CROSBY STYLE JOS-E, JBS-E, JBSBP-E, JDS-E, JLTJBS-E, JLTJBSBP-E, JLTJOS-E, JLTJDS-E VALVES

INSTALLATION AND MAINTENANCE INSTRUCTIONS

Before installation, these instructions must be carefully read and understood.

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ATTENTION

The safety of lives and property often depends on the proper operation of the pressure relief valves. Consequently, the valves should be kept clean and should be tested and reconditioned periodically to ensure they function properly.

⚠ WARNING

Suitability of the material and product for the use contemplated by the buyer is the sole responsibility of the buyer. Also storage, installation and proper use and application are the sole responsibility of the purchaser. Emerson disclaims any and all liability arising out of the same.

Any installation, maintenance, adjustment, repair and testing performed on pressure relief valves should be done in accordance with the requirements of all applicable codes and standards under which those performing such work should maintain proper authorization through appropriate governing authorities.

No repair, assembly and test work done by other than Emerson shall be covered by the warranty extended by Emerson to its customers. You assume full responsibility for your work. In maintaining and repairing Crosby products you should use only parts manufactured by Emerson. Call your nearest Emerson regional sales office or representative for a service engineer should you wish assistance with your field needs.

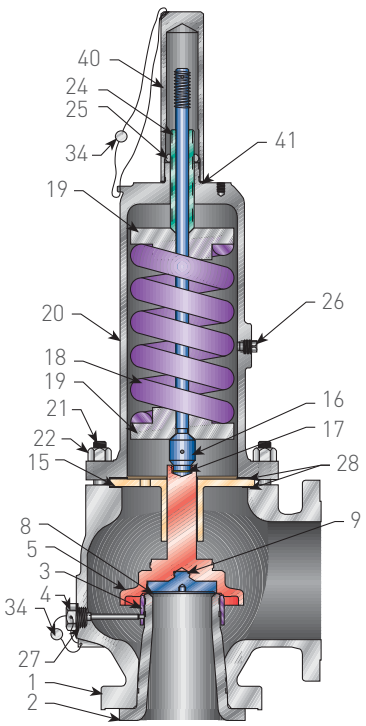
SAFETY FIRST

To reduce the risk during installation:

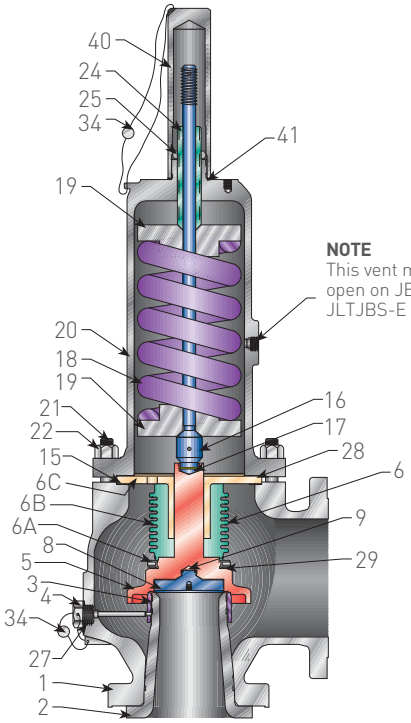
- *Comply with all information on the product, in this manual and in any local and national codes that apply to this product.*
- *Do not allow untrained personnel to work with this product.*
- *Use Emerson parts and work procedures specified in this manual.*

Engineering Doc. #IS-V3137B

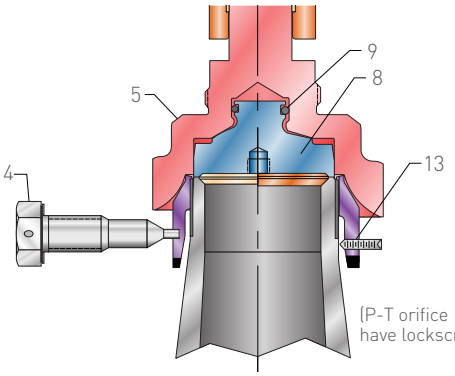
FIGURE 1



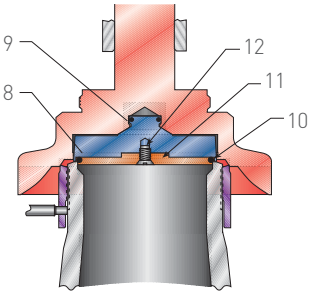
Style JOS-E



Style JBS-E

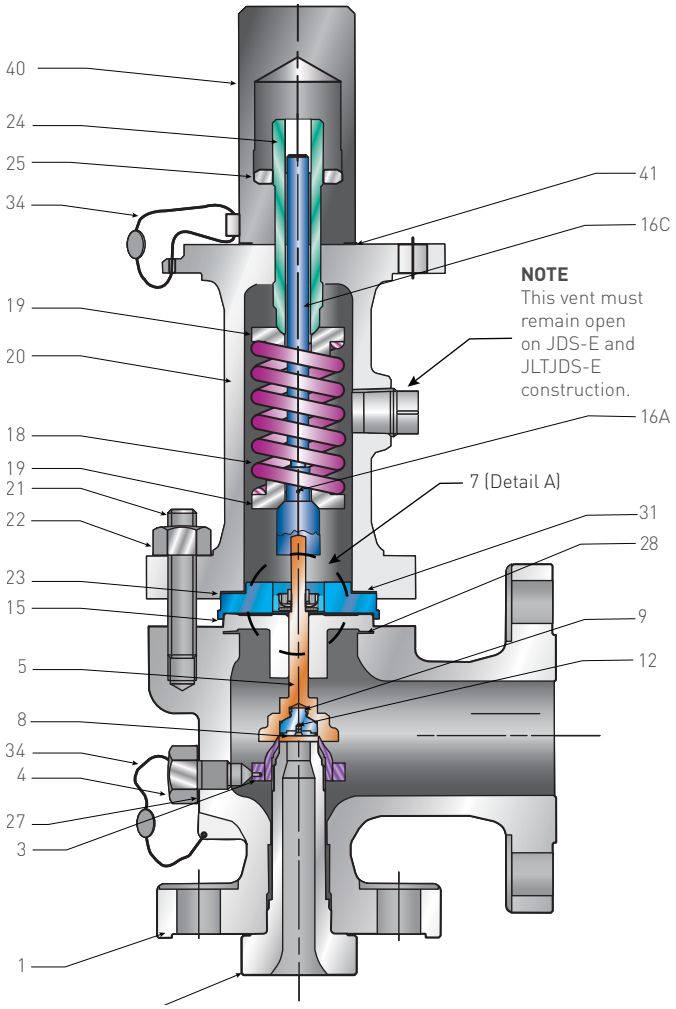


Style JLT
D-N orifice construction

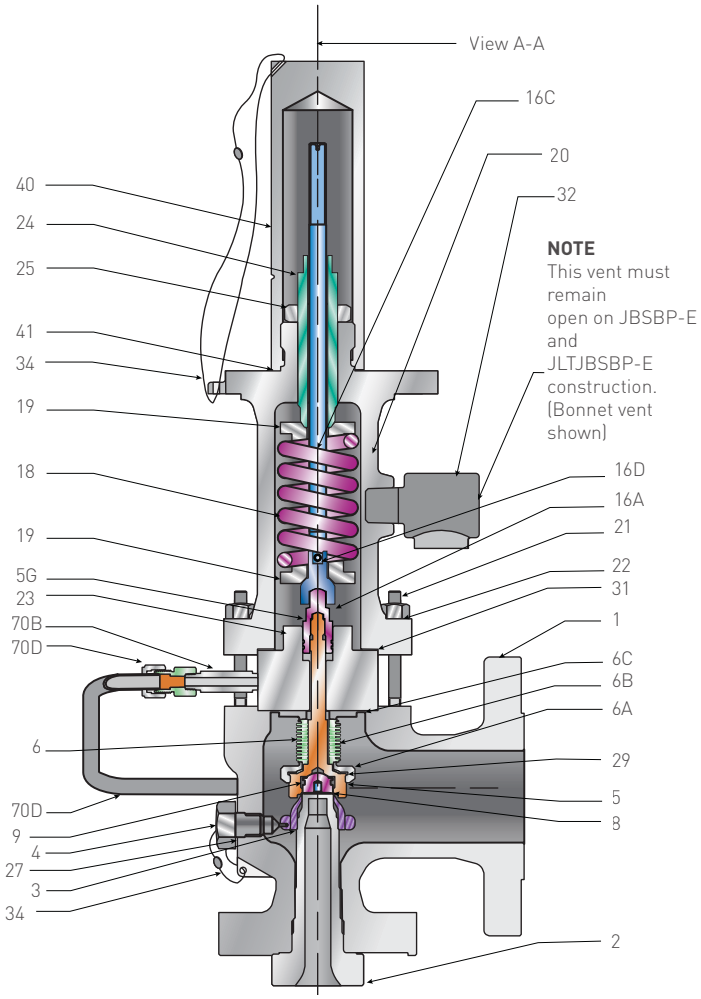


Soft seat

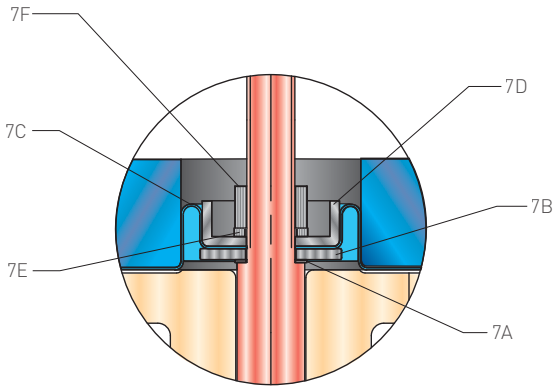
FIGURE 2



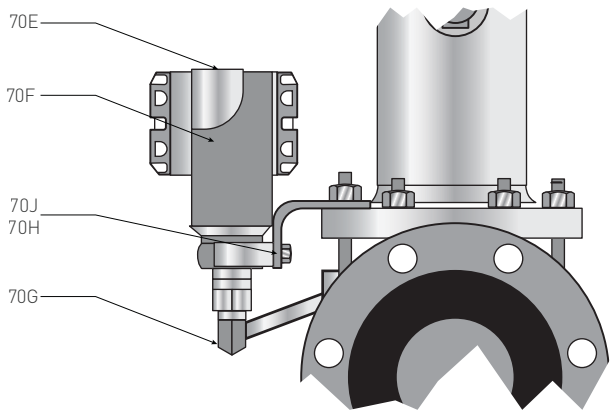
Style JDS-E



Style JBSBP-E with Bellows Leak Detection



Detail A



View A-A

PARTS LIST

No.	Part name	Notes
1	Body	
2	Nozzle	2
3	Nozzle ring	3
4	Set screw	3, except P-T orifice JLT
4A	Set screw	3, 8 (M-T2 orifice)
4B	Set screw rod	3, 8 (M-T2 orifice)
4C	Set screw pin	3, 8 (M-T2 orifice)
5	Disc holder	2, 5, 9
5B	Bushing	2
5G	Piston	2, 9
5H	Piston pin/Retainer	2
5J	Stem pin	2
6	Bellows assembly	2, 8
6A	Bellows tailpiece	8
6B	Bellows	8
6C	Bellows flange	8
7	Diaphragm assembly	5
7A	Diaphragm gasket	1, 5
7B	Spacer	3, 5
7C	Diaphragm	1, 5
7D	Diaphragm plate	3, 5
7E	Lock washer	1, 5
7F	Lock washer nut	3, 5
8	Disc insert	2
9	Retention clip	2
10	O-ring	1
11	O-ring retainer	3
12	Retainer screw(s)	3
13	Nozzle ring lock screw(s)	3, P-T2 orifice JLT
14	Set screw plug	3, P-T2 orifice JLT (not shown)
15	Guide	3, 5
16	Spindle assembly	3
16A	Spindle point	8
16C	Spindle rod	8

No.	Part name	Notes
16D	Spindle rod pin	8
17	Spindle cotter pin(s)	2 (L-T2 orifice)
18	Spring	3, 6
19	Spring washers	3, 6
20	Bonnet	
21	Bonnet stud(s)	3, 5
22	Bonnet stud nut(s)	3
23	Bonnet adapter	3, 5, 8
24	Adjustment bolt	3
25	Adjustment bolt nut	3
26	Pipe plug	
27	Set screw gasket	1, 4
28	Guide gasket(s)	1, 4
29	Tailpiece gasket	1, 4
31	Gasket (bonnet adapter)	1, 4, 5
32	Bug screen	
34	Seal and wire	
35	Seal clip (not shown)	
36	Nameplate (not shown)	
39	Drive screw(s) (not shown)	
40	Cap	7
41	Cap gasket	1, 4
42	Cap bolt(s) (not shown)	3, 7
43	Cap bolt nut(s) (not shown)	3, 7
70A	Reducer	9
70C	Connector	9
70D	Tubing	9
70E	Pressure transmitter	9
70F	Bracket	9
70G	Elbow	9
70H	Bolts	3, 9
70J	Lock washers	3, 9

NOTES

1. Consumable spare parts: valve parts which should be replaced as part of any disassembly and disc inserts which must be replaced if seats are damaged.
2. Repair spare parts: valve parts exposed to wear and/or corrosion during normal operation. They are in fluid flow paths and may require replacement as part of any repair.
3. Insurance spare parts: valve parts exposed to process or environmental wear and/or corrosion and may require replacement as part of a major repair. Emerson recommends that sufficient inventory of spare parts be maintained to support process requirements. Always be sure to use genuine Emerson parts to ensure continued product performance and warranty.
4. Available as a gasket kit, complete set for all valve styles.
5. Available as an Upgrade Kit for existing JOS-E and JBS-E or as a replacement Diaphragm Kit for service of an existing JDS-E/JLTJDS-E.
6. Replacement spring and washers provided as an assembly, washers machined to fit spring, not sold separately.
7. See Figure 21 for cap style variations.
8. Sold as an assembly only.
9. Available as an Upgrade kit for existing JOS-E and JBS-E, Pressure transmitter (70E) and bellows assembly (6) sold separately.

Ordering spare parts
When ordering spare parts, the valve size, style and assembly number and/or serial number should be given together with set pressure, part name and reference number from page 4. Spare parts may be ordered from any Emerson regional sales office or authorized representative.

Safety precautions
Proper handling, storage, installation, maintenance and operation is essential to the safe and reliable functioning of any pressure relief product.

Precautionary statements in the form of warnings, cautions and notes are used throughout this instruction to emphasize important and critical factors where applicable.

Examples:

⚠ WARNING
An operating procedure or practice which, if not observed strictly, may result in injury to personnel or loss of life.

⚠ CAUTION
An operating procedure or practice which, if not observed strictly, may result in damage to or destruction of equipment.

These precautionary statements are by no means exhaustive.

Emerson cannot be expected to know, evaluate and advise customers of all the possible applications and operating conditions for its products or of the possible hazardous consequences which may result from the misapplication or misuse of such products.

Consequently, the improper handling, storage, installation, use or maintenance of any Emerson product by a non Emerson employee may void any Emerson guarantees or warranties with respect to such product.

All personnel working with Emerson products should be trained adequately and thoroughly familiar with the contents of the appropriate instruction manual(s).

Emerson cannot evaluate all conditions in which the products may be used.

