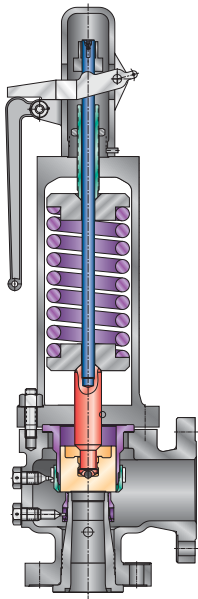


CROSBY STYLE HSL SAFETY VALVES
 INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

Before installation, these instructions must be carefully read and understood



Style HSL safety valves incorporate the Crosby FLEXI-DISC[®] design which is recessed for pressure and temperature equalization ensuring a tight seal capable of containing system pressure at 94% of the valve set pressure. Seat tightness testing at the factory for Style HSL safety valves is conducted at 93% of set pressure.

Centering of the disc through the low friction guide ensures the HSL opens precisely at set pressure, even after repeated cycling. The single bonnet design utilized in both inlet flange ratings allows set pressure changes without the need to change-out any components other than the spring.

Style HSL safety valves are available with optional test gags, weather hoods for outdoor applications and Class 150# drip pan elbows. Ring type joint inlet connection is also available. The entire HSL range of F thru Q orifices uses a full nozzle design (Figure 1) to facilitate removal and ease of maintenance compared to semi-nozzle designs.

Details of the HSL valve design, materials of construction, pressure-temperature ratings and dimensions are provided in Crosby technical datasheet VCTDS-00595.

1 INTRODUCTION

Crosby Style HSL is a full nozzle reaction type safety valve designed for saturated and superheated steam service. The design is suitable for set pressures to 725 psig (50 barg) and temperatures to 1000°F (538°C), with high capacities, two choices of inlet flange ratings and simplicity of design to facilitate ease of maintenance.

The HSL design meets the requirements of ASME Code Section I, (power boilers) and relieving capacities are certified by the National Board of Boiler and Pressure Vessel Inspectors. Style HSL may also be used in steam service applications covered by ASME code section VIII requirements.

2 SPARE PARTS

Emerson recommends spare parts as shown on Figures 1 and 2. When ordering spare parts, the valve size, style and serial number should be given together with set pressure, part name, and reference number from Figure 1 or 2. Spare parts may be ordered from any Emerson regional sales office or authorized Emerson sales representative.

