CROSBY STYLE JOS-E, JBS-E, JLT*-JBS-E, JLT*-JOS-E VALVES

INSTALLATION AND MAINTENANCE INSTRUCTIONS

Before installation these instructions must be read fully and understood

TABLE OF CONTENTS

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 make sure they function properly.

WARNING

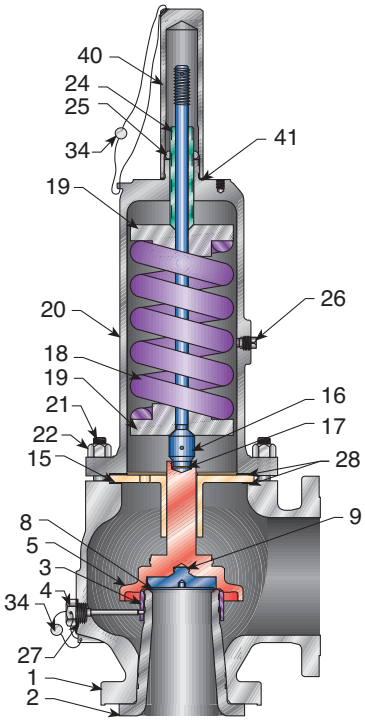
Suitability of the material and product for the use contemplated by the buyer is the sole responsibility of the buyer. Also storage, installation and proper use and application are the sole responsibility of the purchaser. Emerson disclaims any and all liability arising out of the same.

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.

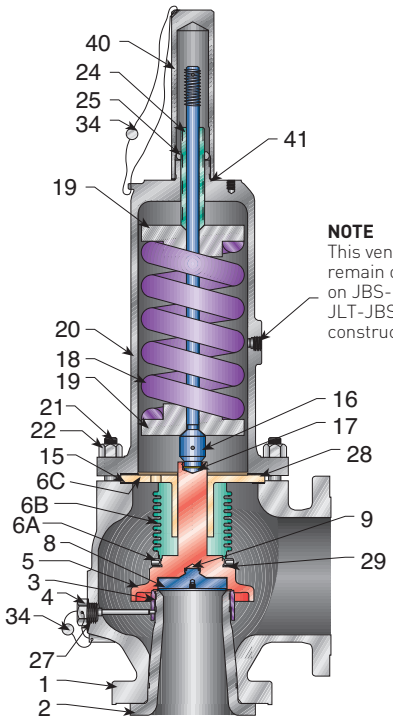
No repair, assembly and test work done by other than Emerson shall be covered by the warranty extended by Emerson to its customers. You assume full responsibility for your work. In maintaining and repairing Crosby products you should use only parts manufactured by Emerson. Call your nearest Emerson regional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

Engineering Doc. #IS-V3137B

FIGURE 1

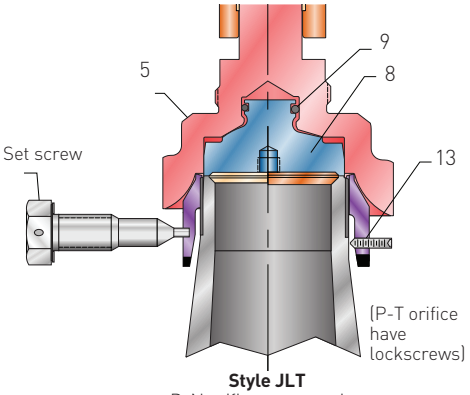


Style JOS-E

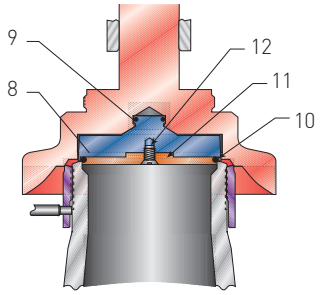


Style JBS-E

NOTE
This vent must remain open on JBS-E and JLT-JBS-E construction



Style JLT
D-N orifice construction



Soft seat

PARTS LIST

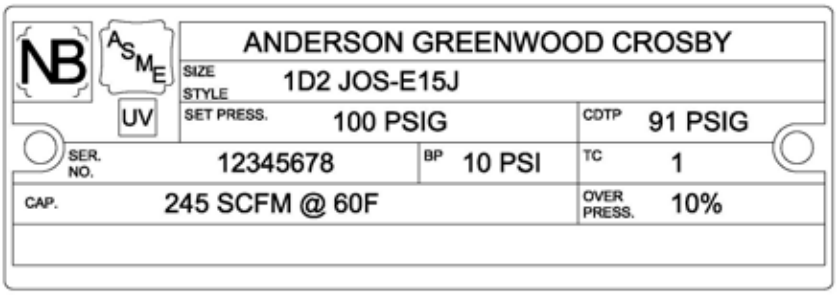
No.	Part name	Notes
1	Body	
2	Nozzle	
3	Nozzle ring	3
4	Set screw	3, except P-T orifice JLT
4A	Set screw	3, (M-T orifice)
4B	Set screw rod	3, (M-T orifice)
4C	Set screw pin	3, (M-T orifice)
5	Disc holder	2
6A	Bellows tailpiece	2
6B	Bellows	2
6C	Bellows flange	2
8	Disc insert	1
9	Retention clip	1
10	O-ring	1
11	O-ring retainer	2
12	Retainer screw(s)	2
13	Nozzle ring lockscrew	P-T orifice JLT
14	Set screw plug	P-T orifice JLT (not shown)
15	Guide	3

No.	Part name	Notes
16	Spindle	3
17	Spindle cotter pin	1 (L-T orifice)
18	Spring	3
19	Spring washers	3
20	Bonnet	
21	Bonnet stud	
22	Bonnet stud nut	
24	Adjusting bolt	
25	Adjusting bolt nut	
26	Pipe plug	
27	Set screw gasket	1
28	Guide gasket	2
29	Tailpiece gasket	1
34	Seal and wire	
35	Seal clip (not shown)	
36	Nameplate (not shown)	
40	Screwed cap	
41	Cap gasket	1
	Gasket kit	1, 4

NOTES

1. Consumable spare parts: valve parts which should be replaced as part of any disassembly, and discs 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. Contains complete set of gaskets for all style of valves.