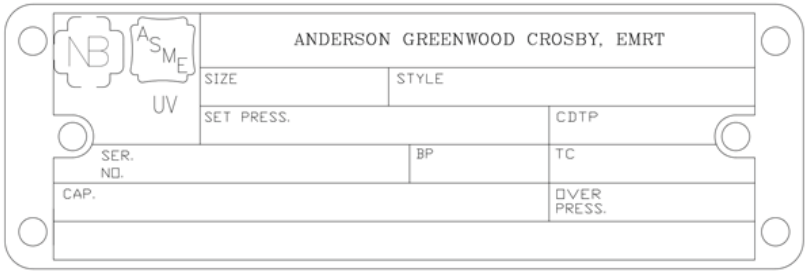
However, Emerson offers the following general safety suggestions:

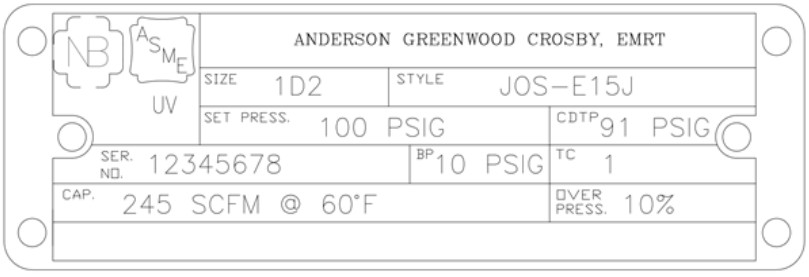
- Never subject valves to sharp impact loads. Rough handling (striking, bumping, dropping, etc.) may alter the pressure setting, deform valve parts and affect seat tightness and valve performance adversely. Striking a valve which is under pressure can cause premature actuation.
- When moving a valve, never use the lifting lever to lift the valve.
- Always lower the system pressure to the pressure level specified in the instruction before making any adjustment to the valve. Furthermore, always install a proper test rod to gag an installed valve before making any ring adjustments on the valve.
- Ear and eye protection should be used when working on a valve which has pressure.
- Never stand in front of the discharge outlet of a pressure relief valve which is under pressure.
- Always stand to the side of and at a safe distance from the valve discharge and use extreme care when observing a valve for leakage.

The above precautions and suggestions are by no means exhaustive and the user should always approach and use any pressure relief valve with great care.

Operation, Installation and Safety Instructions are available at Emerson.com/FinalControl or from your local Emerson regional sales office or representative.

FIGURE 3
Sample nameplates





1 INTRODUCTION

Crosby Style JOS-E, JBS-E, JBSBP-E, JLT-E and JDS-E Pressure Relief Valves have been selected for installation because of their performance features, reliability and ease of maintenance.

Adherence to the installation and maintenance procedures specified herein will provide the utmost in safety, a minimum of maintenance and a long service life. Crosby Style JOS-E, JBS-E, JBSBP-E, JDS-E and JLT-E Valves are manufactured in accordance with the requirements of Section VIII ASME Boiler and Pressure Vessel Code and Section XIII Rules for Overpressure Protection.

- **Style JOS-E** is a conventional closed bonnet valve. Style JBS-E has a balanced bellows for minimizing the effect of back pressure.
- **Style JBSBP-E** are balanced bellows valves with a supplementary back pressure balancing piston with optional wired or wireless bellows leak detection monitoring options.
- **Style JDS-E** utilizes a balanced diaphragm technology eliminating the need for bellows providing improved performance.
- **Style JLT-E** is a high performance valve designed specifically for liquid service. The JLT-E features a contoured liquid trim in a standard JOS-E, JBS-E and/or JDS-E envelope.

2 STORAGE AND HANDLING

Valves are often on hand at the job site months before they are installed. Unless stored properly and protected, valve performance may be affected adversely.

Rough handling and dirt may damage or cause misalignment of the valve parts. It is recommended that the valves be left in their original shipping containers and that they be stored in a warehouse or at a minimum on a dry surface with a protective covering until they are used.

Care should be exercised to ensure the elastomer parts like diaphragm, soft seat and O-ring etc., are not damaged during shipping and handling. In the case of large size elastomer parts, provisions should be made to not fold, crease or bend the material.

Unless otherwise specified, elastomer parts can be only used until their Maximum Shelf Life. The parts shall be scrapped past their Maximum Shelf Life.

3 INSTALLATION

3.1 Care in handling

Pressure relief valves must be handled carefully and never subjected to sharp impact loads. They should not be struck, bumped or dropped. Rough handling may alter the pressure setting, deform valve parts and affect seat tightness and valve performance adversely.

When it is necessary to use a hoist, the chain or sling should be placed around the valve body and bonnet in a manner that will ensure that the valve is in a vertical position to facilitate installation. The valve should never be lifted or handled using the lifting lever inlet and outlet protectors should remain in place until the valve is ready to be installed on the system.

3.2 Inspection

Pressure relief valves should be inspected visually before they are installed to ensure that no damage has occurred during shipment or while in storage.

All protective material, sealing plugs and any extraneous material inside the valve body or nozzle must be removed.

The valve nameplate and other identifying tags should be checked to ensure that the particular valve is being installed at the location for which it was intended.

The valve seals protecting the spring setting and ring adjustments should be intact. If seals are not intact, the valve should be inspected, tested and seals installed properly before use.

3.3 Inlet piping

Pressure relief valves should be mounted vertically in an upright position either directly on a nozzle from the pressure vessel or on a short connecting fitting that provides direct and unobstructed flow between the vessel and the valve. Installing a pressure relief valve in other than this recommended position might affect its operation adversely. Where rounded or beveled approaches cannot be provided ahead of the valve it is recommended that one size larger nozzle or fitting be used. A valve should never be installed on a fitting having a smaller inside diameter than the inlet connection of the valve.

Inlet piping (nozzles) must be designed to withstand the total resultant forces due to the valve discharging at the maximum accumulated pressure and the expected piping loads. The magnitudes of the bending moment exerted on the inlet piping will depend on the configuration and method of supporting the outlet piping.

Many valves are damaged when first placed in service because of failure to clean the connections properly when installed. Both the valve inlet and the vessel and/or line on which the valve is mounted must be cleaned thoroughly of all foreign material. The inlet connection bolts or studs should be drawn down evenly to avoid straining the valve body with possible distortion of the nozzle flange or base.

3.4 Outlet piping
Outlet piping should be simple and direct. Where possible, for non-hazardous fluids, a short discharge pipe or vertical riser connected through a long radius elbow venting directly to atmosphere is recommended. Such discharge piping should be at least the same size as the valve outlet.

All discharge piping should be run as direct as is practicable to the point of final release for disposal. Valve effluent must discharge to a safe disposal area.

Where discharge piping is long, due consideration shall be given to the use of long radius elbows and the reduction of excessive line strains through the use of expansion joints and proper means of support to minimize line sway and vibration under operating conditions. Adequate drainage is required to prevent corrosive media from collecting in the discharge side of the pressure relief valve. When required, low point drains shall be provided in the discharge pipe. Particular care must be observed to ensure that the drains are directed or piped to a safe disposal area. In installations where the pressure relief valve discharges into a closed system, care must be taken to ensure that built up and superimposed back pressure has been calculated properly, specified and accounted for when sizing and selecting the valve.
Where built up back pressure is expected to exceed 10% of set pressure or if superimposed back pressure is variable, a bellows valve or a diaphragm valve is required.

⚠ CAUTION
Bellows and diaphragm valves must have an open bonnet vent. Non bellows and diaphragm valves must have a bonnet plug installed.

4 HYDROSTATIC PRESSURE TESTS

4.1 Hydrostatic test of vessel or system
When a pressure vessel or system is to be hydrostatically tested, it is recommended that the pressure relief valve be removed and a blank flange be installed in its place. This practice precludes the possibility of any damage to the pressure relief valve. Bent spindles and damaged valve seats are problems that can be caused by improper hydrostatic test procedures.

Blank flanges must be removed and the pressure relief valve reinstalled before the vessel is placed in service.

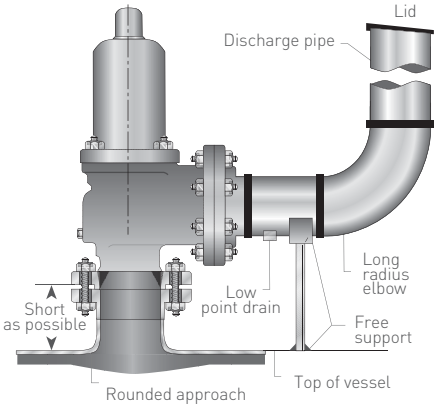
When the hydrostatic test must be performed with the valve in place, a test gag may be used. Crosby Style JOS-E/JBS-E/JDS-E Valves are designed to accommodate test gags for use with each type of cap. In the case of the Type C cap with lifting lever, the lifting lever assembly must be replaced with a hydrostatic test cap and test rod prior to hydrostatic testing. When test rods are used, care must be exercised to prevent over tightening that could damage the valve spindle and valve seats. Generally, a test rod which is hand tight will provide sufficient force to hold the valve closed.

After the hydrostatic test, the test rod (gag) must be removed and replaced by either a cap plug or a cap not fitted with a test rod.

4.2 Hydrostatic test of outlet system
When a hydrostatic test must be conducted on the outlet piping system, with the valve in place, special consideration must be given not to exceed the design pressure limits of the downstream side of the pressure relief valve. The outlet side of a pressure relief valve is known as the secondary pressure zone. This zone is normally designed to a lower pressure rating than the inlet and frequently is designed to a lower pressure rating than the outlet flange. This is true particularly in the case of balanced bellows or diaphragm designs and in the larger valve sizes.

Consult relevant product specifications for the back pressure design limits of the Style JOS-E/JBS-E/JBSBP-E/JDS-E or JLT-E Valves.

FIGURE 4
Recommended installation discharging to atmosphere



5 SETTING, TESTING AND ADJUSTMENTS

5.1 New valves

Every new Crosby J-Series Pressure Relief Valve is tested and sealed prior to shipment by following ASME Section XIII 3.6. The external adjustment points of each valve are sealed to ensure that no changes have been made to the valve after shipment and that the valve has not been disassembled or tampered with. The seals and nameplates are your assurance that the valve has been built and tested to the applicable Codes and Standards and are the physical evidence of our product warranty.

All new Crosby J-Series Valves are tested fully prior to shipment on the appropriate testing medium, so there is no need to pretest the valve prior to installation. If pretesting is required, in order to maintain the product warranty, an Emerson authorized service organization should be contacted to perform the testing. Contact your local sales representative or visit our website to locate the authorized service organization closest to your location. By choosing an Emerson authorized service organization to perform testing you can be assured that the correct testing procedure is followed which will save time and cost by avoiding possible valve damage caused by improper testing methods. In any event, if pretesting is to be performed, several important cautions should be observed.

First it is vital that the appropriate test fluid is used to test any valve. See Section 5.5. This will ensure accuracy of the test results as well as avoid possible damage to the valve.

All Crosby J-Series valves are tested for seat tightness after the final set point test and prior to shipment from the factory. If further seat tightness testing is required before installation, it is recommended that the test be performed prior to any set point verification testing. Repeated pressure testing of a metal seated valve can cause damage to the sealing surfaces leading to seat leakage.

Testing on a low volume test stand requires specific testing techniques in order to ensure accurate test results and to avoid damage to the sealing surfaces of the valve. In many cases this requires temporary adjustment of the nozzle ring during the test as described in Section 5.8 and specifically in Section 5.8.1. For valves with set points in excess of 500 psig (3447 kPa), it is recommended that when testing on a low volume test bench, the lift be restricted temporarily by use of a gag or other suitable device. When a test rod is used,it is recommended that the test rod be installed until the rod contacts the spindle and then backed off approximately one-half turn. However, it is good practice to inspect the valve prior to installation.

This inspection determines any damage which may have occurred due to rough handling in transit or storage and initiates appropriate service records.

5.2 Reconditioned valves

Valves which have not been in service for extended periods due to plant shutdown or long term storage, or valves which have been repaired or reconditioned, also should be tested before being put into operation.

⚠ CAUTION

To prevent valve damage, seat leakage and inaccurate set pressure, the testing procedure listed in this manual should be followed. .

5.3 Valves removed from service

Valves being removed from service should be tested on a shop test bench before being disassembled to determine the set pressure and seat tightness. This is an important phase of the maintenance routine and the test results should be recorded for review and determination of necessary corrective action. The 'as received from service' condition of a pressure relief valve is a most useful tool in establishing the proper time interval between inspections.

5.4 The test bench

The quality and condition of the shop test bench is paramount to obtaining proper test results. The test bench must be free of leaks and the test fluid must be clean. Solids or other foreign material in the test medium will damage the seating surfaces of the pressure relief valve being tested.

The test pressure gauge must be calibrated and have a range proper to the pressure level of the valve setting. Set pressure should fall within the middle third of the dial range of the test gauge. The test bench provides an accurate and convenient facility for determining valve set pressure and seat tightness. It does not duplicate all of the field conditions to which a pressure relief valve will be exposed while in service. It is not practical to attempt to measure relieving capacity or blow down using a test bench.

5.5 Test fluids - set pressure test

The test fluid should be air or nitrogen for valves used on gas and vapor service and water for valves used on liquid service. Valves for steam service should be tested on steam. It may be necessary to make a correction to the adjusted set pressure to compensate for the difference in temperature of the test fluids (see appropriate instruction).

5.6 Valve operation
Crosby Style JOS-E/JBS-E/JBSBP-E/JDS-E Valves intended for compressible fluid service and tested with air or steam will open with a sharp clear popping action at the set point. Style JLT-E valves for liquid service tested with water are considered open when there is a continuous unbroken stream of liquid flowing from the valve.

5.7 Set pressure changes
Set pressure changes beyond the specified spring range will necessitate a change in the valve spring assembly consisting of the spring and two fitted spring washers. The new spring and washers must be obtained from Emerson and the valve must be reset by an authorized valve repair facility.

5.8 Set pressure adjustment
Before making any adjustments, reduce the test pressure under the valve seat to at least 10% below the stamped set pressure (or cold differential test pressure - CDTP). This will prevent seat damage due to turning of the disc on the nozzle seat and minimize the chance of an inadvertent valve opening. A strong (high) ring position is necessary to obtain a good clean popping action of the valve on air or gas with the limited volume available on the test bench.

5.8.1 (Not required for testing on liquid)
Remove the nozzle ring set screw and raise the nozzle ring until it touches the disc holder, then back it down two (2) notches. Exercise care in counting the number of notches moved so that the ring can be returned to its proper position following testing.
Moving the notches on the nozzle ring to the left will lower the nozzle ring.
Replace the nozzle ring set screw before each set pressure test. The set screw must engage one of the ring notches, being careful that it does not bear on the top of a tooth.

5.8.2 Remove the cap or lifting lever following the instruction for valve disassembly (see Section 6.2).

5.8.3 Loosen the adjusting bolt nut and turn the adjusting bolt clockwise to increase set pressure or counterclockwise to reduce set pressure.

5.8.4 Re-tighten the adjusting bolt nut following each adjustment.

5.8.5 Two or three consecutive valve openings at the same pressure are necessary to verify the opening pressure accurately.

5.8.6 Opening pressure tolerance shall comply with ASME Section XIII Table 3.6.3.1-2 for UV Designator as below or other tolerance may be used so long as it meets ASME requirements:
The set pressure tolerance for pressure relief valves shall not exceed ±2 psi (15 kPa) for pressures up to and including 70 psi (500 kPa) and ±3% for pressures above 70 psi (500 kPa)

5.8.7 Once the set pressure has been established, lower the nozzle ring to the installed ring position as indicated in Table 1 and replace the nozzle ring set screw as described above. Seal wire the cap and adjusting ring set screw with identifying seals.

5.9 Nozzle ring settings
The nozzle ring adjustment is made at the factory and resetting in service is seldom necessary. Should it be necessary to change blowdown or reduce valve simmer, the nozzle ring may be adjusted as shown in Table 1 and Table 2.

⚠ CAUTION
Should any adjustments be made while the valve is installed on a pressurized system, the valve should be gagged while ring adjustments are made to prevent valve from inadvertently relieving.