CROSBY STYLE HSL SAFETY VALVES

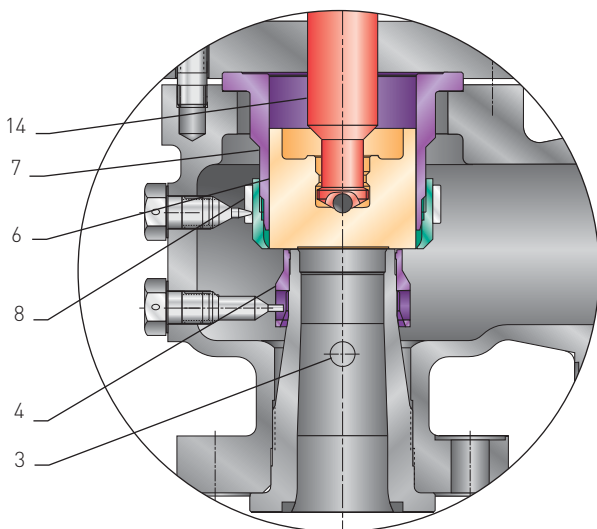
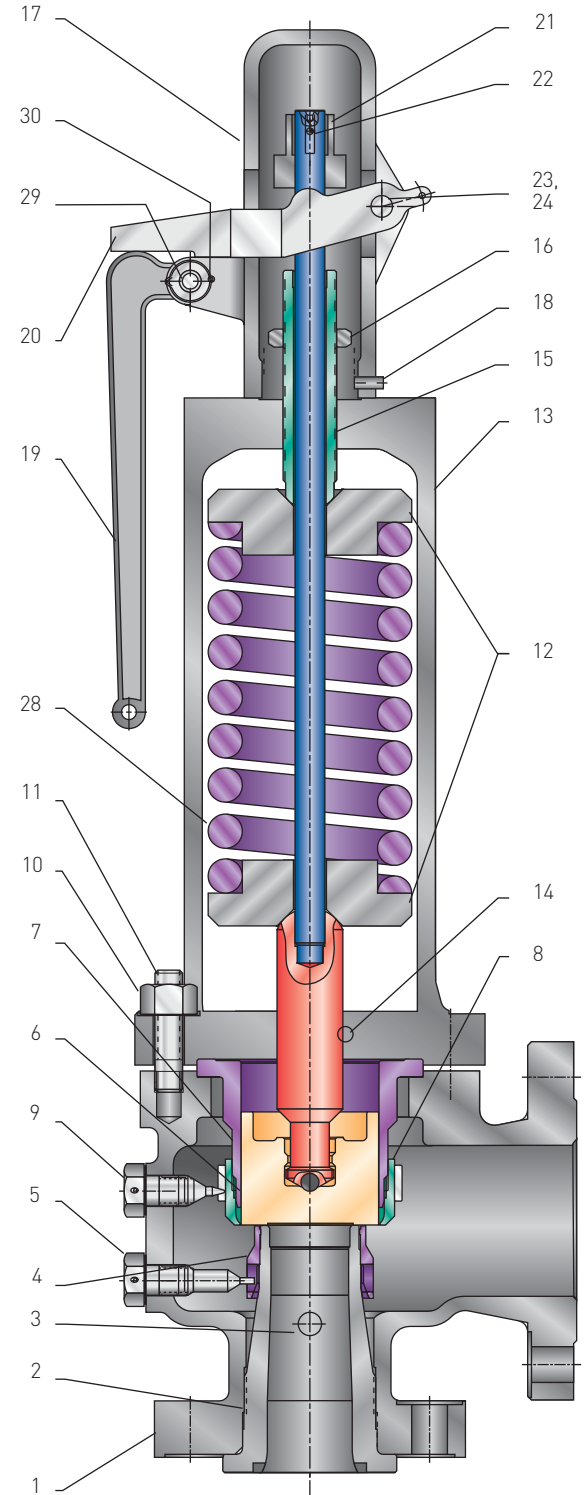
INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

BILL OF MATERIALS (F thru J Orifice)

Item	Part name	Material
1	Body	ASME SA216 Grade WCB/WCC Carbon steel (HSL-(16) ASME SA217 Grade WC6 Chrome Moly steel (HSL-(18)
2	Nozzle	ASME SA479 Type 316 Stainless steel
3	Drain plug	Carbon steel
4	Nozzle ring	Stainless steel
5	Nozzle ring set screw	Type 416 Stainless steel
6	Disc*	Type 422 Stainless steel
7	Guide	Monel® ASME SA351 Grade CF8M
8	Guide ring	Stainless steel
9	Bonnet stud set screw	Type 416 Stainless steel
10	Bonnet stud nut	ASME SA194 - Class 2H
11	Bonnet stud	ASME SA193 Grade B7
12	Spring washers	Carbon steel
13	Bonnet	ASME SA216 Grade WCB/WCC Carbon steel (HSL-(16) ASME SA217 Grade WC6 Chrome Moly steel (HSL-(18)
14	Spindle	Type 416 Stainless steel
15	Adjusting bolt	Type 416 Stainless steel
16	Adjusting bolt nut	Steel
17	Cap	Malleable iron
18	Cap set screw	Stainless steel
19	Lever	Malleable iron
20	Forked lever	Malleable iron
21	Spindle nut	Steel
22	Spindle nut cotter pin	Steel
23	Cotter pin	Steel
24	Forked lever pin	Steel
28	Spring	Alloy steel (corrosion resistant coating)**
29	Lever pin	Steel
30	Cotter pin	Steel
	Nameplate	Stainless steel (not shown)

* Recommended spare part
 ** May be upgraded to Inconel® X750

FIGURE 1



F thru J
Orifice construction

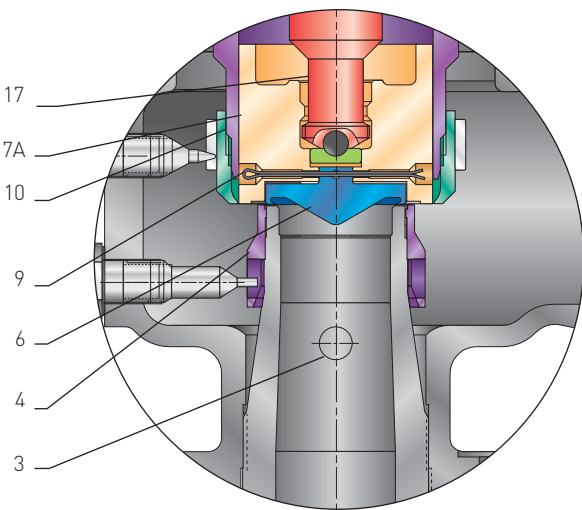
CROSBY STYLE HSL SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

