildup occurring that overstresses diaphragms. Relocate regulator or protect with safety relief valve.
C. O-ring failure.	C. Replace O-ring (15), apply appropriate torque.

4. Sluggish operation.

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

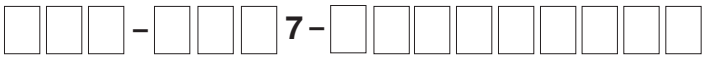
5. Excessive pressure downstream.

Possible Causes	Remedies
A. Regulator not closing tightly.	A. Inspect the seating. Clean and lap metal seat surfaces; replace if lapping does not remedy. If composition seats are depressed, nicked or embedded with debris, replace trim.
B. Downstream block.	B. Check system; isolate (block) flow at regulator inlet - not outlet. Relocate regulator if necessary.
C. No pressure relief protection.	C. Install safety relief valve, or rupture disc.
D. Restricted diaphragm movement.	D. Assure no moisture in spring chamber at temperatures below freeze point. Assure no dust or debris entering vent opening. If rainwater or debris can enter, re-orient regulator.

SECTION VIII

VIII. ORDERING INFORMATION:
NEW REPLACEMENT UNIT vs PARTS "KIT" FOR FIELD REPAIR

To obtain a quotation or place an order, please retrieve the Serial Number and Product Code that was stamped on the metal name plate and attached to the unit. This information can also be found on the Bill of Material (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).



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 accomodate 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 Bill of Materials 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.

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

NOTES

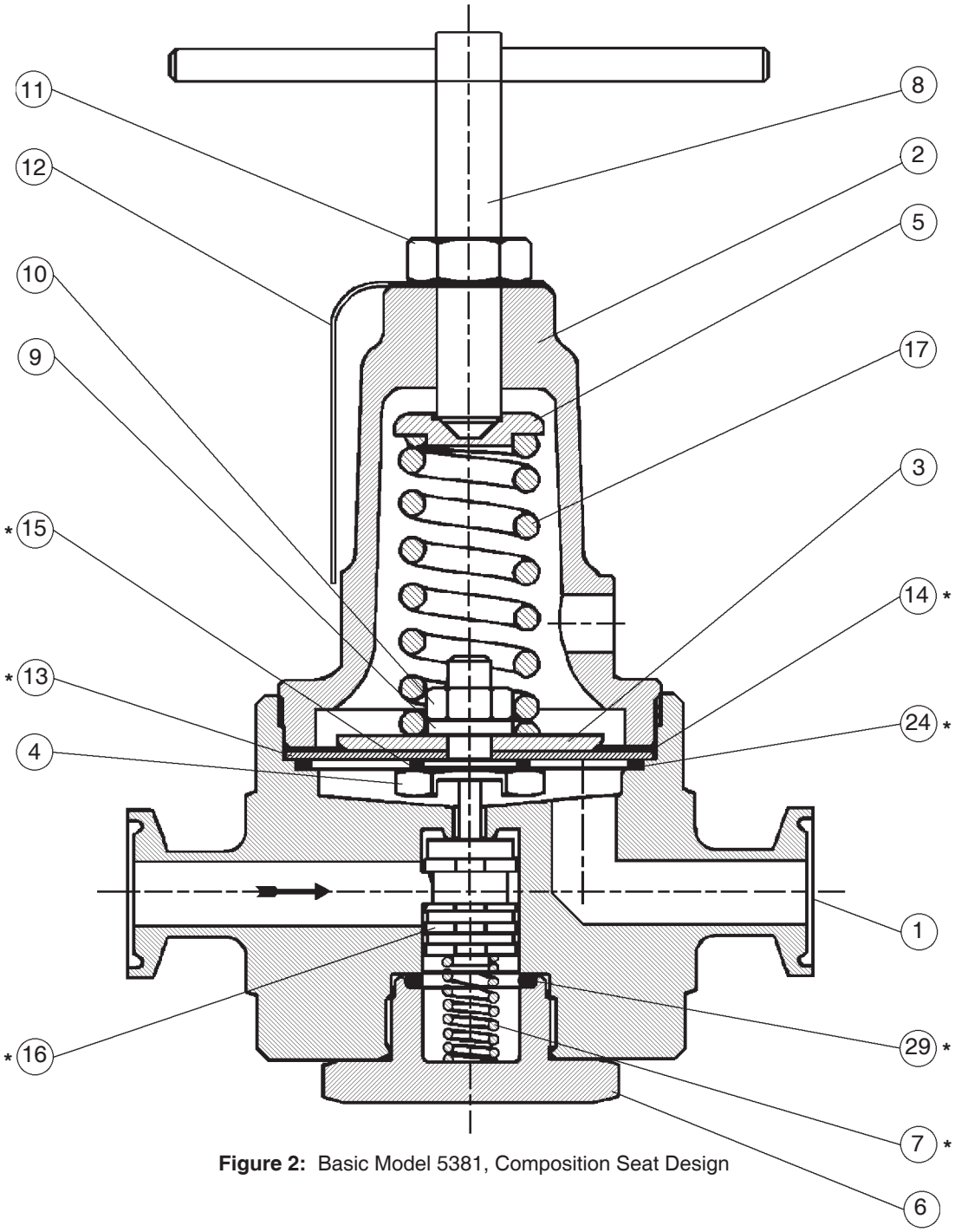


Figure 2: Basic Model 5381, Composition Seat Design

Item No.	Description	Repair Kit B
1	Body	
2	Spring Chamber	
3	Pressure Plate	
4	Pusher Plate	
5	Spring Button	
6	Body Cap	
7	Piston Spring	*
8	Adjusting Screw	
9	Lock Washer	
10	Pressure Plate Nut	
11	Adjusting Screw Locknut	
12	Nameplate	
13	Diaphragm(s)	*
14	Diaphragm Gasket	*
15	Pusher Plate O-ring	*
16	Piston & Piston Subassy.	*
17	Range Spring	
24	O-ring (diaphragm)	*
29	O-ring	*

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