TABLE 1

Service	Orifice size	Nozzle ring setting (below highest lock position)
Style JOS-E/JBS-E/JBSBP-E/JDS-E pressure relief valve recommended nozzle ring settings		
Vapor and gases	D through J	-5
	K through N	-10
	P through T2	-15
Style JLT-E pressure relief valve recommended nozzle ring settings		
Liquids and gases	D, E, and F	-2
	G, H, and J	-3
	K and L	-5
	M and N	-10
	P and Q (see Table 2)	
	R, T and T2 (see Table 2)	

NOTE
Minus sign indicates number of ring notches below starting position of nozzle ring which is the highest position with the valve closed (contact with disc holder).

TABLE 2

JLT-E orifice size	Nozzle ring setting - Total revolutions below highest lock position
P and Q	¾ Revolution
R, T and T2	1 Revolution

5.9.1 JOS-E, JBS-E, JBSBP-E, JDS-E

5.9.1.1 Remove the nozzle ring set screw and insert a screwdriver to engage the ring notches.

5.9.1.2 Turning the ring to the right raises the ring, thereby increasing blow down. Turning the ring to the left lowers the ring, thereby decreasing the blow down.

5.9.1.3 Do not lower the nozzle ring to the point where the valve begins to have excessive simmer. Raising of the ring will reduce simmer.

5.9.1.4 The nozzle ring should not be moved more than two notches before retesting. When making adjustments, always keep count of the number of notches and the direction in which the nozzle ring is moved. This will permit returning to the original setting in case of error.

5.9.2 JLTJOS, JLTJBS, JLTJBSBP-E, JLTJDS

The Style JLT in the P, Q, R, T and T2 orifice sizes is preset at the factory and cannot be adjusted externally in the field, since the special contoured skirt on the disc holder prevents engagement of the set screw with the nozzle ring. As a result the nozzle ring is not slotted and is held in place by three set screws. The position of the nozzle ring must be set prior to valve assembly as follows:

5.9.2.1 Screw the nozzle ring (3) on to the nozzle. The top of the nozzle ring should be below the nozzle seating surface.

5.9.2.2 Install the disc insert retention clip (9) onto the disc insert. Assemble the disc insert (8) and disc holder (5). The disc insert should snap into place using hand force only.

5.9.2.3 Lower the disc holder and disc insert carefully onto the nozzle.

5.9.2.4 Reach through the valve body outlet and turn the nozzle ring until it touches the disc holder lightly. This is the highest lock position.

5.9.2.5 Carefully remove the disc holder and disc insert from the valve.

5.9.2.6 Lower the nozzle ring (turn to the left) the total number of revolutions shown in Table 2.

5.9.2.7 Carefully tighten each of the set screws on the nozzle ring to hold the ring in position.

5.10 Cold differential test pressure adjustments

When a pressure relief valve is on a test bench at room temperature and atmospheric pressure, and is to be installed on a system operating at a higher temperature and/or a higher back pressure, a compensating adjustment is necessary. The test pressure required to have the valve open at the desired set pressure under actual service conditions is known as the cold differential test pressure.

5.10.1 Temperature correction

When a Crosby Style JOS-E/JBS-E/ JBSBP-E/JDS-E or JLT-E Valve is set on air or water at room temperature and then used at a higher service temperature, the test pressure shall be corrected to exceed the set pressure using the temperature correction shown in Table 3.

NOTE

This table is not applicable to JOS-H-E open bonnet or steam service valves.

5.10.2 Back pressure correction

Conventional valves without balancing bellows or diaphragm with atmospheric pressure at the outlet and intended for use under elevated constant back pressure conditions shall be adjusted so that the test pressure is equal to the set pressure minus the expected back pressure. See example below:

Set pressure	100 psi (689 kPa)
Constant back pressure	10 psi (69 kPa)
Cold differential test pressure	90 psi (621 kPa)

In all instances, the spring should be selected based on the cold differential test pressure; in the example above, 90 psi (621 kPa). See sample nameplate on page 5 which shows how temperature and back pressure are indicated.

5.10.3 Saturated steam correction factors

Crosby Style JOS and JOS-E Pressure Relief Valves excluding JOS-H-E open bonnet valves that are used for saturated steam service and are within the set pressure limits established in Table 4 may be set on air at ambient temperature, provided the correction factors in Table 5 are applied to the valve set pressure.

TABLE 3

Operating temperature	% Excess pressure
0 - 150°F (-18 - 65°C)	- - - -
151 - 600°F (66 - 315°C)	1%
601 - 800°F (316 - 430°C)	2%
801 - 1000°F (431 - 540°C)	3%

TABLE 4 - (JOS/JOS-E STYLE ONLY)

Orifice size	Saturated steam set pressure (max), psig (kPa)
D, E, F, G, H, J, K, L	1500 (10342)
M	1100 (7584)
N, P	1000 (6895)
Q	600 (4137)
R, T, T2	300 (2068)

TABLE 5 - SATURATED STEAM SERVICE

Air set pressure correction factors at ambient temperature	
Set pressure	**% Increase in spring set pressure**
15 - 400 psig (103 - 2758 kPa)	3%
401 -1000 psig (2765 - 6895 kPa)	4%
1001 - 1500 psig (6902 - 10,342 kPa)	5%

FIGURE 5
Typical test arrangement

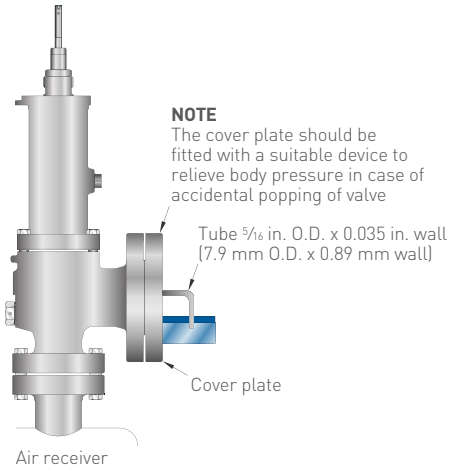
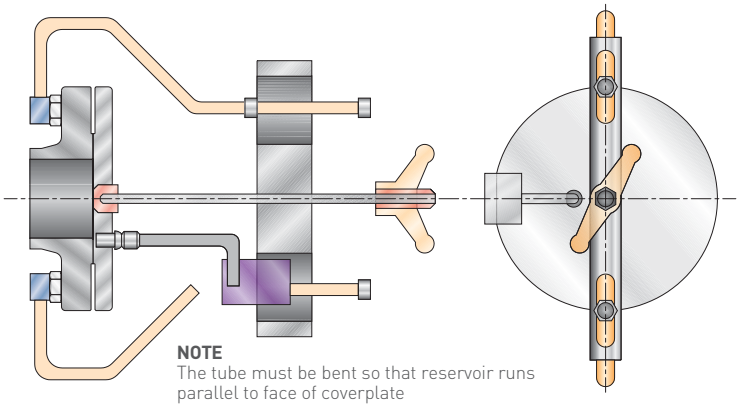


FIGURE 6
Seat leak apparatus for 150 and 300 lbs. (68 and 136 kg.) outlets 1 in. to 10 in. sizes



5.11 Seat leakage tests

Ambiguous terms such as 'bubble-tight', 'drop tight', 'zero leakage' and 'commercial tightness' sometimes are used to describe seat tightness. However, these terms lack uniform definition and true practical meaning.

Test procedure API standard 527 provides a standard for 'commercial' tightness and has been adopted by industry and users in order to clarify testing methods and tightness criteria. This standard applies to flanged inlet nozzle type pressure relief valves.

5.11.1 Testing with air

- Testing apparatus
  A typical test arrangement for determining seat tightness for pressure relief valves per API standard 527 is shown in Figure 5. Leakage is measured using a 5/16 in. (7.9 mm) OD tube with 0.035 in. (0.89 mm) wall. The tube end is cut square and smooth, is parallel to and ½ in. (12.7 mm) below the surface of the water. A snap-on type test clamp shown in Figure 6 is available.
- Testing pressure
  - All valves covered by this manual shall be tested for seat tightness.
  - Metal to metal and TFE seated valves with set pressures or CDTP of 45 psig (3.10 bar) or greater shall be tested at not less than 90% of the CDTP.
  - Elastomer O-ring seated valves with set pressure or CDTP of 45 psig (3.10 bar) or greater shall be tested at not less than 95% of the CDTP.
  - All valves with set pressures or CDTP of less than 45 psig (3.10 bar) and greater than or equal to 20 psig (1.3 bar) shall be tested at a pressure equal to or greater than 4.5 psig (0.31 bar) below the CDTP.
  - All valves with set pressures or CDTP below 20 psig (1.38 bar) and greater than 7 psig (0.48 bar) shall be tested at a pressure of not less than 75% of the CDTP.
  - All valves with set pressure or CDTP of 7 psig (0.48 bar) and below shall be tested at a pressure equal to or greater than 2 psig (0.14 bar) below the CDTP.
- Waiting time before observation of leakage:
  - 2 in. (50.8) and smaller - 1 minute
  - 2½ in. (63.5 mm), 3 in. (76.2 mm) and 4 in. (102 mm) - 2 minutes
  - 6 in. (152 mm) and greater - 5 minutes
- Acceptance criteria
  - Metal-to-metal seated valves
    The leakage rate in bubbles per minute shall be observed for at least one minute and shall not exceed the values indicated in Table 6.
  - Soft seated valves
    For soft seated valves there shall be no leakage for one minute (zero bubbles for one minute).

5.11.2 Testing with water

After opening the valve at the set pressure, the valve shall be allowed to reseat. Testing pressure should be same as testing with air.

- Waiting time
  The seat leak pressure shall be maintained for a period of not less than three (3) minutes.
- Acceptance criteria
  - The maximum allowable leakage rate for metal to metal seat valves shall not exceed ten (10) cubic centimeters per hour per inch of diameter of nominal valve inlet size.
  - The maximum allowable leakage rate for Teflon and O-ring seat valves shall be zero.

TABLE 6 - MAXIMUM SEAT LEAKAGE RATE - METAL SEATED PRESSURE RELIEF VALVES

	Effective orifice sizes 0.307 In² (198 mm²) and smaller D, E and F			Effective orifice sizes larger than 0.307 In² (198 mm²) G orifice and lager		
Set pressure psig (kPa)	Max. bubbles per minute	Approximate leakage rate per 24 hours Standard cubic feet	Standard cubic meters	Max. bubbles per minute	Approximate leakage rate per 24 hours Standard cubic feet	Standard cubic meters
15-1000 (103-6895)	40	0.6	0.017	20	0.30	0.0085
1500 (10,342)	60	0.9	0.026	30	0.45	0.0130
2000 (13,790)	80	1.2	0.034	40	0.60	0.0170
2500 (17,237)	100	1.5	0.043	50	0.75	0.0210
3000 (20,684)	100	1.5	0.043	60	0.90	0.0260
4000 (27,579)	100	1.5	0.043	80	1.20	0.0340
5000 (34,474)	100	1.5	0.043	100	1.50	0.0430
6000 (41,369)	100	1.5	0.043	100	1.50	0.0430

5.11.3 Testing with steam

- Testing pressure should be same as testing with air
- Waiting time
  The seat leak pressure shall be maintained for a period of not less than three (3) minutes.

NOTE

Any condensate in the valve body bowl shall be removed before the seat tightness test. Air may be used to dry condensate.

- Acceptance criteria-
  For both metal- and soft-seated valves, there shall be no audible or visible leakage for one minute.

5.11.4 Testing with air for open bonnet valve

Leakage shall be measured on open bonnet valves and valves that do not have back pressure integrity by filling the valve outlet with water above the nozzle and the seating surfaces. The valve outlet shall be partially sealed with water to about 0.5 in. (12.7 mm) above nozzle's seating surface.

- Testing pressure should be same as testing with air.
- Waiting time
  The seat leak pressure shall be maintained for a period of not less than one (1) minute.
- Acceptance criteria
  The maximum allowable leakage rate for metal-to-metal seated valves in bubbles per minute shall not exceed 50% of the value in Table 6. For soft seated valves there shall be no leakage for one minute (0 bubbles/minute).

6 VALVE MAINTENANCE

⚠ CAUTION

Valves in hazardous fluid service and any other materials classified as dangerous must be neutralized immediately after removal from service.

6.1 Visual inspection and neutralizing

A visual inspection shall be made when valves are first removed from service. The presence of deposits or corrosive products in the valve and in the piping should be recorded and valves should be cleaned to the extent possible prior to disassembly. Check the condition of external surfaces for any indication of corrosive atmospheric attack or evidence of mechanical damage.

6.2 Disassembly

Crosby JOS-E/JBS-E/JDS-E/JLTJOS-E/JLTJBS-E/ JLTJDS-E/JBSBP-E/JLTJBS-BP-E Valves should be disassembled as described below. Parts identification may be found on pages 2 through 4. The parts from each valve should be marked properly and segregated to keep them separate from parts used in other valves.

6.2.1 Remove the cap (40) and cap gasket (41). If the valve has a lifting lever device follow the instructions in Section 6.9.6.2.2 Remove the nozzle ring set screw (4) and set screw gasket (27). Record the position of the nozzle ring (3) with respect to the disc holder (5) by counting the number of notches required to raise the ring until it just touches the disc holder. This information may be needed again when reassembling the valve. (For Style JLT P through T2 orifice refer to 6.2.13)

6.2.3 Loosen the adjusting bolt nut (25). Before releasing the spring load, make note of the depth of the adjusting bolt in the bonnet by measuring the height of the adjustment bolt with a pair of dial calipers or depth micrometer. This measurement will help when reassembling the valve to its approximate original setting.

6.2.4 Release all of the spring load by rotating the adjusting bolt (24) in a counterclockwise direction.

6.2.5 Remove the bonnet stud nuts (22). For bellows leak detection styles JBSBP-E/ JLTJBSBP-E remove the tubing from the transmitter and set aside.

6.2.6 Lift the bonnet (20) straight up to clear the spindle (16) and valve spring (18). Exercise care when lifting the bonnet (20) as the spring (18) and spindle (16) will then be free to fall aside.

6.2.7 The spring (18) and spring washers (19) can now be lifted off the spindle (16). The spring and spring washers are fitted together and must be kept together as a subassembly. Spring washers (19) are not interchangeable between ends of the spring.

6.2.8 For D through K orifice, remove the spindle assembly (16). While holding the top of the disc holder (5), lift the disc holder assembly straight up out of the body (1).
For L through T2 orifice, while holding the spindle, lift the spindle and disc holder assembly straight up out of the body (1). Then, remove the two spindle cotter pins (17) and the spindle assembly (16).
For JOS-E, JLTJOS-E, JBS-E and JLTJBS-E styles, lift off the guide (15) from the disc holder (5).
For JDS-E and JLTJDS-E styles, see 6.2.9 before removing the guide (15).
For JBSBP-E and JLTJBSBP-E, see 6.2.10 before removing the guide (15).

NOTE
A mechanical lifting aid such as a hoist may be required for N-T2 orifice. Screw the correct size eye bolt adapter shown in Figure 8 on top of the Spindle assembly (16). Except for diaphragm valves orifice size Q, R, T and T2, attach the eye bolt adapter on disc holder (5) top thread as per the Table 7. Ensure enough threads are engaged to safely lift the required assembly.

⚠ CAUTION
For balanced bellows and bellows leak detection valves (Style JBS-E, JLTJBS-E, JBSBP-E and JLTJBSBP-E) special care must be taken not to damage the bellows assembly (6). If parts are difficult to remove, due to the presence of corrosive or foreign materials, soaking in a suitable solvent may be required.