BILL OF MATERIALS (K thru Q Orifice)

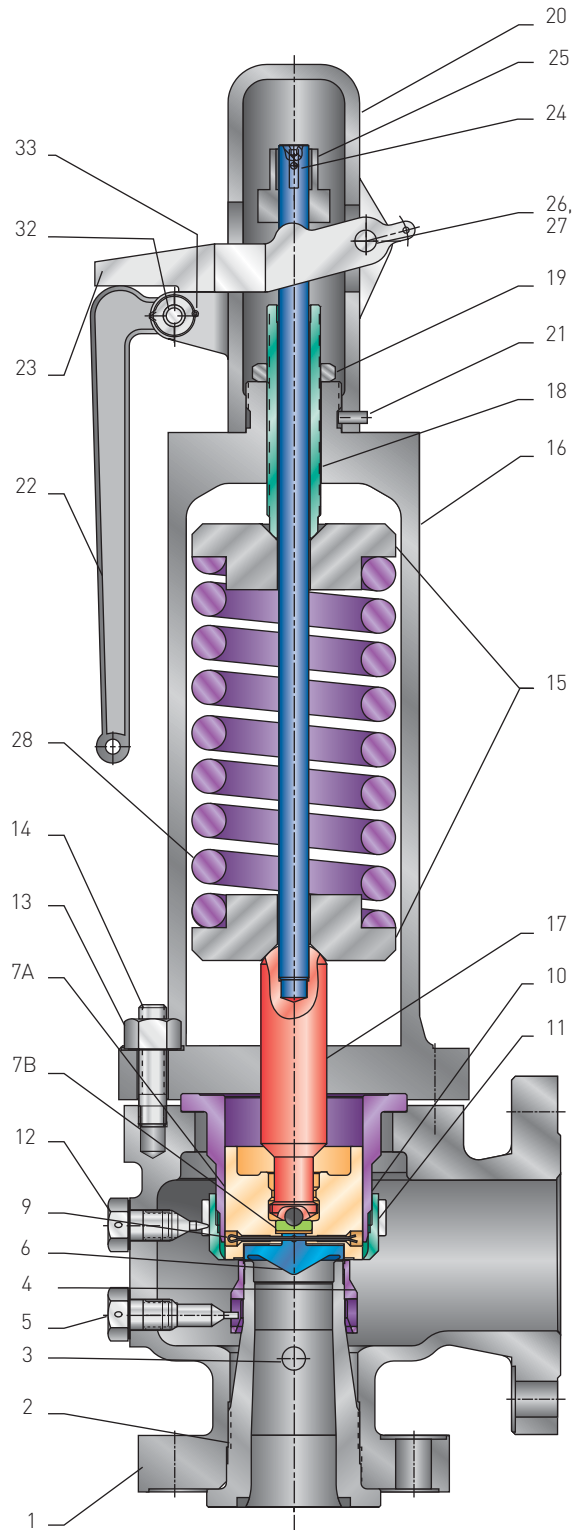
Item	Part name	Material
1	Body	ASME SA216 Grade WCB/WCC Carbon steel (HSL- (J6) ASME SA217 Grade WC6 Chrome Moly steel (HSL- (J8)
2	Nozzle	ASME SA479 Type 316 Stainless steel
3	Drain plug	Carbon steel
4	Nozzle ring	ASME SA351 Grade CF8M Stainless steel
5	Nozzle ring set screw	Type 416 Stainless steel
6	Disc insert*	Type 422 Stainless steel
7A and B	Disc holder and bushing	Monel®/440C Stainless steel
9	Disc insert cotter pin*	Stainless steel
10	Guide	Monel®
11	Guide ring	ASME SA351 Grade CF8M Stainless steel
12	Guide ring set screw	Type 416 Stainless steel
13	Bonnet stud nut	ASME SA194 - Class 2H
14	Bonnet stud	ASME SA193 Grade B7
15	Spring washers	Carbon steel
16	Bonnet	ASME SA216 Grade WCB/WCC Carbon steel (HSL- (J6) ASME SA217 Grade WC6 Chrome Moly steel (HSL- (J8)
17	Spindle	Type 416 Stainless steel
18	Adjusting bolt	Type 416 Stainless steel
19	Adjusting bolt nut	Steel
20	Cap	Malleable iron
21	Cap set screw	Stainless steel
22	Lever	Malleable iron
23	Forked lever	Malleable iron
24	Spindle nut	Steel
25	Spindle nut cotter pin	Steel
26	Cotter pin	Steel
27	Forked lever pin	Steel
28	Spring	Alloy steel (corrosion resistant coating)
32	Lever pin	Steel
33	Cotter pin	Steel
	Nameplate	Stainless steel (not shown)