Sample nameplate after 2014



Restricted lift nameplate

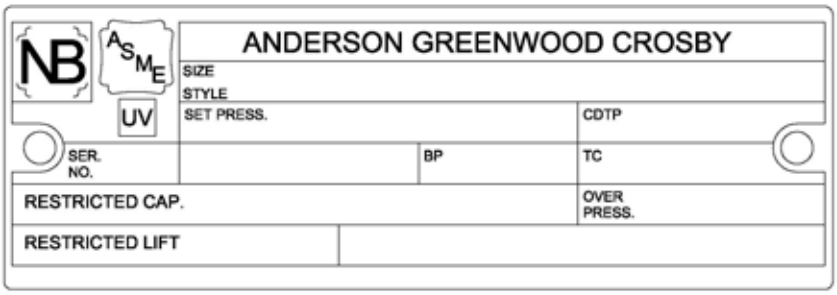


FIGURE 2 - Sample nameplates

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 2. The valve assembly number is shown on the valve nameplate as, 'Shop Number'. Spare parts may be ordered from any Emerson regional sales office or 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.

1 INTRODUCTION

Crosby Style JOS-E/JBS-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 and JLT-E valves are manufactured in accordance with the requirements of Section VIII Pressure Vessels, ASME Boiler and Pressure Vessel Code. Style JOS-E is a conventional closed bonnet valve. Style JBS-E has a balanced bellows for minimizing the effect of back pressure.
Style JLT-E is a high performance valve designed specifically for liquid service.
The JLT-E features patented contoured liquid trim in a standard JOS-E/JBS-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.

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.

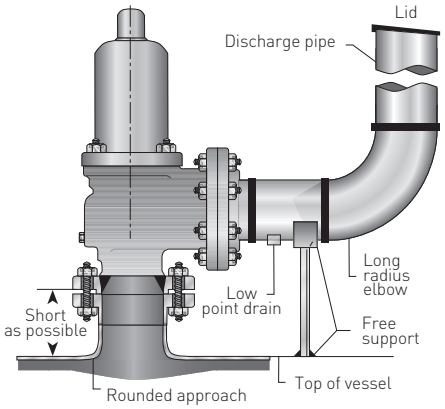


FIGURE 3 - Recommended installation discharging to atmosphere

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 is required.

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 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 overtightening 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 designs and in the larger valve sizes.

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

5 SETTING, TESTING AND ADJUSTMENTS

5.1 New valves

Every new Crosby J series pressure relief valve is tested fully and sealed prior to shipment. 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 pre-test the valve prior to installation. If pre-testing is required, in order to maintain the product warranty, a Crosby valves 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 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 pre-testing 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, 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.

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

Improper testing may cause valve damage and seat leakage.

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 blowdown 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 valves intended for compressible fluid service and tested with air or steam will open with a sharp clear popping action at the set point. 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 and the nameplate restamped by an authorized valve repair facility.

5.8 Set pressure adjustment
Before making any adjustments, reduce the pressure under the valve seat to at least 10% below the stamped opening pressure. 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 paragraph 6).

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 Retighten 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 VIII Division 1 UG-136 (d) (1) as below or other tolerance may be used so long as they meet ASME requirement:
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 adjusting bolt 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 follows: (see the next paragraph for P, Q, R and T orifice Style JLT).

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.

TABLE 1

Service	Orifice size	Nozzle ring setting (below highest lock position)
Style JOS-E/JBS-E pressure relief valve recommended nozzle ring settings		
Vapor and gases	D through J	-5
	K through N	-10
	P through T	-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 and T (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 and T	1 Revolution

TABLE 3

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

TABLE 4 - (JOS/JOS-E Style only)

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

TABLE 5 - Saturated steam service

Air set pressure correction factors at ambient temperature	
Set pressure (psig)	**% Increase in spring set pressure**
15-400	3%
401-1000	4%
1001-1500	5%

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

5.9.2 Turning the ring to the right raises the ring, thereby increasing blowdown. Turning the ring to the left lowers the ring, thereby decreasing the blowdown.

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

5.9.4 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.

5.9.5 Style JLT

The Style JLT in the P, Q, R and T 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:

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

B. 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.

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

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

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

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

G. 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 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 steam service valves.

5.10.2 Back pressure correction

Conventional valves without balancing bellows set 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
Constant back pressure	10 psi
Cold differential test pressure	90 psi

In all instances, the spring should be selected based on the cold differential test pressure; in the example above, 90 psi. See sample nameplate on page 3 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 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.

FIGURE 4
Typical test arrangement

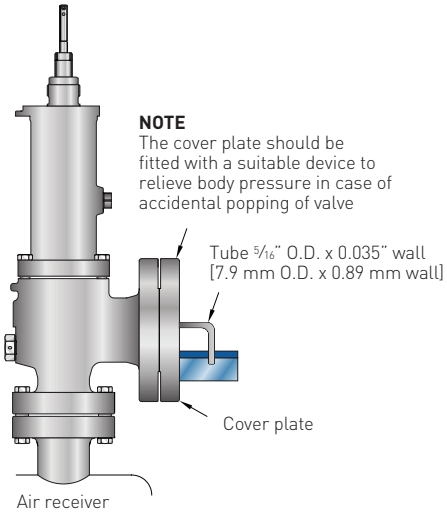
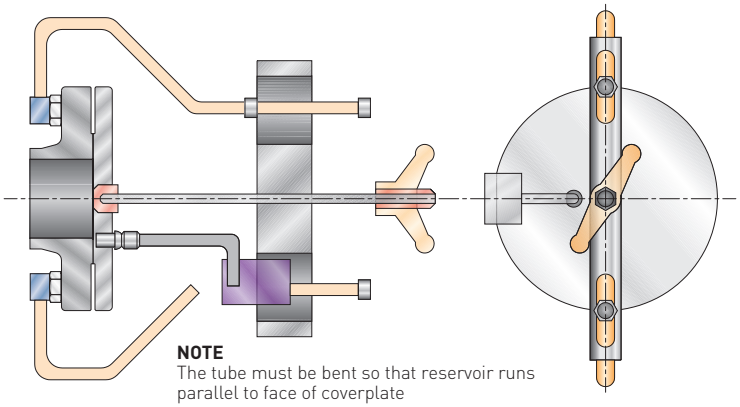