6.2.9 For diaphragm valves (JDS-E and JLTJDS-E), place the disc holder (5) in a vise (as shown in Figure 7). Lift off the bonnet adapter (23), remove the lock washer nut (7F) by turning counterclockwise, lift off the lock washer (7E), diaphragm plate (7D), diaphragm (7C), spacer (7B) and diaphragm gasket (7A), lift off the guide (15) from the disc holder (5).

NOTE
A mechanical lifting aid such as hoist may be required for lifting bonnet adapter (23) on orifice sizes Q, R, T and T2. Use the provided lifting holes as shown in Figure 9 with ⅜ in. (9.5 mm) shoulder eye bolt adapter with 0.75 in. (19 mm) shank length as shown in Figure 10. Ensure that the eye bolt adapter thread is engaged completely for shoulder to contact the flat surface.

⚠ WARNING
The disc holder sub-assembly must be secured firmly on a 3-jaw vise prior to lifting the bonnet adapter (23). The guide (15) along with diaphragm (7C) may stick to bonnet adapter (23) during disassembly which can result in an injury from falling of heavy parts. Lightly tap around the outer perimeter of the bonnet adapter (23) with a soft blow hammer to prevent it from sticking during lifting.

6.2.10 For bellows leak detection styles (JBSBP-E and JLTJBS-BP-E) place the disc holder (5) in a vise (as shown in Figure 7) remove the bonnet adapter (23) by lifting it off the guide (15), for D/E orifice the bonnet adapter (23) is used in lieu of the guide (15). Remove the piston (5G) using a suitable wrench turning counterclockwise, if disassembly is not possible with hand tools it may be required to heat the piston with a heat gun up to a maximum of 500°F (260°C), remove piston while hot, lift off the guide (15) from the disc holder (5).

⚠ CAUTION
If piston was heated use suitable gloves. Warning since Loctite is used it may also act as a thread sealant trapping some pressure inside the piston. During disassembly care should be taken to ensure any pressure trapped is released during disassembly.

6.2.11 For bellows and bellows leak detection valves (JBS-E, JLTJBS-E, JBSBP-E, and JLTJBSBP-E), with the disc holder (5) in a vise (as shown in Figure 7). The bellows assembly is threaded onto the disc holder to remove use a suitable wrench on the bellows tailpiece (6A) by turning counterclockwise, remove the tailpiece gasket (29). The bellows assembly (6A, 6B, 6C) are welded and there should be no attempt to separate. For JBS/JLTJBS styles with bellows welded to the disc holder see IS-V3137A.

NOTE
The larger sizes may require a 3-jaw vise.

TABLE 7

Valve Type	Orifice Size	Pressure Class	CAP Style	Lift Location	Eye Bolt Adapter
JOS-E, JBS-E, JLT JOS-E, JLT JBS-E, JDS-E, JLT JDS-E	N, P	1() - 3()	A, B, G, H	Spindle thread	0.625-11 UNF-2A
			C, D, E, J, K, L, M	Spindle thread	0.750-16 UNF-2A
	N	4()	A, B, G, H	Spindle thread	0.625-11 UNF-2A
			C, D, E, J, K, L, M	Spindle thread	0.750-16 UNF-2A
	P	4()	A, B, G, H	Spindle thread	0.750-10 UNC-2A
			C, D, E, J, K, L, M	Spindle thread	0.875-14 UNF-2A
	Q, R, T, T2	1() - 4()	A, B, G, H	Spindle thread	0.750-10 UNC-2A
			C, D, E, J, K, L, M	Spindle thread	0.875-14 UNF-2A
JDS-E, JLT JDS-E	N, P, Q, R, T, T2	1() - 4()	- - - -	Disc holder thread	1.625-12 UN-2A

FIGURE 7

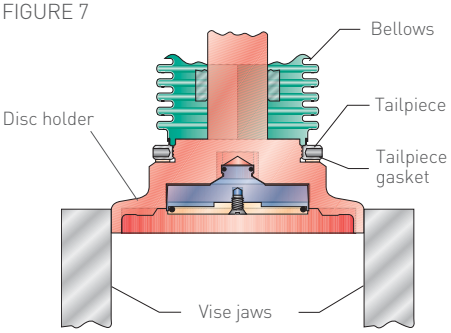


FIGURE 8

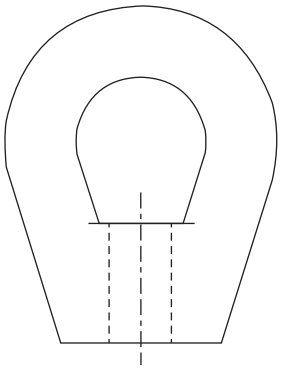


FIGURE 9

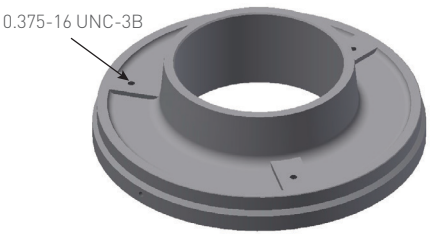
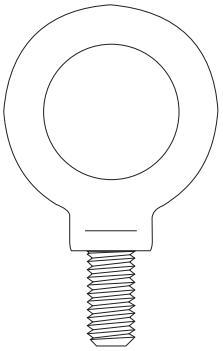


FIGURE 10



6.2.12 *Disc insert removal*

- Orifice sizes D through M (metal seats) Screw a standard bolt into the tapped hole (refer to Table 8) in the face of the disc insert (8) (See Figure 11). Using hand force pull the bolt straight out. The disc insert (8) with the retention clip (9) should come out with moderate force. If additional pullout force is required, a bolt with a T handle may be used. The method described below for orifice sizes N through T2 may be used if necessary.
- Orifice sizes N through T2 (metal seats) The removal of the disc insert (8) is accomplished using a tool as shown in Figure 11. This tool consists of a rectangular steel bar which spans the outside diameter of the disc holder (5) and a center hole through which the standard bolt can be inserted before screwing into the disc insert (8). A nut and washer are also required as shown. Tightening the nut with a wrench will exert a pulling force on the disc insert (8) and cause it to be removed from the disc holder (5).
- Orifice sizes D through K (O-ring seats) The O-ring seat design has a retaining screw (12) in the center of the disc insert (8). A drilled and tapped hole (4-40 UNC) is provided in the center of the retaining screw (12) for removal of the disc insert (8) (refer to Figure 12). Screw a standard bolt into the hole in the retaining screw (12). Using hand force pull the bolt straight out. The disc insert (8) with the retention clip (9) should come out with moderate force.
- Orifice sizes L through T2 (O-ring seats) Remove the three retaining screws (12) from the disc insert (8). Remove the O-ring retainer (11) and O-ring seat (10). A tapped hole (refer to Table 8) is provided in the disc insert (8) for insertion of a removal bolt. Follow instructions for metal seated insert removal.

⚠ CAUTION

Safety precautions should be followed whenever heavy parts are being lifted or transported. Dropping the disc holder may dislodge the insert. If the valve has been in dirty service, it may be necessary to use a suitable solvent to aid in removal.

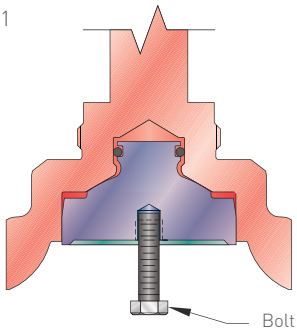
6.2.13 Remove the nozzle ring (3) from the nozzle (2) by turning counterclockwise. For styles (JLTJOS-E, JLTJBS-E, JLTJBSBP-E, or JLTJDS-E) orifice sizes P through T2, remove the nozzle ring lock screws (13) with the appropriate allen head wrench before removing the nozzle ring.

6.2.14 Remove the nozzle (2) from the valve body (1) if necessary. Unless the valve seat on the nozzle has been damaged mechanically or shows signs of corrosive attack, it will not be necessary to remove the nozzle. In most cases the nozzle can be reconditioned without removal from the valve body. To remove the nozzle, turn the valve body over taking care not to damage the bonnet studs (21). Turn the nozzle counterclockwise by using the wrench flats on the nozzle flange or a nozzle wrench designed to clamp onto the nozzle flange.

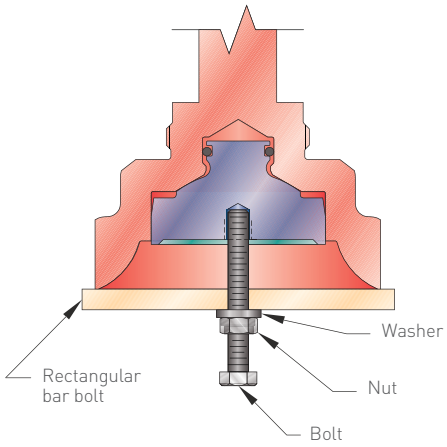
6.3 Cleaning

External parts such as the valve body, bonnet and cap should be cleaned by immersion in a bath such as hot Oakite solution or equivalent. These external parts may be cleaned by wire brushing, provided the brushes used do not damage nor contaminate the base metals. Only clean stainless-steel brushes should be used on stainless steel components. The internal parts such as the guide, disc holder, disc insert, nozzle ring and spindle should be cleaned by immersion in a commercial high alkaline detergent. Guiding surfaces on the disc holder and guide may be polished using a fine emery cloth. The bellows and other metal parts may be cleaned using acetone or alcohol, then rinsed with clean tap water and dried.

FIGURE 11

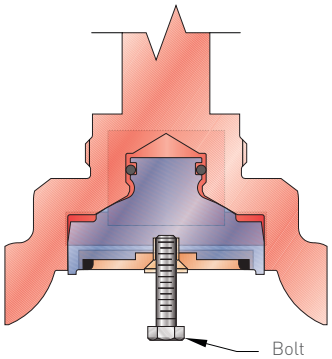


Remove disc insert by pulling on bolt



Remove disc insert by turning nut with wrench

FIGURE 12



Remove disc insert by pulling on bolt

TABLE 8 - JOS-E/JBS-E/JDS-E DISC INSERT THREADED HOLE SIZES

Orifice size	Thread size (UNC)
D, E	# 10 - 24
F, G, H	¼ - 20
J, K, L	¼ - 20
M, N, P, Q, R, T, T2	⅜ - 16

6.4 Inspection

Check all valve parts for wear and corrosion. The valve seats on both the nozzle and disc insert must be examined to determine if they have been damaged. Most often, lapping the valve seats is all that is necessary to restore them to their original condition. If the inspection shows that the valve seats are damaged badly, re-machining will be necessary or it may be advisable to replace these parts. When the time element is a factor, it may be advantageous to replace damaged parts from spare parts stock, thereby permitting the replaced part to be checked and reworked at leisure. (See Figure 14 and Table 9 for nozzle critical dimensions). The valve spring (18) should be inspected for evidence of cracking, pitting or deformation. The bellows (6B) in a Style JBS-E, JBSBP-E, JLTJBS-E, and JLTJBSBP-E valve and diaphragm (7C) in a Style JDS-E and JLTJDS-E valves should be inspected for evidence of cracking, pitting or deformation that might develop into a leak. The bearing surfaces on the guide and disc holder should be checked for residual product build up and any evidence of scoring. Inspection of valve components is important to ensure proper valve performance. Damaged valve parts must be repaired or replaced.

Spindle assemblies should be checked for excessive run out. For D to K orifice the total run out between the spindle point to top of the spindle rod should be less than 0.015 in. (0.38 mm). For L orifice and larger it should be less than 0.030 in. (0.80 mm). Check and inspect all gaskets for evidence of damage (creases, gouges, cuts) or corrosion. Metal gaskets may be re-used if found to be undamaged. All organic fiber or soft gaskets should be replaced.

6.5 Reconditioning of valve seats

The tightness of a valve and its proper operation depend directly on the condition of the seats. Many pressure relief valve problems are due to eroded or damaged seats.

The standard Crosby Style JOS-E/JBS-E/ JBSBP-E/JDS-E/JLT-E Valve is constructed with a flat metal-to-metal seat. It is important that seating surfaces be refurbished properly by lapping with a flat cast iron lap coated with the correct lapping compound.

6.5.1 Lapping procedures

Unless the seats have been damaged badly by dirt or scale, lapping the seating surfaces should restore them to their original condition. Never lap the disc insert against the nozzle. Lap each part separately against a cast-iron lapping block of the proper size. These blocks hold the lapping compound in their surface pores and must be recharged frequently. Lap the block against the seat

Never rotate the block continuously, but use an oscillating motion.

Extreme care should be taken throughout to make certain that the seats are kept perfectly flat. If considerable lapping is required, spread a thin coat of medium coarse lapping compound on the block. After lapping with the medium coarse compound, lap again with a medium grade compound. Unless much lapping is called for, the first step can be omitted. Next, lap again using a fine grade compound. When all nicks and marks have disappeared, remove all the compound from the block and seat. Apply polish compound to another block and lap the seat.

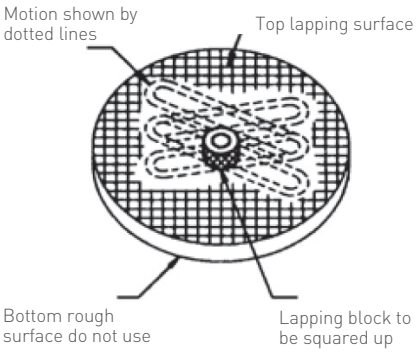
As the lapping nears completion, only the compound left in the pores of the block should be present. This should give a very smooth finish. If scratches appear, the cause is probably dirty lapping compound. These scratches should be removed by using compound free from foreign material.

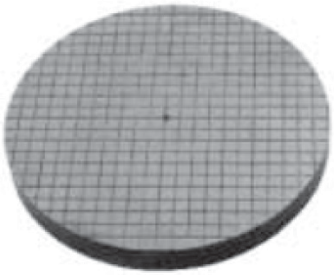
Disc inserts should be lapped in the same way as nozzles. The disc insert must be removed from the holder before lapping. Before the disc insert is placed back in the holder all foreign material should be removed from both parts. The insert must be free when in the holder. If the disc insert is damaged too badly to be reconditioned by lapping, it should be replaced.

Re-machining the insert will change critical dimensions, affect the action of the valve and is not recommended.