* Recommended spare part



K thru Q
Orifice construction

FIGURE 2



CROSBY STYLE HSL SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

WARNING

The protection and safety of equipment, property, and personnel depends on the proper operation of the pressure relief valves described in this manual. All Emerson pressure relief valves should be kept in proper working condition in accordance with the manufacturer's written instructions. Periodic testing and maintenance by the user of this equipment is essential for reliable and safe valve operation.

All installation, maintenance, adjustment, repair and testing performed on safety valves should be done by qualified technicians having the necessary skills and training adequate to perform such work.

All applicable codes and standards, governing regulations and authorities should be adhered to when performing pressure relief valve repair. No repair, assembly, adjustment or testing performed by other than Emerson or its authorized assemblers and representatives shall be covered by the warranty extended by Emerson to its customers

This manual is provided as a general guide for the repair and maintenance of the safety valves described herein. It is not possible to describe all configurations or variations of such equipment.

The user is advised to contact Emerson or its authorized assemblers and representatives for assistance in situations that are not covered adequately or described in this manual

Before removing a safety valve for maintenance, ensure that the system pressure has been depressurized fully. If an isolation block valve is used, ensure that any trapped fluid between the block valve and the safety valve is vented safely. Before disassembling the safety valve, ensure that the valve has been decontaminated from any harmful fluids and that it is at a safe temperature range for handling.

Before installation, the Installation and Operational Safety Instructions should be read fully and understood. These Instructions may be requested from the factory or are available at Emerson.com.

3 STORAGE

Often, pressure relief valves are received at the job site months before they actually are installed. Unless they are stored and protected properly, their performance may be affected seriously. Rough handling may damage flanges or cause misalignment of the valve parts. It is best to store the valves vertically in a dry place with a protective covering until they are used. Special care should be taken to cover the inlet and discharge flanges.

4 RIGGING AND HANDLING

Pressure relief valves must be handled carefully and never subjected to sharp impact loads. While in the shipment case or when uncrated they should not be bumped or dropped.

Rough handling may alter the pressure setting, deform valve parts and affect seat tightness adversely.

When it is necessary to use a hoist, a sling should be placed around the valve body and bonnet in a manner that ensures the valve is in the vertical position to facilitate installation.

Flange protection should remain in place until the valve is ready to be installed on the system.

CAUTION

Pressure relief valves should never be lifted or carried using the lifting lever.

5 INSPECTION PRIOR TO INSTALLATION

Safety 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 should 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 seals protecting the spring setting and ring adjustments should be intact. If seals are not intact, the valve should be inspected, tested and new seals installed prior to use.

WARNING

To ensure trouble-free performance, be sure to clean the inlets and outlets of the valves thoroughly before installing. All dirt, sediment and scale in the protected vessel and piping must be removed completely before installation (foreign material entering the valve may cause seat leakage, plugging and valve malfunction).

6 INLET PIPING

Safety valves should be mounted in a vertical position, directly on the pressure vessel; the nozzle should have a well-rounded approach that provides smooth, unobstructed flow between the vessel and the valve.

A safety valve should never be installed on a fitting having an inside diameter smaller than the inlet connection of the valve as restricted flow can cause faulty valve operation.

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 precise nature of the loading and the resulting stresses will depend on the configuration of the valve and the discharge piping. This must be taken into consideration by those responsible for the installation of the safety valve and associated vessel or piping.

Determination of the outlet reaction forces is the responsibility of the designer of the vessel and/or piping.