FIGURE 5
Seat leak apparatus for 150 and 300 lb. outlets 1" to 10" sizes



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.
- Test apparatus
  A typical test arrangement for determining seat tightness for pressure relief valves per API standard 527 is shown in Figure 4. Leakage is measured using a 5/16 inch OD tube with 0.035 inch wall. The tube end is cut square and smooth, is parallel to and ½ inch below the surface of the water. A snap-on type test clamp shown in Figure 5 is available.
- Procedure
  With the valve mounted vertically, the leakage rate in bubbles per minute shall be determined with pressure at the pressure relief valve inlet raised up to and held at 90 percent of the set pressure (or cold differential test pressure - CDTP) immediately after popping. This applies except for valves set at 50 psig or below, in which case the pressure shall be held at 5 psig below the set pressure immediately after popping. The test pressure shall be applied for a minimum of one minute for valves of inlet sizes through 2"; two minutes for sizes 2½", 3" and 4"; five minutes for sizes 6" and 8". Air (or nitrogen) at approximately ambient temperature shall be used as the pressure medium.
- Tightness standard
  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).

- Crosby seat tightness standard-liquid service valves (Style JLT-E)
  Crosby liquid service pressure relief valves are checked for seat tightness by a quantitative seat leakage test.

TABLE 6 - Maximum seat leakage rate - Metal seated pressure relief valves

	Effective orifice sizes 0.307 In^2 and smaller D, E and F			Effective orifice sizes larger than 0.307 In^2 G orifice and lager		
Set pressure psig (barg)	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 (1.03-68.9)	40	0.6	0.017	20	0.30	0.0085
1500 (103.4)	60	0.9	0.026	30	0.45	0.0130
2000 (137.9)	80	1.2	0.034	40	0.60	0.0170
2500 (172.4)	100	1.5	0.043	50	0.75	0.0210
3000 (206.8)	100	1.5	0.043	60	0.90	0.0260
4000 (275.8)	100	1.5	0.043	80	1.20	0.0340
5000 (344.8)	100	1.5	0.043	100	1.50	0.0430
6000 (413.7)	100	1.5	0.043	100	1.50	0.0430

All of the test fluid passing through an assembled valve is collected and measured per the following test procedure:

1. The inlet pressure is adjusted to a test pressure which is 90% of the cold differential test pressure. Valves set below 50 psig are tested at 5 psig below the cold differential test pressure.
2. The test pressure is maintained for a period of not less than ten minutes.

- Allowable leakage rate
  The maximum allowable leakage rate should not exceed 10 cubic centimeters per hour per inch of diameter of nominal valve inlet size. For nominal valve sizes of 1 inch or less, the leakage rate shall not exceed 10 cubic centimeters per hour. For soft seated valves there shall be no leakage for one minute.
- Soft seated valves
  For exceptional seat tightness, an O-ring soft seat design is offered. Refer to Figure 15. The Crosby soft seat design will provide a valve that has no visible leakage at a test pressure of 90 percent of the set pressure or cold differential test pressure. Soft seated valves are tested using the same test procedure used for metal-to-metal seated valves.

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 valves should be disassembled as described below. Parts identification may be found in Figure 1 on page 2. 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 6.7.

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 will be needed again when reassembling the valve. (Measure the revolutions for P, Q, R and T orifice Style JLT. See Table 2).

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 and count the number of turns required to remove the spring load. This information 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).

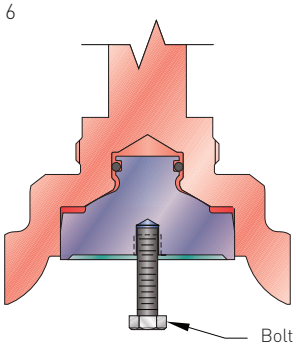
6.2.6 Lift the bonnet (20) straight up to clear the spindle (16) and valve spring (18). Exercise care when lifting the bonnet as the spring and spindle will then be free to fall aside.

6.2.7 The spring 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 are not interchangeable between ends of the spring.

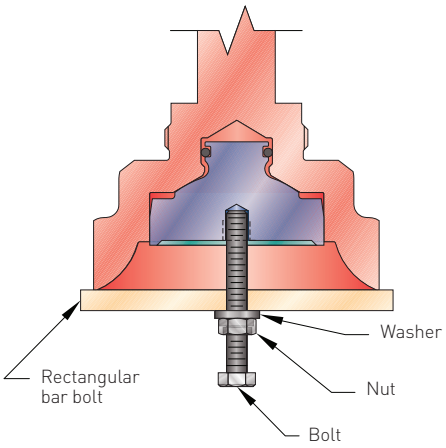
TABLE 7 - JOS-E / JBS-E disc insert threaded hole sizes

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

FIGURE 6

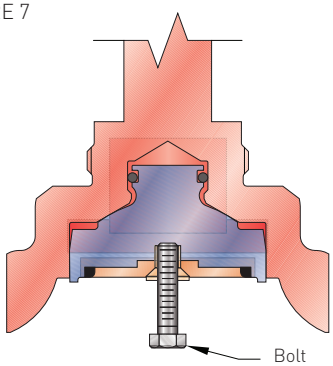


Remove disc insert by pulling on bolt



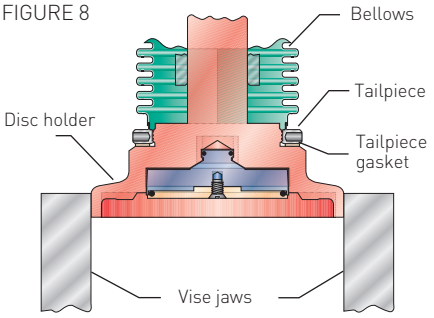
Remove disc insert by turning nut with wrench

FIGURE 7



Remove disc insert by pulling on bolt

FIGURE 8



6.2.8 Remove the spindle, guide (15), disc holder and disc insert (8). For balanced bellows valves (Style JBS-E and JLT-JBS-E) special care must be taken not to damage the bellows subassembly (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 Remove the spindle from the disc holder.

6.2.10 Lift the guide off the disc holder.

6.2.11 *Disc insert removal*

Note: for removal of threaded inserts supplied with JOS/JBS valves, see IS-V3137A.