- Lapping blocks
  Lapping blocks are made of a special grade of annealed cast iron. There is a block for each orifice size. Each block has two perfectly flat working sides and it is essential that they retain this high degree of flatness to produce a truly flat seating surface on either the disc insert or the nozzle. Before a lapping block is used, it should be checked for flatness and reconditioned after use on a lapping plate. The block should be lapped in a figure eight motion, applying uniform pressure while rotating the lapping block against the plate as shown in Figure 10.
- Lapping compounds
  Experience has proven that medium coarse, medium fine and polish lapping compounds will condition any damaged pressure relief valve seat properly except where the damage requires re-machining. The following lapping compounds, or their commercial equivalents are suggested:

FIGURE 13





Lapping block resurfacing plate

Lapping block

Grit compound no.	Description
320	Medium coarse
400	Medium
600	Fine
900	Polish

TABLE 9 - MINIMUM NOZZLE FACE TO SEAT DIMENSIONS (SEE FIGURE 14)

Orifice	Valve type																	
	12, 14, 15, 16		22, 24, 25, 26		32, 34, 35, 36, 37		47		42, 44, 45, 46		57		55, 56		64, 65, 66, 67		75, 76, 77	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
D	3.453	87.7	3.453	87.7	3.453	87.7	3.453	87.7	3.453	87.7	3.675	93.3	3.675	93.3	3.675	93.3	4.796	121.8
E	3.453	87.7	3.453	87.7	3.453	87.7	3.453	87.7	3.453	87.7	3.675	93.3	3.675	93.3	3.675	93.3	4.796	121.8
F	4.013	101.9	4.013	101.9	4.013	101.9	4.013	101.9	4.013	101.9	4.013	101.9	4.013	101.9	4.013	101.9	4.633	117.7
G	3.763	95.6	3.763	95.6	3.763	95.6	3.763	95.6	3.763	95.6	3.763	95.6	3.763	95.6	4.763	121.0	4.763	121.0
H	3.889	98.8	3.889	98.8	3.889	98.8	3.889	98.8	4.826	122.6	4.826	122.6	4.826	122.6	4.826	122.6	- - - -	- - - -
2J3	4.326	109.9	4.326	109.9	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
2½J4	- - - -	- - - -	- - - -	- - - -	4.357	110.7	4.357	110.7	5.107	129.7	5.107	129.7	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
3J4	- - - -	- - - -	- - - -	- - - -	6.232	158.3	6.232	158.3	6.232	158.3	6.232	158.3	6.441	163.6	6.441	163.6	- - - -	- - - -
K	4.701	119.4	4.701	119.4	4.701	119.4	4.701	119.4	5.826	148.0	5.826	148.0	7.013	178.1	7.013	178.1	- - - -	- - - -
L	5.045	128.1	5.045	128.1	5.263	133.7	5.263	133.7	5.263	133.7	6.236	158.4	6.236	158.4	6.236	158.4	- - - -	- - - -
M	5.576	141.6	5.576	141.6	5.576	141.6	5.576	141.6	5.576	141.6	6.389	162.3	6.389	162.3	- - - -	- - - -	- - - -	- - - -
N	6.107	155.4	6.117	155.4	6.117	155.4	6.117	155.4	6.117	155.4	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
P	5.857	148.8	5.857	148.8	7.607	193.2	7.607	193.2	7.607	193.2	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
Q	7.732	196.4	7.732	196.4	7.732	196.4	7.732	196.4	7.732	196.4	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
R	8.107	206.2	8.117	206.2	8.117	206.2	8.117	206.2	8.117	206.2	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
T, T2	9.576	243.2	9.576	243.2	9.576	243.2	- - - -	- - - -	9.576	243.2	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -

TABLE 10 - DISC INSERT MINIMUM SEAT HEIGHTS

Orifice	D and E		F		G		H		J		K		L		M		N		P		Q		R		T	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
'A'	0.332	8.4	0.370	9.4	0.369	9.4	0.398	10.1	0.429	10.9	0.531	13.5	0.546	13.9	0.605	15.4	0.632	16.1	0.692	17.6	0.783	19.9	0.781	19.8	0.839	21.3
'B'	0.021	0.5	0.025	0.6	0.030	0.8	0.036	0.9	0.044	1.1	0.051	1.3	0.063	1.6	0.070	1.8	0.076	1.9	0.091	2.3	0.118	3.0	0.139	3.5	0.176	4.5
	0.023	0.6	0.027	0.7	0.032	0.8	0.038	1.0	0.046	1.2	0.053	1.3	0.065	1.7	0.072	1.8	0.078	2.0	0.093	2.4	0.120	3.0	0.141	3.6	0.178	4.5

6.5.2 *Machining of nozzle seats*

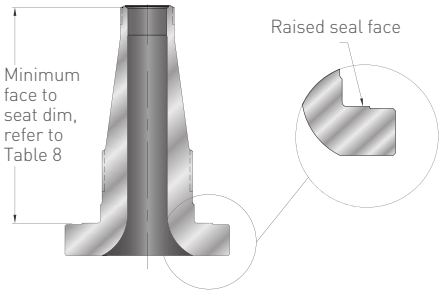
If machining of the nozzle seat or other major repairs are necessary, it is recommended that the valve be returned to an authorized Emerson Service Center for repair. All parts must be machined accurately per Emerson specifications. No pressure relief valve will be tight, nor will it operate properly unless all parts are machined correctly. The most satisfactory way to machine a nozzle is to remove it from the valve body. However, it may also be machined while assembled within the valve body. In any event, it is vitally important that the seating surfaces run absolutely true before machining.

Machining dimensions for Crosby Style JOS-E/JBS-E/JBSBP-E/JDS-E/JLT-E Valves with metal-to-metal nozzle seats are shown in Figure 14 and Table 9. Remove only enough metal to restore the surface to its original condition. Turning to the smoothest possible finish will facilitate lapping. The nozzle must be replaced when minimum face to seat dimension is reached. This critical dimension is shown in Table 9.

6.5.3 *Machining of disc insert seats*

When the damage to the disc insert seat is too severe to be removed by lapping, the disc insert may be machined and lapped provided that minimum seat height is maintained (Figure 15 and Table 10).

FIGURE 14
Nozzle seat critical dimensions



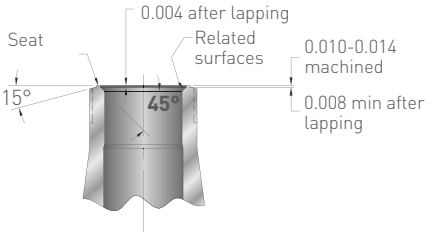
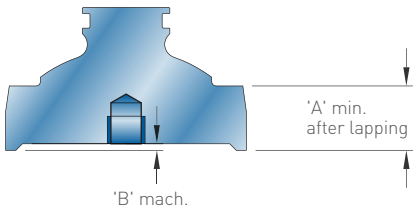


FIGURE 15
Disc insert minimum seat height (Table 9)



6.6 Assembly

All components should be clean. Before assembling the following parts, lubricate with pure nickel 'Never-Seez®' or equivalent (See Figure 15).

- Nozzle to body threads.
- Nozzle and body sealing surface.
- All studs and nuts.
- Spindle rod threads.
- Spring spacer bevels.
- Set screw threads.
- Adjusting bolt and bonnet threads.
- Bonnet pipe plug (JOS-E and JLTJOS-E only).
- Cap threads.
- Dog shaft bearing threads.
- Spindle point thrust bearing.
- Body, bonnet, cap set screw gaskets and bellows tailpiece gasket.
- Disc insert bearing.
- D through H orifice Disc holder top threads (JDS-E and JLTJDS-E only) by using Loctite®243.
- J through T orifice Disc holder top threads (JDS-E and JLTJDS-E only).

Special attention should be given to the guiding surfaces, bearing surfaces, threaded surfaces, and gasket surfaces to ensure that they are clean, undamaged, and ready for assembly. For parts identification, refer to Figure 1. Please refer to the respective manufacturer's latest documentation on usage, dry time, curing time, etc. for proper performance. Metal gaskets and O-ring soft seals (if applicable) should be replaced during each repair for best performance. Metal gaskets can be re-used if not damaged or corroded.

6.6.1 Apply lubricant to the flange surface in contact with the valve body (1) and on the body to nozzle threads. Screw the nozzle (2) into the valve body (1) and tighten with the appropriate nozzle wrench.

6.6.2 Screw the nozzle ring (3) onto the nozzle (2). The top of the nozzle ring should be above the nozzle seating surface. This prevents damaging the seating surfaces during installation of the disc holder assembly.

6.6.3 If removed, install the retention clip (9) onto the disc insert (8) by placing the retention clip over the groove of the disc insert and pushing into the groove. For O-ring soft seat (see Figure 22) lightly coat the new O-ring (10) with "Parker Super O-Lube" place the O-ring around the radius lip of the O-ring retainer (11) and install into the disc insert (8) being careful not to pinch the O-ring, place a small amount of Loctite® 242 (or equivalent removable thread lock) onto the O-ring retainer screw(s) threads (12) thread the retainer screw(s) into the disc insert finger tight. Using the proper allen head wrench securely tighten the retainer screw(s). Place the disc insert (8) into the disc holder (5) and push on the disc insert until it snaps into the disc holder using hand force only. Rocking the disc insert may aid in snapping into place.

⚠ CAUTION

Safety precautions should be followed whenever heavy parts are being lifted or transported. Dropping the disc holder assembly may dislodge the disc insert.

6.6.4 For bellows valves (JBS-E/JLTJBS-E/JBSBP-E/JLTJBSBP-E), place the disc holder (5) in a vise (or 3 jaw vise for larger sizes) as shown in Figure 7. Install the new tailpiece gasket (29) onto the disc holder (5). Screw the bellows assembly (6) onto the disc holder by holding the bellows tailpiece (6A), tighten the bellows using the flats on the tailpiece with a suitable wrench. For Bellows Leak Detection Style JBSBP-E/JLTJBSBP-E, see paragraph 6.8 for assembly.

NOTE

Special care should be taken to not damage the bellows, never use a pipe wrench to tighten the tailpiece (6A).

6.6.5 Assemble the disc holder (5) and guide (15), by sliding the guide over the disc holder. For restricted lift styles "RL" install the restricted lift spacer over the disc holder prior to installing the guide (See Figure 21, paragraph 6.7).

NOTE

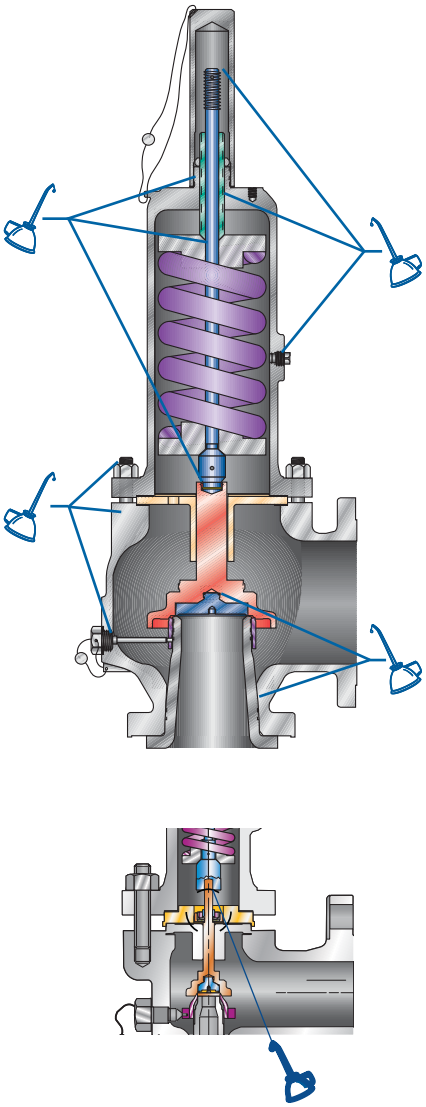
For orifice sizes D and E only on styles JOS-E/JBS-E/JLTJOS-E/JLTJBS-E the guide lift stop protrudes up into the valve bonnet (20), orifice sizes F through T2 the guide lift stop protrudes down into the body (1). For orifice sizes D through T2 on styles JDS-E/JLTJDS-E/JBSBP-E/JLTJBSBP-E the guide lift stop protrudes down into the valve body (1). For D/E orifice the bonnet adapter (23) is used in lieu of the guide (15).

a. For styles JDS-E/JLTJDS-E with the disc holder (5) in the vise (or 3 jaw vise), place the diaphragm gasket (7A) onto the shoulder of the disc holder being careful to make sure the diaphragm gasket rests squarely on the shoulder of the disc holder then stack the spacer (7B) onto the diaphragm gasket, keep the non-serration surface of the spacer against the diaphragm gasket.

NOTE

Visually check for any burrs on the spacer (7B) serration prior to assembling.

FIGURE 16
Recommended lubrication points



b. Install the diaphragm (7C) onto the spacer (7B) through the center hole, keep the rubber side of the diaphragm towards the serration surface of the spacer. Fold down the diaphragm to be convoluted around the spacer so that diaphragm rests on the guide flatly and evenly in the circumferential direction.

c. Place the diaphragm plate (7D) onto the diaphragm (7C), serration side down towards the diaphragm. Stack the wedge lock washer set (7E) above the diaphragm plate (7D) keep the pair of washers together. (See Figure 15 for the correct paired washer stacking). (See Figure 17 for JDS assembly).

NOTE
Visually check for any burrs on the diaphragm plate (7D) serration surface prior to assembling.

d. For D through H orifice sizes, place a small amount of Loctite® 243 (removable thread locker) onto the disc holder top threads (5).
For J through T2 orifice sizes, lubricate the disc holder top threads (5) with pure Nickle "Never-Seez®" or equivalent. Screw the lock washer nut (7F) onto the disc holder (5) finger tight. Using the proper wrench tighten the nut to the torque required per Table 10. The torque shall be increased slowly to avoid diaphragm (7C) rotation and potential diaphragm gasket (7A) damage. The torque shall not exceed the maximum value as specified in Table 11.

e. Install the bonnet adapter (23) by positioning the counter bore on the O.D. of the diaphragm (7C) and guide (15).

NOTE
A mechanical lifting aid such as hoist may be required for lifting bonnet adapter (23) on orifice sizes Q, R, T and T2. Use the provided lifting holes as shown in Figure 9 with ⅜ in. (9.5 mm) shoulder eye bolt adapter with 0.75 in. (19 mm) shank length as shown in Figure 10. Ensure that the eye bolt adapter is threaded completely for shoulder to contact the flat surface.

6.6.6 Install the new bottom guide gasket (28), into the recess in the body (1) below the guide (15). For bellows valves, the bellows flange eliminates the need for the bottom guide gasket (28).

6.6.7 While holding the top of the disc holder (5) install the disc holder and guide assembly into the body (1). Align the hole in the guide with the body outlet. Once guide is seated, the disc holder (5) and disc insert (8) assembly, can be lowered into the nozzle (2). By reaching into the valve outlet lower the nozzle ring (3) clockwise below the seat so that it moves freely. For JLTJOS-E/JLTJBS-E/JLTJDS-E/ JLTJBSBP-E orifice sizes P-T2 only, turn the nozzle ring (3) counter-clockwise until it touches the disc holder (5). Remove the disc holder guide and disc assembly and position the nozzle ring (13) (per Table 2), then tighten the three set screws (13) with the appropriate allen head wrench. Once the set screws are installed re-install the disc holder, guide and disc assembly.

NOTE
It may be required for orifice sizes L-T2 to install the spindle (16) and cotter pins (17) and use a mechanical lifting aid such as eye bolt adapter shown in Figure 8 attached to the spindle threads. Refer Table 7 for correct size eye bolt adapter. For diaphragm valves orifice size Q, R, T and T2 attach the eye bolt adapter on disc holder (5). Ensure enough threads are engaged to safely lift the required assembly.

6.6.8 Position the upper gasket (28) onto the guide, line up the O.D. of the gasket with the O.D. of the guide. For diaphragm type JDS position the bonnet adapter gasket (31) above the bonnet adapter (23). Place the spring (18) and washers (19) onto the spindle (16) and assemble the spindle to the disc holder. Orifice sizes L through T2 require two cotter pins (17) to attach the spindle to the disc holder (5) in the two pre-drilled holes. No cotter pins are required in orifice sizes D-K.

6.6.9 Lower the bonnet (28) over the spindle (16) and spring assembly (18-19) onto the bonnet studs (21) in the body (1). Position the bonnet counter bore gasket surface on the O.D. of the guide (15) or bonnet adapter (23) as applicable. The bonnet vent should face the outlet direction unless otherwise specified.

NOTE
The spindle and spring assembly for orifices L through T2 will tend to shift to the side, special care should be taken to hold the spring and washer assembly upright before installing the bonnet (20) this can be accomplished by placing a sized block of wood (or any alternate spacer) on two opposing sides between the bottom spring washer (19) and the guide (15). Once the bonnet clears the spindle the blocks or spacer must be removed prior to lowering the bonnet into its final seated position.

Figure 17
JDS Assembly

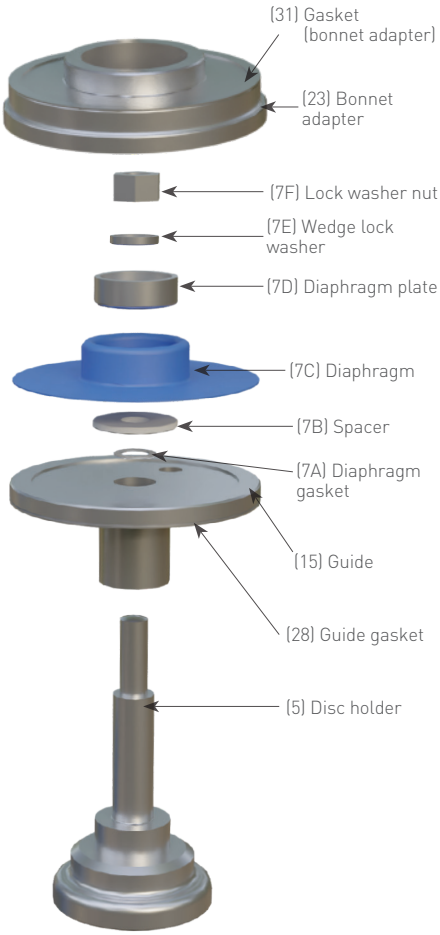


Figure 18
Wedge Lock Washer Set

6.6.10 Install the bonnet nuts (22) finger-tight onto the bonnet studs (21).
For JBSBP-E and JLTJBSBP-E, install the bracket opposite of the nameplate (See Figure 20) tighten the nuts in the sequence shown in the diagram in Figure 19 approximately one-half the minimum torque value. Repeat the same sequence of tightening to the maximum torque value shown in Table 12. Then starting with the Number 1 nut, tighten each nut in order in a clockwise or counterclockwise direction to a value no greater than the maximum value shown in Table 12.

6.6.11 Screw the adjusting bolt nut (25) onto the adjusting bolt (24), then screw the adjusting bolt and nut assembly into the bonnet threads (24), tighten by turning clockwise to apply force to the spring and washers (18-19). The original set pressure can be approximated by screwing the adjustment bolt (24) down to the original measurement taken during disassembly.

NOTE
It may be necessary to hold the spindle (16) with pliers (or two nuts tightened onto the spindle and held by the bottom nut) or hold disc holder by reaching into the valve outlet while tightening the adjustment bolt to prevent damage to the seats.

6.6.12 For JOS-E/JBS-E/JDS-E/JBSBP-E styles in air or gas service, turn the nozzle ring (3) counterclockwise until it touches the disc holder (5), then lower it clockwise two notches. This is the test stand setting only, once valve setting is complete, nozzle ring should be adjusted by turning counterclockwise until it touches the disc holder, then adjusted down by turning clockwise to the recommended position in Table 1. For JLTJOS-E/JLTJBS-E/JLTJDS-E/JLTJBSBP-E on liquid and air service the nozzle ring (3) can be adjusted to the recommended position in Tables 1 and 2 without presetting to two notches.

6.6.13 Place the new set screw gasket (27) onto the set screw (4) and screw the set screw into the body (1) the set screw should engage the nozzle ring between the slots allowing the nozzle ring to move slightly back and forth after set screw is tightened. For styles JLTJOS-E/JLTJBS-E/JLTJBSBP-E/JLTJDS-E, P through T2 orifice the set screw does not engage the nozzle ring due to nozzle ring is held by lock screws (13).

6.6.14 The valve is now ready for testing. After testing, the following measures should be taken:

- Be sure that adjusting bolt nut (25) is locked.
- Return the nozzle ring (3) to either the original recorded position or to the recommended position shown in Table 1.
- Install the cap or lifting device. See paragraph 6.9 for lifting lever assembly.
- Seal the external adjustments, cap or lifting lever device and nozzle ring set screw to prevent tampering.

FIGURE 19
Sequence Diagram

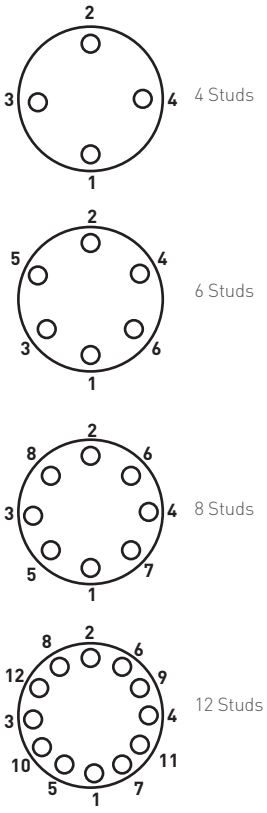


TABLE 11 - REQUIRED TIGHTENING TORQUE FOR DIAPHRAGM NUT

		Torque in ft-lbs (N•m)	
Orifice	**Thread**	**Minimum**	**Maximum**
D and E	1/4 - 28	3.0 (4.0)	4.0 (5.4)
F	1/4 - 28	3.5 (4.7)	3.8 (5.2)
G	5/16 - 24	6.6 (8.9)	7.4 (10.1)
H	3/8 - 32	12.3 (16.7)	14.2 (19.3)
J	1/2 - 20	28.0 (38.0)	31.0 (43.0)
K	5/8 - 18	57.0 (76.0)	59.0 (80.0)
L	1 1/4 - 12	147.0 (200.0)	169.0 (230.0)
M	1 3/8 - 12	162.0 (220.0)	162.0 (220.0)
N	1 5/8 - 12	224.0 (305.0)	224.0 (305.0)
P	1 5/8 - 12	269.0 (365.0)	269.0 (365.0)
Q, R, T and T2	1 5/8 - 12	270.0 (365.0)	276.0 (375.0)

TABLE 12 - REQUIRED TIGHTENING TORQUE FOR BONNET NUT

	Torque in ft-lbs (N•m)	
Thread	**Minimum**	**Maximum**
7/16 - 14	23.0 (31.2)	30.0 (40.7)
1/2 - 13	35.0 (47.5)	45.0 (61.))
5/8 - 11	70.0 (94.9)	90.0 (122.0)
3/4 - 10	115.0 (155.9)	150 (203.4)
7/8 - 9	185.0 (250.8)	240.0 (325.4)
1 - 8	240.0 (325.4)	370.0 (501.7)
1 1/8 - 8	405.0 (549.1)	525.0 (711.8)
1 1/4 - 8	580.0 (786.4)	750.0 (1016.9)

6.7 Restricted lift valves

Crosby JOS-E/JDS-E/JBS-E/JBSBP-E and JLT-E Pressure Relief Valves are available in a restricted lift version. The purpose of a restricted lift valve is to more closely match the required capacity of the protected vessel or pipe with the actual and rated capacities of the relief valve providing over-pressure protection.

Restricted lift (RL) versions of the J-Series may be built by a certified Emerson manufacturing facility or by an ASME certified Assembler with the required certification specific to the RL version (National Board certificates 01045 and 01382). Any ASME marked RL valve may be VR repaired by a repair organization certified under the National Board VR repair program. Existing non- restricted lift versions of the J-Series may be converted to the restricted lift version by VR certificate holders. In addition existing RL versions may have their lift modified using the same procedures.

NOTE

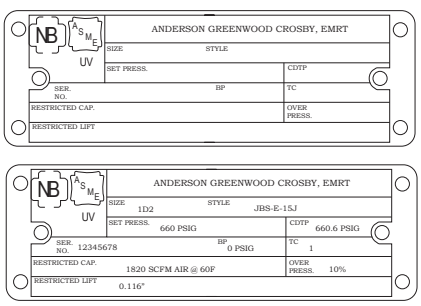
Restricted lift valves may be identified by the restricted lift nameplate by model number with "-RL".

6.7.1 Restricted lift valves have a limit spacer that prevents the disc and disc holder from lifting its limits. These valves may be restricted to a minimum lift of 30% of the full rated capacity or .080 in. (2.03 mm).It is important to check lift on all restricted lift valves to ensure accuracy of the capacity on the nameplate. For production purposes the spacers are precut for 10% increments. 5% increments can be added for K orifice and larger.

6.7.2 *Determining the correct limit spacer height*

- The nameplate capacity should be as specified on the nameplate or determined by calculation (See example on page 21).
- The required lift should also be specified on the nameplate or determined by calculation (See example on page 21).
- Select the limit spacer(s) to the required limit spacer height (See Tables 12 and 13).

FIGURE 20
Sample Restricted Lift Nameplate



6.7.3 *Measure the valve lift.*

- Install the limit spacer (see Figure 21) with the chamfer down and reassemble the valve as described in Steps 6.6.1 through 6.6.10. Install bellows to disc holder first for bellows valve, then install spacer.
- Measure the lift of the valve and compare it with the required lift as given on the restricted lift nameplate with tolerance (-0.020 in., +0.020 in. (-0.50 mm, +0.50 mm)).
- Based on the results, if the lift is not in the tolerance:

If the actual lift is less than required, machine the limit spacer as necessary to obtain the required lift. (Machine chamfer, deburr and polish before installation into the valve.)

If the actual lift is greater than required, obtain a new next taller limit spacer, disassemble the valve and return to section 6.7.3. (Machine chamfer, deburr and polish before installation into valve.)

- Once correct lift is obtained, disassemble the valve.
- Ensure the limit spacer has been chamfered to fit over the radius of the disc holder. The limit spacer must be installed so that the chamfered end is mating to the back face of disc holder, and not sitting on the disc holder radius.
- Prior assembly, verify the lift for each valve

⚠ CAUTION

Do not interchange internal parts or use a different nozzle after a set of parts has been custom-fit.

6.7.4 *Assembly*

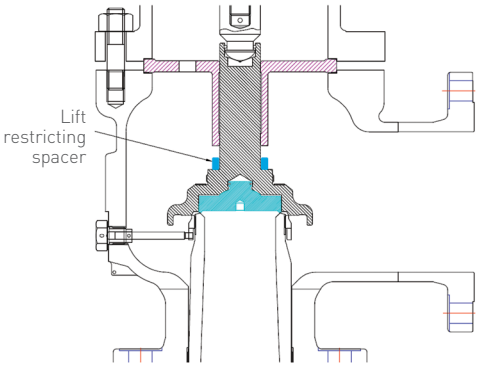
Valves need to be assembled as per Section 6.6.

6.7.5 *Restricted Lift Nameplate*

For new restricted lift version valves, use the restricted lift nameplate (See Figure 17.) If a non-restricted lift J-Series PRV is converted to the RL version, or if the restricted lift is changed on an existing RL version valve the following procedure regarding nameplates should be followed.

- The information on the original ASME nameplate which is changed by the conversion, such as model number, capacity and restricted lift should be lightly etched out but still legible.
- Information changed by conversion of the valve or change to the restricted lift shall be included on the repair nameplate to serve as a record of the conversion and its effect on the performance of the PRV.

FIGURE 21
Restricted lift spacer



Examples

Valve model number:	JBS-E
Size and orifice:	6 Q 8
Set pressure:	600 psig (4137 kPa)
Back pressure:	100 psig (689 kPa)
Operating temperature:	350°F (177°C)
Design temperature:	450°F (232°C)
Outlet temperature:	100°F (38°C)
Body/bonnet material:	Carbon steel
Full lift:	1.243 in. (31.6 mm)
Rated full capacity of full lift:	374.860 lbs/hr (170 kgs/hr)

CASE 1

Capacity required: 250.000 lbs/hr (113 kg/hr)

Selection 1

Maximum, not to exceed, rated nameplate capacity (110% of capacity required): 275.000 lbs/hr (125 kgs/hr)
Required capacity of full capacity: 250.000 / 374.860 = 67%
Required lift: 67% × 1.243 in. = 0.833 in. (21.2 mm)
Choose a spacer of 70% of full capacity in Table 12: 11408478
Nameplate restricted lift: 1.243 × 70% = 0.870 in. (22.1 mm)
Nameplate capacity: 374.860 lbs/hr ×70% = 262.402 lbs/hr (119 kgs/hr)

NOTE

Nameplate capacity shall be greater than required capacity of 250.000 lbs/hr (113 kg/hr) and lower than maximum of 275.000 lbs/hr (125 kgs/hr).

CASE 2

Capacity required: 165.000 lbs/hr (74.84 kg/hr)

Selection 2

Maximum, not to exceed, rated Nameplate Capacity (110% of capacity required): 181.500 lbs/hr (82.32 kgs/hr)
Required capacity of full capacity: 165.000 / 374.860 = 44%
Required lift: 44% × 1.243 in. = 0.547 in. (13.9 mm)
Choose two spacers of 50% of Full Capacity and 5% Reduction in Table 12: 11408482 and 11408471
Nameplate restricted lift: 1.243 × 45% = 0.559 in. (14.2 mm)
Nameplate capacity: 374.860 lbs/hr × 45% = 168.687 lbs/hr (76.51 kgs/hr)

NOTE

Nameplate capacity shall be greater than required capacity of 165,000 lbs/hr (74.84 kgs/hr) and lower than maximum of 181.500 lbs/hr (82.32 kgs/hr)