- Orifice sizes D through M (metal seats) Screw a standard bolt into the tapped hole (see Table 7) in the face of the disc insert. Using hand force pull the bolt straight out. The disc insert with the retention clip (9) should come out with moderate force. If the valve has been in dirty service, it may be necessary to use a suitable solvent to aid in removal. If additional pullout force is required, a bolt with a T handle may be used. The method described below for orifice sizes N through T may be used if necessary.
- Orifice sizes N through T (metal seats) Safety precautions should be followed whenever heavy parts are being lifted or transported. Dropping disc holder assembly may dislodge the insert. The removal of the insert is accomplished by the use of a tool as shown in Figure 6. This tool consists of a rectangular steel bar which spans the outside diameter of the disc holder with a center hole through which the standard bolt can be inserted before screwing into the disc insert. A nut and washer is also required as shown. Tightening the nut with a wrench will exert a pulling force on the disc insert and cause it to be removed from the disc holder.
- Orifice sizes D through K (O-ring seats) The O-ring seat design for orifice sizes D through K has a retaining screw in the center of the disc insert. A drilled and tapped hole (4-40 UNC) is provided in the center of the retaining screw for removal of the disc insert (Figure 7). Screw a standard bolt into the hole in the retaining screw. Using hand force pull the bolt straight out. The disc insert with the retention spring should come out with moderate force.
- Orifice sizes L through T (O-ring seats) Safety precautions should be followed whenever heavy parts are being lifted or transported. Dropping the disc holder may dislodge the insert. Remove the three retaining screws from the insert. Remove the retainer and O-ring seat. A tapped hole (refer to Table 7) is provided in the disc insert for insertion of a removal bolt. Follow instructions for metal seated insert removal.

6.2.12 For bellows valves only, place the disc holder in a vise (the larger sizes may require a 3-jaw vise) as shown in Figure 8. Using a suitable wrench unscrew the tailpiece and bellows from the disc holder.

6.2.13 Remove the nozzle ring (3) from the nozzle (2).

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.

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, remachining 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 10 and Table 8 for critical dimensions). The valve spring (18) should be inspected for evidence of cracking, pitting or deformation. The bellows (6B) in a Style JBS-E and JLT-JBS-E valve 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 runout. For D to K orifice the total runout between the spindle point to top of the spindle rod should be less than 0.015 inch. For L orifice and larger it should be less than 0.030 inch.

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/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. Remachining the insert will change critical dimensions, affect the action of the valve and is not recommended.

- Lapping blocks

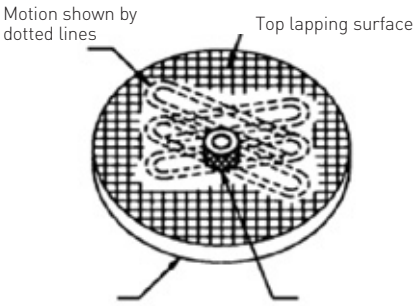
  Lapping blocks are made of a special grade of annealed cast iron. There is a block for each orifice size. Each block has two perfectly flat working sides and it is essential that they retain this high degree of flatness to produce a truly flat seating surface on either the disc insert or the nozzle. 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 9.

- 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 remachining. The following lapping compounds, or their commercial equivalents are suggested:

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

FIGURE 9



Lapping block resurfacing plate

Lapping block

TABLE 8 - Minimum nozzle face to seat dimensions (see Figure 10)

	Valve type								
Orifice	**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**
D	3.453	3.453	3.453	3.453	3.453	3.675	3.675	3.675	4.796
E	3.453	3.453	3.453	3.453	3.453	3.675	3.675	3.675	4.796
F	4.013	4.013	4.013	4.013	4.013	4.013	4.013	4.013	4.633
G	3.763	3.763	3.763	3.763	3.763	3.763	3.763	4.763	4.763
H	3.889	3.889	3.889	3.889	4.826	4.826	4.826	4.826	-
2J3	4.326	4.326	-	-	-	-	-	-	-
2½J4	-	-	4.357	4.357	5.107	5.107	-	-	-
3J4	-	-	6.232	6.232	6.232	6.232	6.441	6.441	-
K	4.701	4.701	4.701	4.701	5.826	5.826	7.013	7.013	-
L	5.045	5.045	5.263	5.263	5.263	6.236	6.236	6.236	-
M	5.576	5.576	5.576	5.576	5.576	6.389	6.389	-	-
N	6.117	6.117	6.117	6.117	6.117	-	-	-	-
P	5.857	5.857	7.607	7.607	7.607	-	-	-	-
Q	7.732	7.732	7.732	7.732	7.732	-	-	-	-
R	8.117	8.117	8.117	8.117	8.117	-	-	-	-
T, T2	9.576	9.576	9.576	-	*9.576	-	-	-	-

* Type 42, 44 not available

TABLE 9 - Disc insert minimum seat heights

Orifice	**D and E**	**F**	**G**	**H**	**J**	**K**	**L**	**M**	**N**	**P**	**Q**	**R**	**T**
'A'	0.332	0.370	0.369	0.398	0.429	0.531	0.546	0.605	0.632	0.692	0.783	0.781	0.839
'B'	0.021	0.025	0.030	0.036	0.044	0.051	0.063	0.070	0.076	0.091	0.118	0.139	0.176
	0.023	0.027	0.032	0.038	0.046	0.053	0.065	0.072	0.078	0.093	0.120	0.141	0.178

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 a Emerson facility for repair. All parts must be machined accurately per Emerson specifications.

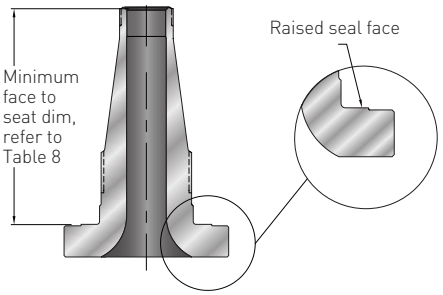
No pressure relief valve will be tight, nor will it operate properly unless all parts are machined correctly. The most satisfactory way to machine a nozzle is to remove it from the valve body. However, it may also be machined while assembled within the valve body. In any event, it is vitally important that the seating surfaces run absolutely true before machining.