TABLE 13 - JOS/JBS/JDS RESTRICTED LIFT SS316 SPACER / J_S-RL SS316 SPACER

	Part number	Height[1], In. (mm)	Part number	Height[1], In. (mm)	Part number	Height[1],In. (mm)	Part number	Height[1], In. (mm)
Orifice	**30% of full capacity**		**40% of full capacity**		**50% of full capacity**		**60% of full capacity**	
D 1-4()	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
JOS D 5-7()	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
E 1-4()	N/A	N/A	N/A	N/A	11408429	0.117 (3)	11408440	0.100 (2.5)
JOS E 5-7()	N/A	N/A	N/A	N/A	11408809	0.117 (3)	11408807	0.099 (2.5)
F 1-4()	N/A	N/A	11408542	0.161 (4.1)	11408554	0.141 (3.6)	11408535	0.120 (3.0)
F 5-7()	N/A	N/A	11408542	0.161 (4.1)	11408554	0.141 (3.6)	11408535	0.120 (3.0)
G	11408534	0.225 (5.7)	11408818	0.199 (5.1)	11408819	0.173 (4.4)	11408536	0.146 (3.7)
H	11277099	0.274 (7.0)	11408828	0.241 (6.1)	11408829	0.208 (5.3)	11408830	0.174 (4.4)
J	11408532	0.342 (8.7)	11408839	0.299 (7.6)	11408840	0.257 (6.5)	11408842	0.215 (5.5)
K	11408854	0.407 (10.3)	11408855	0.356 (9.0)	11408856	0.306 (7.8)	11408858	0.255 (6.5)
L 1-4()	11408387	0.501 (12.7)	11408539	0.438 (11.1)	11408388	0.375 (9.5)	11408389	0.311 (7.9)
L 5-6()	11408401	0.514 (13.1)	11408402	0.451 (11.5)	11408403	0.388 (9.9)	11408404	0.324 (8.2)
M	11408410	0.560 (14.2)	11408417	0.486 (12.3)	11408419	0.416 (10.6)	11408420	0.345 (8.8)
N	11408434	0.608 (15.4)	11408435	0.530 (13.5)	11408436	0.453 (11.5)	11408437	0.375 (9.5)
P	11408452	0.735 (18.7)	11408453	0.640 (16.3)	11408454	0.546 (13.9)	11408455	0.451 (11.5)
Q	11408469	0.961 (24.4)	11408485	0.829 (21.1)	11408482	0.708 (18)	11408480	0.583 (14.8)
R	11408486	1.128 (28.7)	11408483	0.979 (24.9)	11408485	0.829 (21.1)	11408481	0.679 (17.2)
T	11408505	1.455 (37)	11408506	1.264 (32.1)	11408508	1.074 (27.3)	11408509	0.883 (22.4)
T2	11408488	1.435 (36.4)	11408489	1.237 (31.4)	11408490	1.040 (26.4)	11408491	0.843 (21.4)
Orifice	**70% of full capacity**		**80% of full capacity**		**90% of full capacity**			
D 1-4()	11408396	0.114 (2.9)	11408407	0.102 (2.6)	11408418	0.090 (2.3)		
JOS D 5-7()	11408808	0.114 (2.9)	11408680	0.102 (2.6)	11408798	0.090 (2.3)		
E 1-4()	11408451	0.084 (2.1)	11408462	0.067 (1.7)	11408473	0.051 (1.3)		
JOS E 5-7()	11408786	0.084 (2.1)	11408775	0.067 (1.7)	11408750	0.051 (1.3)		
F 1-4()	11408566	0.099 (2.5)	11408577	0.078 (2.0)	11408588	0.058 (1.5)		
F 5-7()	11408566	0.099 (2.5)	11408577	0.078 (2.0)	11408588	0.058 (1.5)		
G	11408820	0.120 (3.0)	11408821	0.093 (2.4)	11408823	0.066 (1.7)		
H	11408831	0.141 (3.6)	11408832	0.108 (2.7)	11408834	0.075 (1.9)		
J	11408844	0.172 (4.4)	11408845	0.130 (3.3)	11408847	0.087 (2.2)		
K	11408859	0.204 (5.2)	11408860	0.153 (3.9)	11408861	0.103 (2.6)		
L 1-4()	11408390	0.248 (6.3)	11408391	0.185 (4.7)	11408392	0.122 (3.1)		
L 5-6()	11408405	0.261 (6.6)	11408406	0.198 (5.0)	11408408	0.135 (3.4)		
M	11408421	0.274 (7.0)	11408422	0.203 (5.2)	11408423	0.132 (3.4)		
N	11408438	0.297 (7.5)	11408439	0.219 (5.6)	11408441	0.141 (3.6)		
P	11408456	0.357 (9.1)	11408537	0.262 (6.7)	11408457	0.168 (4.3)		
Q	11408478	0.459 (11.7)	11408476	0.335 (8.5)	11408474	0.210 (5.3)		
R	11408479	0.530 (13.5)	11408477	0.380 (9.7)	11408475	0.231 (5.9)		
T	11408511	0.692 (17.6)	11408538	0.501 (12.7)	11408512	0.311 (7.9)		
T2	11408492	0.645 (16.4)	11408493	0.448 (11.4)	11408494	0.250 (6.4)		
Orifice	**5% increment**							
D Thru J	N/A	N/A						
K	11408853	0.025 (0.6)						
L 1-4()	11408386	0.032 (0.8)						
L 5-6()	11408400	0.032 (0.8)						
M	11408416	0.035 (0.9)						
N	11408433	0.039 (1.0)						
P	11408450	0.047 (1.2)						
Q	11408471	0.062 (1.6)						
R	11408472	0.075 (1.9)						
T	11408504	0.095 (2.4)						
T2	11408487	0.099 (2.5)						

NOTE

1. Tolerance of Spacer Height is +/-.005. in. (+/-0.13 mm)
2. N/A = Not Applicable, does not exist.

TABLE 14 - JLT RESTRICTED LIFT SS316 SPACER / JLT-J_S-RL SS316 SPACER

	Part number	Height[1] In. (mm)	Part number	Height[1] in. (mm)	Part number	Height[1] In. (mm)
Orifice	**40% of full capacity**		**50% of full capacity**		**60% of full capacity**	
D 1-4()	N/A	N/A	N/A	N/A	11408383	0.137 (3.5)
JLTJOS D 5-7()	N/A	N/A	N/A	N/A	11408808	0.113 (2.9)
E 1-4()	11408810	0.146 (3.7)	11408822	0.126 (3.2)	11408833	0.105 (2.7)
JLTJOS E 5-7()	11408702	0.122 (3.1)	11408680	0.102 (2.6)	11408669	0.081 (2.1)
F 1-4()	11408533	0.182 (4.6)	11408484	0.157 (4.0)	11408496	0.131 (3.3)
F 5-7()	11408737	0.182 (4.6)	11408726	0.157 (4.0)	11408714	0.131 (3.3)
G	11408534	0.225 (5.7)	11408814	0.192 (4.9)	11408815	0.159 (4.0)
H	11277099	0.274 (7.0)	11408824	0.233 (5.9)	11408825	0.192 (4.9)
J	11408532	0.342 (8.7)	11408835	0.291 (7.4)	11408836	0.238 (6.0)
K	11408854	0.407 (10.3)	11408849	0.343 (8.7)	11408850	0.28 (7.1)
L 1-4()	11408387	0.501 (12.7)	11408863	0.424 (10.8)	11408864	0.346 (8.8)
L 5-6()	11408401	0.514 (13.1)	11408394	0.437 (11.1)	11408395	0.359 (9.1)
M	11408410	0.56 (14.2)	11408411	0.472 (12)	11408412	0.384 (9.8)
N	11408426	0.611 (15.5)	11408427	0.515 (13.1)	11408428	0.419 (10.6)
P	11408444	0.739 (18.8)	11408445	0.623 (15.8)	11408446	0.506 (12.9)
Q	11408469	0.961 (24.4)	11408468	0.808 (20.5)	11408466	0.654 (16.6)
R	11408470	1.149 (29.2)	11408469	0.961 (24.4)	11408467	0.779 (19.8)
T	11408498	1.511 (38.4)	11408499	1.275 (32.4)	11408500	1.038 (26.4)
Orifice	**70% of full capacity**		**80% of full capacity**		**90% of full capacity**	
D 1-4()	11408495	0.122 (3.1)	11408611	0.107 (2.7)	11408725	0.092 (2.3)
JLTJOS D 5-7()	11408807	0.098 (2.5)	11408786	0.084 (2.1)	11408646	0.068 (1.7)
E 1-4()	11408846	0.085 (2.2)	11408857	0.064 (1.6)	11408385	0.044 (1.1)
JLTJOS E 5-7()	11408635	0.061 (1.5)	11408612	0.04 (1.0)	11408599	0.02 (0.5)
F 1-4()	11408507	0.105 (2.7)	11408577	0.078 (2.0)	11408519	0.054 (1.4)
F 5-7()	11408691	0.105 (2.7)	11408657	0.079 (2.0)	11408623	0.054 (1.4)
G	11408816	0.126 (3.2)	11408821	0.093 (2.4)	11408817	0.061 (1.5)
H	11408826	0.151 (3.8)	11408832	0.108 (2.7)	11408827	0.069 (1.8)
J	11408837	0.186 (4.7)	11408838	0.133 (3.4)	11408540	0.081 (2.1)
K	11408851	0.217 (5.5)	11408860	0.153 (3.9)	11408852	0.092 (2.3)
L 1-4()	11408865	0.268 (6.8)	11408866	0.189 (4.8)	11408867	0.111 (2.8)
L 5-6()	11408397	0.281 (7.1)	11408398	0.202 (5.1)	11408399	0.124 (3.1)
M	11408413	0.296 (7.5)	11408414	0.209 (5.3)	11408415	0.121 (3.1)
N	11408430	0.322 (8.2)	11408431	0.226 (5.7)	11408432	0.129 (3.3)
P	11408447	0.389 (9.9)	11408448	0.272 (6.9)	11408449	0.155 (3.9)
Q	11408464	0.5 (12.8)	11408461	0.346 (8.8)	11408459	0.192 (4.9)
R	11408465	0.594 (15.1)	11408463	0.408 (10.4)	11408460	0.223 (5.7)
T	11408501	0.802 (20.4)	11408502	0.566 (14.4)	11408503	0.33 (8.4)

Orifice	**5% increment**	
D thru J	N/A	N/A
K	11408848	0.031 (0.8)
L 1-4()	11408862	0.039 (1.0)
L 5-6()	11408393	0.039 (1.0)
M	11408409	0.044 (1.1)
N	11408425	0.048 (1.2)
P	11408443	0.058 (1.5)
Q	11408472	0.075 (1.9)
R	11408458	0.093 (2.4)
T	11408497	0.118 (3.0)

NOTE

1. Tolerance of Spacer Height is +/-.005 in. (+/- 0.13 mm)
2. N/A = Not Applicable, does not exist.

6.8 Bellows Leak Detection Valves

The Crosby J-Series Bellows Leak Detection feature is based on two technologies: a backup piston that guarantees balanced operation if the bellows ruptures and a Rosemount™ pressure transmitter that monitors the pressure chamber between the piston and the bellows. The steps below show the high-level assembly procedure. The rest of the parts that are not discussed herein will follow the standard assembly procedure used for standard J-Series in Section 6.6 JBS-E or JLTJBS-E.

6.8.1 Bellows leak detection assembly

a. As outlined in 6.6.4 place the disc holder (5) in a vise (or 3 jaw-vise for larger sizes) as shown in Figure 7. Install the new tailpiece gasket (29) onto the disc holder (5). Screw the bellows assembly (6) onto the disc holder by holding the bellows tailpiece (6A), tighten the bellows using the flats on the tailpiece with a suitable wrench. Install the guide (15) with lift stop protruding downward toward the base of the disc holder (5). For restricted lift styles "RL" install the restricted lift spacer over the disc holder prior to installing the guide (See Figure 21, paragraph 6.7). D/E orifice uses the bonnet adapter (23) in lieu of the guide (15).

b. Refer to Table 15, select the appropriate primer and Loctite® and apply on the external threads of the disc holder (5) and internal threads of the Piston (5G). Directions for use can be found

Loctite® 243: Directions for use:
https://tds.henkel.com/tds5/Studio/ShowPDF/?pid=LOCTITE 243UPDATED&format=MTR&subformat=REAC&language=EN&plant=WERCS&authorization=2

Loctite® 7649™ Primer Directions for use:
https://tds.henkel.com/tds5/Studio/ShowPDF/?pid=SF 7649&format=MTR&subformat=REAC&language=EN&plant=WERCS&authorization=2

Loctite® 277™ Primer Directions for use:
https://tds.henkel.com/tds5/Studio/ShowPDF/?pid=277&format=MTR&subformat=REAC&language=EN&plant=WERCS&authorization=2

c. Thread piston (5G) on the disc holder (5) to the torque value specified in Table 16. The piston (5G) has two flats so a torque wrench with adjustable wrench adaptor may be required. The only exception is the D orifice which has two slots for the spanner.

d. After threading the piston (5G) to the disc holder (5A) follow the curing time listed in Table 14 before assembling into the valve.

e. Install the disc insert (8) see paragraph 6.6.3.

f. Apply ample lubricant on the top of the Piston (5G) head for designs where the Piston (5G) contacts the Spindle Assembly (16).

g. Place gasket (28) on top of the guide (15).

h. Mount the Bonnet Adaptor (23) on top of the gasket (28) followed by another gasket (31) on top of the Bonnet Adaptor (23). The NPT port of the bonnet adapter (23) should face the rear of the valve.

i. The valve can now assembled refer to 6.6.7.

6.8.2 Bracket, tubing, and pressure transmitter

a. Mount the pressure transmitter (70E) on the side opposite of the nameplate.

b. Tube the pressure transmitter (70E) to the bonnet adapter (23) port using the provided fittings. The tubing (70D) should be a simple U-shaped configuration. The tubing (70D) should be installed without imparting any additional stress on the Bonnet Adapter (23) NPT threads.

c. Use Nickel Impregnated High Temperature Teflon tape for all NPT connection.

d. Refer to Figure 23 for two examples of mounting configuration.

6.8.3 Leak check

After assembly, apply 10 psig pressure through the Bonnet vent (20) and ensure there is no leakage at the bonnet adapter gaskets (31), guide gasket (28), bellows flange sealing area (6C), or tubing connections.

FIGURE 22
Bellows leak detection feature

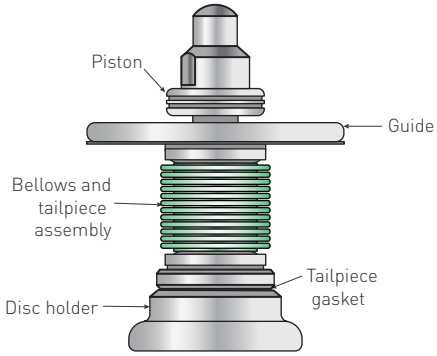


FIGURE 23
Examples of mounting configuration

TABLE 15 - BELLOWS LEAK DETECTION LOCTITE DRY AND CURING TIME

Orifice	P/C	Thread Size	Loctite®	Dry Time	Cure Time
D, E, F	1()-7()	.3125-20 UN-2A	243	N/AP	10 Minutes
G	1()-7()	.375-20 UN-2A	243	N/AP	10 Minutes
H	1()-6()	.500-20 UNF-2A	243	N/AP	10 Minutes
J	1()-6()	.625-20 UN-2A	243	N/AP	10 Minutes
K	1()-6()	.750-20 UNEF-2A	243	N/AP	10 Minutes
L	1()-4()	1.375-16 UN-2A	7649 + 277	30-70 Seconds	60 Minutes
L	5()-6()	.750-20 UNEF-2A	243	N/AP	10 Minutes
M	1()-5()	1.375-16 UN-2A	7649 + 277	30-70 Seconds	60 Minutes
N and P	1()-4()	1.625-20 UN-2A	7649 + 277	30-70 Seconds	60 Minutes
Q, R, T and T2	1()-4()	1.750-12 UN-2A	7649 + 277	30-70 Seconds	60 Minutes

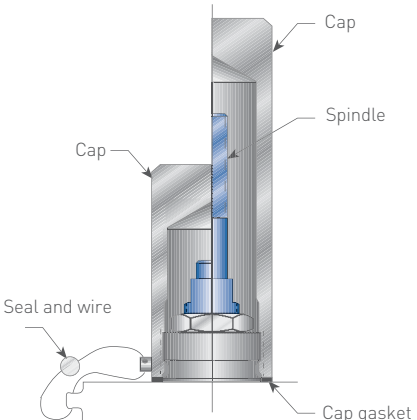
TABLE 16 - REQUIRED TIGHTENING TORQUE FOR PISTON

Orifice	Maximum Torque, N•m	Maximum Torque, ft-lbs
D and E 1()-4()	3.0	2.2
F	5.9	4.3
G	12.5	9.2
H	12.8	9.4
J	18.5	13.7
K	39.6	29.2
L 1()-4()	164.5	121.3
M	164.5	121.3
N	109.9	81.1
P	109.9	81.1
Q, R, T and T2	338.9	250.0

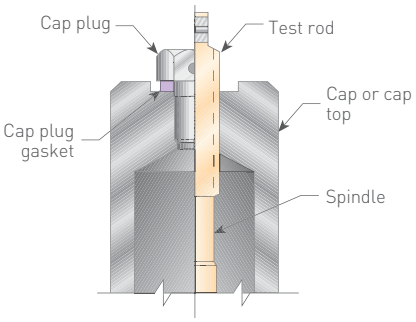
6.9 Assembly of cap and lifting lever devices
Styles JOS-E/JBS-E/JBSBP-E/JDS-E and JLT-E Pressure Relief Valves are furnished with several different caps and lifting lever devices. The following describes assembly of the available types of cap construction.
(Disassembly is the reverse of assembly). For part identification refer to Figure 24.

- Type A and J
  Install the cap gasket and screw the cap onto the top of the bonnet. Tighten the cap with a strap wrench.
- Type B and K
  Install the cap gasket and screw the cap onto the top of the bonnet. Tighten the cap with a strap wrench. Install the cap plug gasket and screw cap plug into the cap. The test rod is installed only during system hydrostatic testing. Never install the test rod unless performing system hydrostatic testing.
- Type C
  Screw the spindle nut onto the spindle. Place the cap on the bonnet. Install the forked lever and forked lever pin. Attach the lever to the cap using the lever pin and secure with the lever pin cotter.
  Adjust the spindle nut until the forked lever rests on the lever and there is a 1/16 in. (1.58 mm) minimum of play between the forked lever and the spindle nut. The spindle nut may be adjusted by removing the forked lever pin, forked lever and cap. When the spindle nut is in proper adjustment, install the spindle nut cotter pin. Replace the cap and forked lever and install the forked lever pin and forked lever pin cotter.
  Position the lever opposite the valve outlet and install the four (4) cap set screws and tighten them against the groove in the top of the bonnet.
- Type D
  Install the cap gasket on the bonnet. Screw the spindle nut onto the spindle. Place the dog in the cap and install the dog shaft so that the dog is horizontal and the square on the end of the dog shaft has a corner on top. With the dog shaft in the position above, scribe a horizontal line on the end of the dog shaft. This line must be horizontal when the lifting gear is finally installed on the valve. Install the dog shaft O-ring in the dog shaft bearing and place the dog shaft bearing gasket on the dog shaft bearing.
  Screw the dog shaft bearing into the cap. Rotate the dog shaft so that the dog is pointing down and install the cap assembly onto the bonnet. Rotate the dog shaft so that the dog contacts the spindle nut. With the scribed line horizontal, remove the assembly and adjust the position of the spindle nut. Repeat the operation until the scribed line is horizontal when the dog contacts the spindle. Remove the assembly and install the spindle nut cotter pin.
  Install the lifting gear assembly onto the bonnet and secure it with cap studs and nuts. For Type D lifting levers that have two part caps (cap and cap top) the above procedure is accomplished more easily. After the cap is screwed to the bonnet, the positioning of the dog shaft is the same as above except that the positioning of the spindle nut is performed last through the open end of the cap.
  With the dog in the horizontal position, screw the spindle nut onto the spindle until it contacts the dog. Install the spindle nut cotter, cap top gasket and screw the cap top into the cap.
- Type E
  Assembly of Type E lifting lever is identical to Type D with the addition of the cap plug gasket and cap plug. The test rod is installed only during system hydrostatic testing. Never install the test rod unless performing system hydrostatic test.
- Type G and L
  Install the cap studs to the bonnet top. Place the cap gasket onto the bonnet and the cap onto the cap studs. Install and tighten cap stud nuts.
- Type H and M
  Assembly of Type H and M is identical to Type G and L with the addition of the cap plug gasket and cap plug. The test rod is installed only during system hydrostatic testing. Never install the test rod unless performing system hydrostatic test.

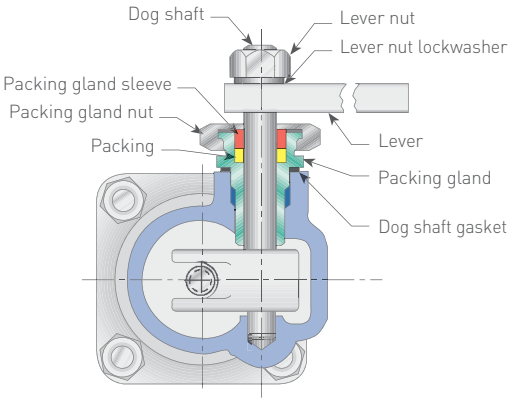
FIGURE 24 - Cap and lifting levers



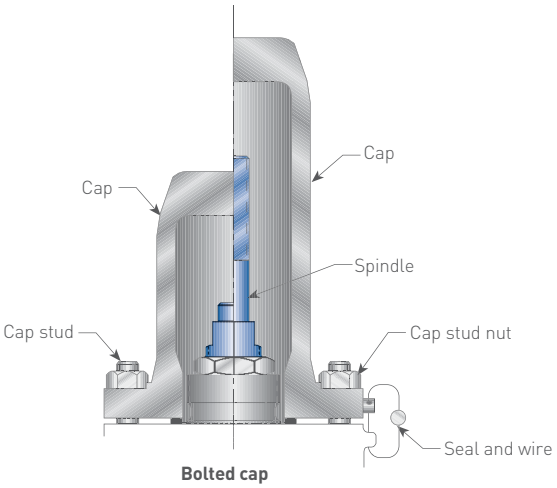
Threaded cap
Type A | **Type J** (standard)



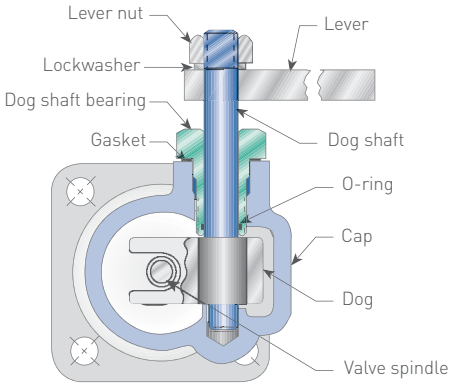
Cap and test rod
Type B - screwed cap
Type E - packed lifting lever
Type H - bolted cap
Type K - screwed cap (standard)
Type M - bolted cap (standard)



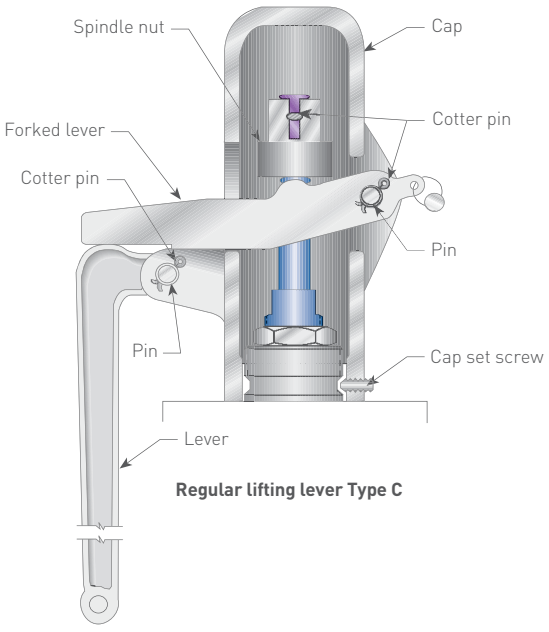
Packed lifting lever Type D
(Top view of packing gland construction used for special materials)



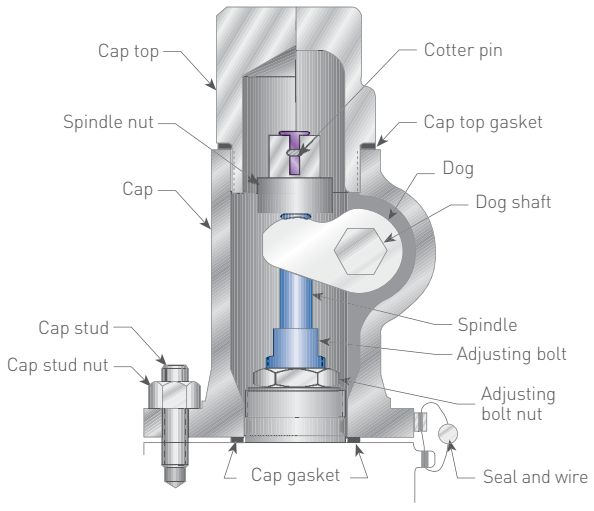
Bolted cap
Type G | **Type L** (standard)



Packed lifting lever Type D
(Top view)



Regular lifting lever Type C



Packed lifting lever Type D

7 STYLE VARIATIONS

The Crosby Style JOS-E Pressure Relief Valve was designed with flexibility and interchangeability in mind. Retrofitting from conventional to balanced bellows or diaphragm high performance liquid trim or soft seat design is accomplished with a minimum number of new parts. These style retrofits can be accomplished at lowest possible cost.

- Balanced bellows
  A Crosby JOS-E Conventional Non-bellows Pressure Relief Valve may be converted to a Style JBS-E balanced bellows valve simply by adding the bellows assembly and tailpiece gasket.
- Balanced diaphragms
  A Crosby JOS-E Conventional Non-bellows Pressure Relief Valve may be converted to a Style JDS-E balanced diaphragm valve by replacing with threaded disc holder and guide and adding the diaphragms assembly and bonnet adapter.
- JLT liquid trim
  Crosby Style JOS-E/JBS-E/JDS-E Pressure Relief Valves in D to T2 orifice sizes may be converted to high performance JLT liquid service design simply by replacing the standard disc holder with a JLT disc holder, or vice versa. For P to T2 orifice sizes, a new nozzle ring is also required.
- O-ring soft seat design
  Crosby Style JOS-E/JBS-E/JDS-E Pressure Relief Valves in all orifice sizes may be converted from the standard metal-to-metal seats to an exceptionally tight soft seat design. This style conversion can be accomplished by replacing the standard disc insert and nozzle with parts adapted to accommodate the soft seat design. The soft seat design uses standard size O-rings and is capable of handling pressures to 1480 psig (10,204 kPa). Standard O-ring materials include NBR, EPR, FKM, FFKM, Silicone and PTFE (see Figure 25.)
- Bellows leak detection
  A Crosby JOS-E Conventional Non-Bellows may be upgraded by replacing the disc holder, guide and installing the bellows assembly, tailpiece gasket, piston, bonnet adapter, bonnet studs, tubing, fittings, bracket and pressure transmitter. A Crosby JBS-E Balanced Bellows may be upgraded by replacing the disc holder, guide and installing the piston, bonnet adapter, bonnet studs, tubing, fittings, bracket and pressure transmitter.

NOTE
When converting any of the styles above the spring and/or spring pressure range may change, consult the Emerson representative for correct spring and range.

8 SERVICE RECORDS

Service records should be completed before a valve is returned to service. These records are important and will provide guidance on establishing time intervals between repairs as well as providing the historical record of repairs and service conditions. Well kept records will be useful in predicting when to retire a valve and which spare parts should be maintained in inventory to ensure uninterrupted plant operation.

9 SPARE PARTS

When ordering spare parts, the valve shop number, assembly number or serial number should be given together with set pressure, part name and item number, valve size and style. Spare parts may be ordered from any Emerson regional sales office or representative.

10 TROUBLE SHOOTING PRESSURE RELIEF VALVES

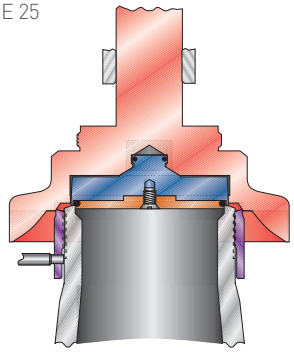
Troubles encountered with pressure relief valves can affect the life and performance of the valve vitally and must be corrected at the first possible opportunity.
Failure of a pressure relief valve to function properly could result in the rupture of a line or vessel jeopardizing the safety of personnel and causing damage to property and equipment.
Some of the most common troubles and the recommended correction measures are discussed in the following paragraphs.

10.1 Seat leakage

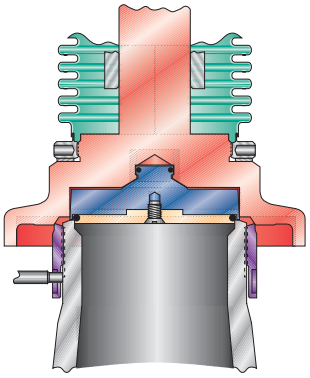
A leaking valve allows fluids to circulate into the secondary pressure zone of the valve where it can cause corrosion of the guide and valve spring. When a leaking valve problem is not addressed immediately, the leakage itself will further contribute to seat damage through erosion (wire-drawing).

10.1.1 Seats damaged by foreign matter
Seating surfaces may be damaged when hard foreign particles such as mill scale, welding spatter, coke and dirt are trapped between the seats. While this type of damage usually occurs while the valve is in service, it may also happen in the maintenance shop. Every precaution should be taken to clean the process system before installing a pressure relief valve and to test the valve using only clean fluids.

FIGURE 25



JLT-E O-ring
Soft seat



JOS-E/JBS-E O-ring
Soft seat

Generally, damaged seating surfaces are reconditioned by lapping. Most often small pits and scratches may be removed by lapping alone. More extensive damage will also require re-machining prior to lapping. In some instances, valve construction can be changed to reduce the effects of seat leakage. The use of an O-ring soft seat when applicable will minimize leakage and thus eliminate the associated corrosion and erosion problems. If it is not possible to use a soft seated valve, or if the corrosive media is present in the exhaust system, conversion to a Style JBS-E and JBSBP-E bellows seated valve will isolate and protect the guides and valve spring from any corrosive fluids.

10.1.2 Distortion from piping strains
Valve bodies can be distorted by excessive piping loads causing seat leakage. Both inlet and discharge piping must be supported properly and anchored so that high bending loads are not transmitted to the valve body.

10.1.3 Operating pressure too close to set pressure
A carefully lapped metal-to-metal seated valve will be commercially tight at a pressure approximately ten percent under the set pressure or 5 psi (34 kPa), whichever is greater. Consequently, this minimum pressure differential should be maintained between set and operating pressure to avoid seat leakage problems.

10.1.4 Chatter
Oversized valves, excessive pressure drop in the inlet lines, restrictions in the inlet line, too great a build up of back pressure or pulsating inlet pressure will cause instability to the pressure relief valve. In such installations, the pressure under the valve disc may be great enough to cause the valve to open but, as soon as flow is established, the pressure drops allowing the valve to close immediately. This cycle of opening and closing sometimes occurs at very high frequency causing severe seat damage, sometimes beyond repair. Proper valve selection and installation techniques are paramount to reliable valve performance.

10.1.5 Incorrectly adjusting lifting gear
A space of $^{1}/_{16}$ in. (1.58 mm) minimum should always be provided between the lifting device and the spindle lift nut. Failure to provide sufficient clearance may result in inadvertent contact causing a slight shift in the opening pressure.

10.1.6 Other causes of seat leakage
Improper alignment of the spindle, too much clearance between the valve spring and the spring washers, or improper bearing contact between the adjusting bolt and the spring washers, spindle and disc holder or spindle and lower spring washer may cause seat leakage problems. Spindles should be checked for straightness and springs and spring washers should be fitted properly and kept together as a spring assembly.

10.1.7 Corrosion
Corrosion may result in pitting of valve parts, failure of various valve parts, build up of corrosive products and general deterioration of the valve materials. Generally, corrosive attack is controlled through selection of suitable materials or by employing a bellows or diaphragm to isolate the valve spring, adjusting bolt, spindle and guiding surfaces from the corrosive attack of the process fluid. Environmental corrosion attacks all exposed surfaces, including studs and nuts. In general, the materials required for a particular service are dictated by the temperature, pressure and the degree of corrosion resistance required.

11 EMERSON FIELD SERVICE AND REPAIR PROGRAMS

Emerson field service provides on-site, in line testing and repair capability for all types of pressure relief devices.

11.1 Parts
Emerson will help you establish the right mix of on-site spares with Emerson's own distribution and manufacturing support.

11.2 Training
Emerson offers intensive factory or on-site seminars to improve maintenance and application skills.

11.3 Testing
Emerson has the capability to evaluate pressure relief valve operability either in the field or at various Emerson facilities. Special qualifications programs may also be conducted in our laboratories.

11.4 Contract management
Emerson will combine a group of services to satisfy your special maintenance needs.

⚠ WARNING

The product is a safety related component intended for use in critical applications. The improper application, installation or maintenance of the product or the use of parts or components not manufactured by Emerson may result in failure of the product. The advice of a qualified engineer should be sought prior to any use of the product. Any installation, maintenance, adjustment, repair or test performed on the product must be done in accordance with the requirements of all applicable codes and standards.

The information, specifications and technical data (the 'Specifications') contained in this document are subject to change without notice. Emerson does not warrant that the specifications are current and assumes no responsibility for the use or misuse thereof.

The purchaser should verify that there have been no changes to the specifications prior to use.