Machining dimensions for Crosby Style JOS-E/JBS-E valves with metal-to-metal nozzle seats are shown in Figure 10 and Table 8. 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 8.

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 11 and Table 9).

FIGURE 10
Nozzle seat critical dimensions



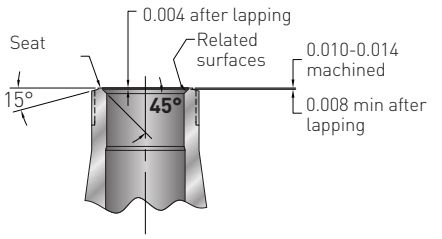
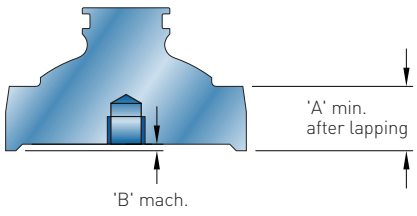


FIGURE 11
Disc insert minimum seat height (Table 9)



6.6 Assembly
All components should be clean. Before assembling the following parts, lubricate with pure nickel 'Never-Seez'.
- Nozzle and body threads
- Nozzle and body sealing surface
- All studs and nut threads
- Spindle and threads
- Set screw threads
- Spring washer bevels
- Adjusting bolt and bonnet threads
- Bonnet pipe plug
- Cap threads
- All metal gaskets
- Dog shaft bearing threads
- Disc holder threads (bellows valves only)

Lubricate the spindle point thrust bearing and disc insert bearing with pure nickel 'Never-Seez'. Special attention should be given to the guiding surfaces, bearing surfaces and gasket surfaces to ensure that they are clean, undamaged and ready for assembly (Figure 12). For parts identification, refer to Figure 1.

6.6.1 Before installing the nozzle (2) 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 a nozzle wrench.

6.6.2 Screw the nozzle ring (3) onto the nozzle (2). **Note:** the top of the nozzle ring should be above the nozzle seating surface. For P, Q, R and T orifice Style JLT, position the nozzle ring per Table 2.

6.6.3 For bellows valves only, place the disc holder in a vise (larger sizes may require a 3 jaw vise) as shown in Figure 8. Install the tailpiece gasket (29). Screw the bellows assembly onto the disc holder. Tighten with a suitable wrench.

6.6.4 Assemble the disc insert (8) and the disc holder (5). (See Figure 14 for O-ring soft seat assembly). Install the disc insert retention clip (9) onto the disc insert. Install the disc insert into the disc holder. The disc insert should snap into place using handforce only. Safety precautions should be followed whenever heavy parts are being lifted or transported. Dropping the disc holder assembly may dislodge the insert.

6.6.5 Assemble the disc holder (5) and guide (15) by sliding the guide over the disc holder. **Note:** the guide for D and E orifice valves protrudes up into the valve bonnet.

6.6.6 Install the two guide gaskets (28), one above and one below the guide. **Note:** when assembling bellows valves, the bellows flange eliminates the need for a bottom guide gasket.

6.6.7 While holding the top of the disc holder, install the guide into the body. Align the hole of the guide with the body outlet. Once the guide is seated, the disc holder and disc insert can be lowered onto the nozzle. **Note:** lower the nozzle ring below the seats so that it moves freely.

6.6.8 Place the spring (18) and washers (19) onto the spindle (16) and assemble the spindle to the disc holder (5) with the spindle cotter pins. **Note:** no cotter pins are required in D through K orifice sizes; all other orifice sizes use two cotter pins.

6.6.9 Lower the bonnet (20) over the spindle and spring assembly onto the bonnet studs (21) in the body. Position the bonnet counter bore on the O.D. of the guide and lower the bonnet onto the guide.

6.6.10 Screw the bonnet nuts (22) onto the bonnet studs and tighten down evenly to prevent unnecessary strain and possible misalignment.

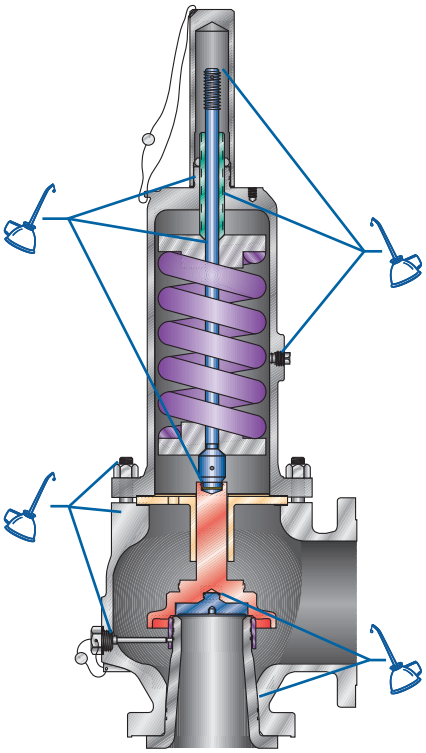
6.6.11 Screw the adjusting bolt (24) and nut (25) into the top of the bonnet to apply force on the spring. (The original set pressure can be approximated by screwing the adjusting bolt down to the predetermined measurement).

6.6.12 Move the nozzle ring up until it touches the disc holder, then lower it two notches. This is a test stand setting only.

6.6.13 Place the set screw gasket (27) onto the set screw (4) and screw the set screw into the body engaging the nozzle ring. The nozzle ring should move back and forth slightly after the set screw is tightened.

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 to either the original recorded position or to the recommended position shown in Table 1.
- Install the cap or lifting device. See Figure 14 for lifting lever assembly.
- Seal the cap or lifting lever device and nozzle ring set screw to prevent tampering.

FIGURE 12
Recommended lubrication points



6.7 Restricted lift valves

Crosby JOS-E and JLT-JOS- E pressure relief valves are available in a restricted lift version. All J series variations including JBS and all service medias may be supplied 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″ (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 18).
- The required lift should also be specified on the nameplate or determined by calculation (See example on page 18).
- Select the limit spacer(s) to the required limit spacer height (See Table 10 and 11).

6.7.3 Measure the valve lift.

- Install the limit spacer (see Figure 13) with the chamfer down and reassemble the valve as described in Steps 6.6.1 through 6.6.10.

Note: install bellows to disc holder for JBS F orifice 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 (.020", +0.020" [-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, and return to section 13.3.1. (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 2.) 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.
- 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 13
Restricted lift spacer

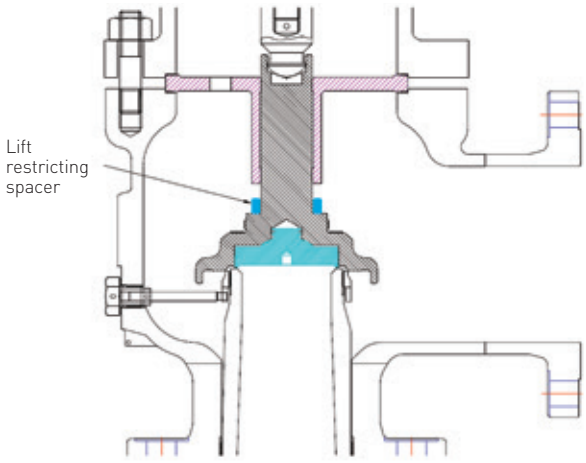


TABLE 10- J0S/JBS RESTRICTED LIFT SS316 SPACER / J_S-RL SS316 SPACER

	Part number	Height[1] (inches)	Part number	Height[1] (inches)	Part number	Height[1] (inches)	Part number	Height[1] (inches)
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	11408440	0.100
F 1-4()	N/A	N/A	11408542	0.161	11408554	0.141	11408535	0.120
F 5-7()	N/A	N/A	11408542	0.161	11408554	0.141	11408535	0.120
G	11408534	0.225	11408818	0.199	11408819	0.173	11408536	0.146
H	11277099	0.274	11408828	0.241	11408829	0.208	11408830	0.174
J	11408532	0.342	11408839	0.299	11408840	0.257	11408842	0.215
K	11408854	0.407	11408855	0.356	11408856	0.306	11408858	0.255
L 1-4()	11408387	0.501	11408539	0.438	11408388	0.375	11408389	0.311
L 5-6()	11408401	0.514	11408402	0.451	11408403	0.388	11408404	0.324
M	11408410	0.560	11408417	0.486	11408419	0.416	11408420	0.345
N	11408434	0.608	11408435	0.530	11408436	0.453	11408437	0.375
P	11408452	0.735	11408453	0.640	11408454	0.546	11408455	0.451
Q	11408469	0.961	11408485	0.829	11408482	0.708	11408480	0.583
R	11408486	1.128	11408483	0.979	11408485	0.829	11408481	0.679
T	11408505	1.455	11408506	1.264	11408508	1.074	11408509	0.883
T2	11408488	1.435	11408489	1.237	11408490	1.040	11408491	0.843
V	11408514	1.772	11408515	1.528	11408516	1.285	11408517	1.041
W	11408523	2.246	11408524	1.935	11408526	1.624	11408527	1.312
Orifice	**70% of full capacity**		**80% of full capacity**		**90% of full capacity**			
D 1-4()	11408396	0.114	11408407	0.102	11408418	0.090		
JOS D 5-7()	11408808	0.114	11408680	0.102	11408798	0.090		
E 1-4()	11408451	0.084	11408462	0.067	11408473	0.051		
JOS E 5-7()	11408786	0.084	11408775	0.067	11408750	0.051		
F 1-4()	11408566	0.099	11408577	0.078	11408588	0.058		
F 5-7()	11408566	0.099	11408577	0.078	11408588	0.058		
G	11408820	0.120	11408821	0.093	11408823	0.066		
H	11408831	0.141	11408832	0.108	11408834	0.075		
J	11408844	0.172	11408845	0.130	11408847	0.087		
K	11408859	0.204	11408860	0.153	11408861	0.103		
L 1-4()	11408390	0.248	11408391	0.185	11408392	0.122		
L 5-6()	11408405	0.261	11408406	0.198	11408408	0.135		
M	11408421	0.274	11408422	0.203	11408423	0.132		
N	11408438	0.297	11408439	0.219	11408441	0.141		
P	11408456	0.357	11408537	0.262	11408457	0.168		
Q	11408478	0.459	11408476	0.335	11408474	0.210		
R	11408479	0.530	11408477	0.380	11408475	0.231		
T	11408511	0.692	11408538	0.501	11408512	0.311		
T2	11408492	0.645	11408493	0.448	11408494	0.250		
V	11408518	0.798	11408520	0.554	11408521	0.310		
W	11408528	1.001	11408529	0.690	11408530	0.379		

Orifice	**5% increment**	
D Thru J	N/A	N/A
K	11408853	0.025
L 1-4()	11408386	0.032
L 5-6()	11408386	0.032
M	11408416	0.035
N	11408433	0.039
P	11408450	0.047
Q	11408471	0.062
R	11408472	0.075
T	11408504	0.095
T2	11408487	0.099
V	11408513	0.122
W	11408522	0.156

NOTE

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

TABLE 11 - JLT RESTRICTED LIFT SS316 SPACER / JLT-J_S-RL SS316 SPACER

	Part number	Height[1] (inches)	Part number	Height[1] (inches)	Part number	Height[1] (inches)
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
JLT-JOS D 5-7()	N/A	N/A	N/A	N/A	11408808	0.113
E 1-4()	11408810	0.146	11408822	0.126	11408833	0.105
JLT-JOS E 5-7()	11408702	0.122	11408680	0.102	11408669	0.081
F 1-4()	11408533	0.182	11408484	0.157	11408496	0.131
F 5-7()	11408737	0.182	11408726	0.157	11408714	0.131
G	11408534	0.225	11408814	0.192	11408815	0.159
H	11277099	0.274	11408824	0.233	11408825	0.192
J	11408532	0.342	11408835	0.291	11408836	0.238
K	11408854	0.407	11408849	0.343	11408850	0.28
L 1-4()	11408387	0.501	11408863	0.424	11408864	0.346
L 5-6()	11408401	0.514	11408394	0.437	11408395	0.359
M	11408410	0.56	11408411	0.472	11408412	0.384
N	11408426	0.611	11408427	0.515	11408428	0.419
P	11408444	0.739	11408445	0.623	11408446	0.506
Q	11408469	0.961	11408468	0.808	11408466	0.654
R	11408470	1.149	11408469	0.961	11408467	0.779
T	11408498	1.511	11408499	1.275	11408500	1.038
Orifice	**70% of full capacity**		**80% of full capacity**		**90% of full capacity**	
D 1-4()	11408495	0.122	11408611	0.107	11408725	0.092
JLT-JOS D 5-7()	11408807	0.098	11408786	0.084	11408646	0.068
E 1-4()	11408846	0.085	11408857	0.064	11408385	0.044
JLT-JOS E 5-7()	11408635	0.061	11408612	0.04	11408599	0.02
F 1-4()	11408507	0.105	11408577	0.078	11408519	0.054
F 5-7()	11408691	0.105	11408657	0.079	11408623	0.054
G	11408816	0.126	11408821	0.093	11408817	0.061
H	11408826	0.151	11408832	0.108	11408827	0.069
J	11408837	0.186	11408838	0.133	11408540	0.081
K	11408851	0.217	11408860	0.153	11408852	0.092
L 1-4()	11408865	0.268	11408866	0.189	11408867	0.111
L 5-6()	11408397	0.281	11408398	0.202	11408399	0.124
M	11408413	0.296	11408414	0.209	11408415	0.121
N	11408430	0.322	11408431	0.226	11408432	0.129
P	11408447	0.389	11408448	0.272	11408449	0.155
Q	11408464	0.5	11408461	0.346	11408459	0.192
R	11408465	0.594	11408463	0.408	11408460	0.223
Orifice	**5% increment**					
D thru J	N/A	N/A				
K	11408848	0.031				
L 1-4()	11408862	0.039				
L 5-6()	11408862	0.039				
M	11408409	0.044				
N	11408425	0.048				
P	11408443	0.058				
Q	11408472	0.075				
R	11408458	0.093				
T	11408497	0.118				
T2	11408487	0.099				
V	11408513	0.122				
W	11408522	0.156				

NOTE

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

Examples

Valve model number:	JBS
Size and orifice:	6 Q 8
Set pressure:	600 psig
Back pressure:	100 psig
Operating temperature:	350 °F
Design temperature:	450 °F
Outlet temperature:	100 °F
Body/bonnet material:	Carbon steel
Full lift:	1.243 inches
Rated full capacity of full lift:	374.860 lbs/hr

CASE 1

Capacity required: 250.000 lbs/hr

Selection 1

Maximum, not to exceed, rated nameplate capacity (110% of capacity required): 275.000 lbs/hr
Required capacity of full capacity: 250.000 / 374.860 = 67%
Required lift: 67%×1.243 inches = 0.833 inches
Choose a spacer of 70% of full capacity in Table 10: 11408478
Nameplate restricted lift: 1.243×70%=0.870 inches
Nameplate capacity: 374.860 lbs/hr ×70% = 262.402 lbs/hr

NOTES

Nameplate capacity shall be greater than required capacity of 250.000 lbs/hr and lower than maximum of 275.000 lbs/hr

CASE 2

Capacity required: 165.000 lbs/hr

Selection 2

Maximum, not to exceed, rated Nameplate Capacity (110% of capacity required): 181.500 lbs/hr
Required capacity of full capacity: 165.000 / 374.860 = 44%
Required lift: 44%×1.243 inches = 0.547 inches
Choose two spacers of 50% of Full Capacity and 5% Reduction in Table 10: 11408482 and 11408471
Nameplate restricted lift: 1.243×45%=0.559 inches
Nameplate capacity: 374.860 lbs/hr ×45% = 168.687 lbs/hr

NOTES

Nameplate capacity shall be greater than required capacity of 165,000 lbs/hr and lower than maximum of 181.500 lbs/hr

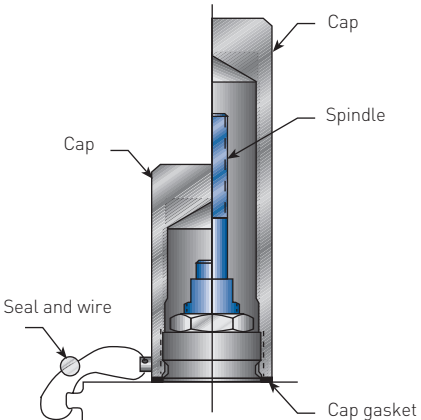
6.8 Assembly of cap and lifting lever devices
Styles JOS-E, JBS-E and JLT-E pressure relief valves are furnished with several different caps and lifting lever devices. The following describes assembly of the available types of cap construction.
(Disassembly is the reverse of assembly).
For part identification refer to Figure 14.

- 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 inch 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.

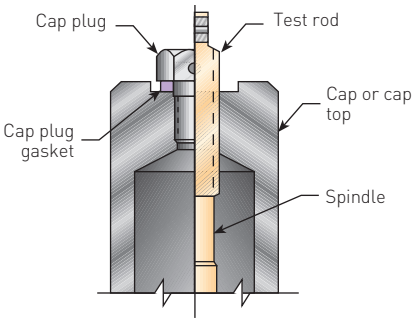
6.9 Soft seat construction
Coat O-ring with 'Parker Super O-Lube' and place a small amount of Loctite 242 (or equivalent removable thread lock) onto retainer screw before assembly. Tighten retainer screw(s) securely.

- O-ring soft seats
  Crosby Style JOS-E/JBS-E metal-to-metal seated pressure relief valves may be converted to an O-ring soft seat by replacing the standard disc insert and nozzle with those parts designed to house the O-ring soft seat or vice versa.

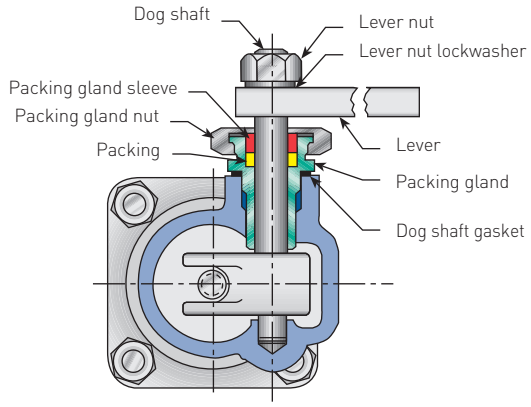
FIGURE 14 - Cap and lifting levers



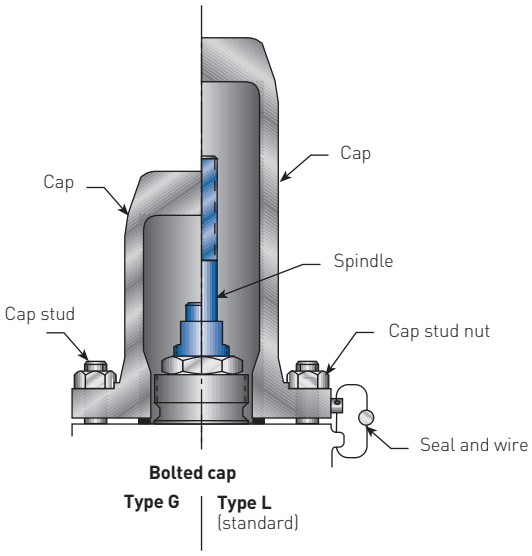
Threaded cap
Type A | **Type J** (standard)



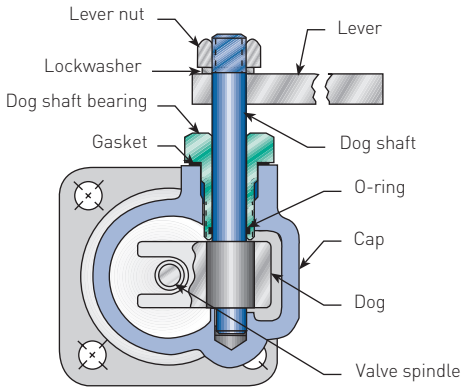
Cap and test rod
Type B - screwed cap
Type E - packed lifting lever
Type H - bolted cap
Type K - screwed cap (standard)
Type M - bolted cap (standard)



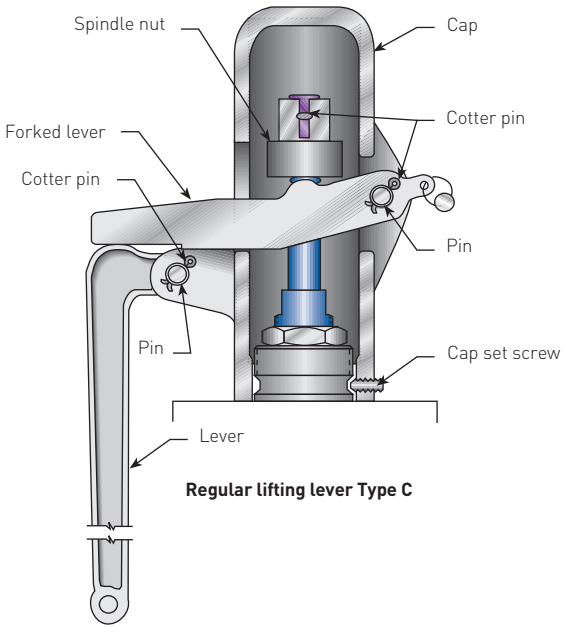
Packed lifting lever Type D
(Top view of packing gland construction used for special materials)



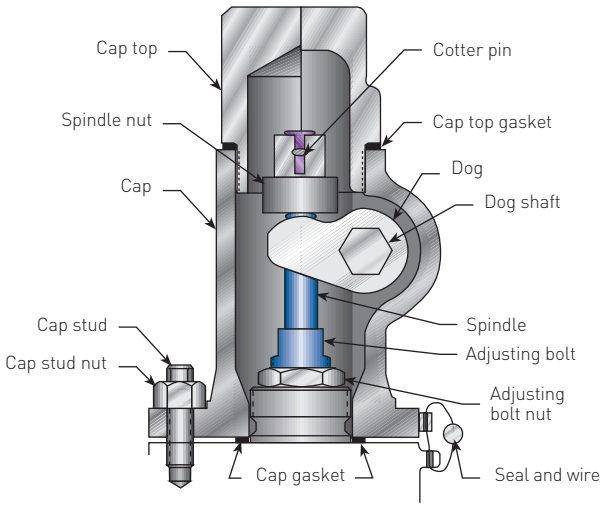
Bolted cap
Type G | **Type L** (standard)



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 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.
- JLT liquid trim
  Crosby Style JOS-E/JBS-E pressure relief valves in D to N 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 T orifice sizes, a new nozzle ring is also required.
- O-ring soft seat design
  Crosby Style JOS-E and JBS-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. Standard O-ring materials include NBR, EPR, FKM, Kalrez®, Silicone and PTFE (see Figure 15 and Table 12).

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.
On the valve nameplate, the valve assembly number is shown as shop number.
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.

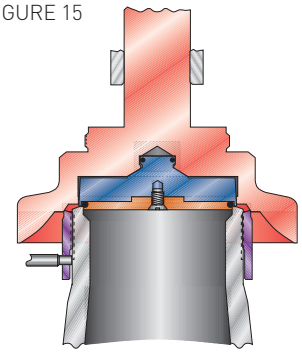
10.1 Seat leakage

Of all the problems encountered with pressure relief valves, seat leakage is the most common and the most detrimental. 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).

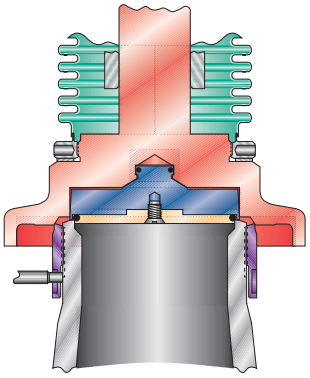
10.1.1 Seats damaged by foreign matter

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.
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 remachining 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 bellows seated valve will isolate and protect the guides and valve spring from any corrosive fluids.

FIGURE 15



JLT-E O-ring
Soft seat



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

TABLE 12 - Soft seat O-ring sizes

Orifice	O-ring size
D, E	*2-013
	** 2-014
F	2-113
G	2-116
H	2-120
J	2-125
K	2-130
L	2-226
M	2-228
N	2-230
P	2-337
Q	2-346
R	2-352
T, T2	2-438

* All elastomers
** PTFE only

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, 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 inch 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 seal 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.