It is essential that the valve inlet, the vessel, and the line on which the valve is mounted be cleaned thoroughly of all foreign material. The inlet connection bolts or studs should be tightened uniformly to avoid straining or distorting the valve body.

CROSBY STYLE HSL SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

FIGURE 3
Safety valve installation

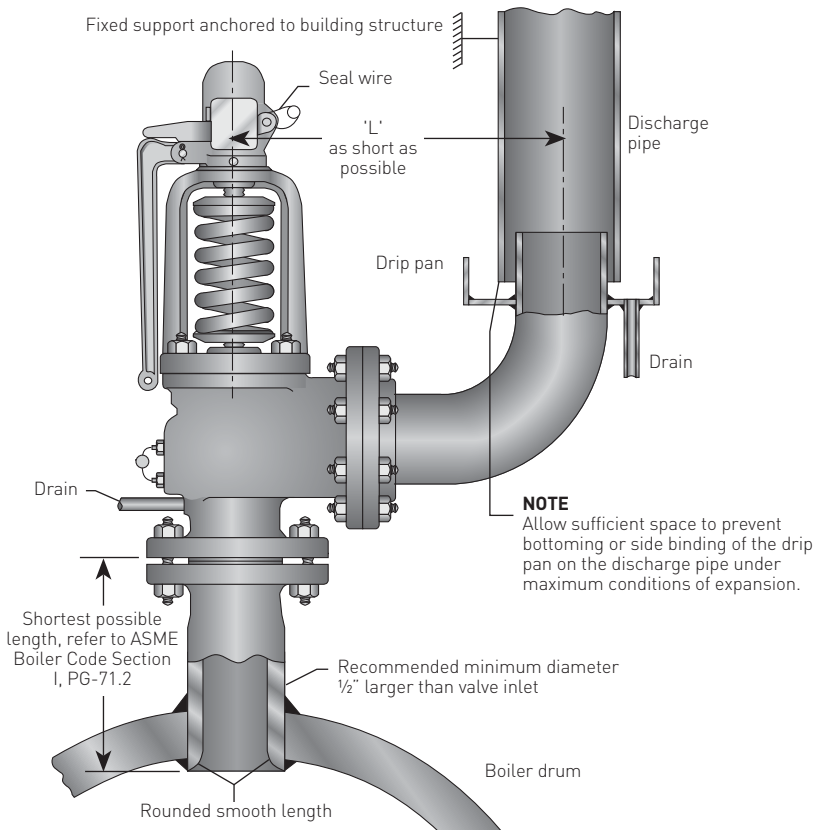
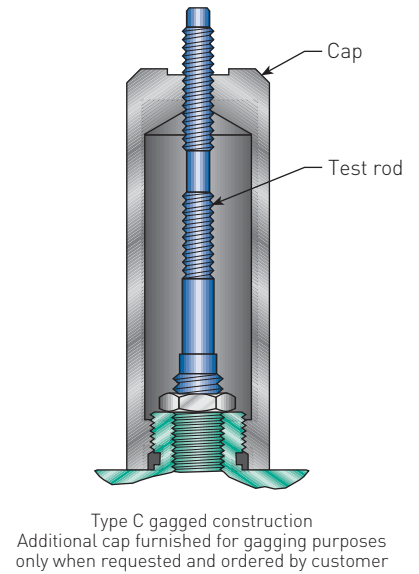


FIGURE 4



7 DISCHARGE PIPING

Discharge piping should be simple and direct. Where possible, a short vertical pipe connected through a long radius elbow discharging directly into the atmosphere is recommended. Discharge piping should be designed so as not to impose any loading on the valve. Excessive discharge piping may cause seat leakage or faulty valve operation. The inside diameter of the discharge pipe must never be less than the valve outlet. Valve effluent must discharge to a safe disposal area. Valve bodies are provided with pipe thread openings for drains. These should be connected to prevent any accumulation of fluid in the valve body. In addition, it is recommended that discharge piping also be drained to prevent any accumulation of fluid. Care must be observed to ensure that the drains are directed or piped to a safe disposal area.

8 HYDROSTATIC TESTING OF BOILER

When a hydrostatic test is made on the system, it is recommended that the testing be performed before installation of the pressure relief valves and that blank flanges are used during the test. In the event the valve has been installed, it is recommended it be removed and blank flanges installed for hydrostatic test purposes. Blank flanges must be removed and the pressure relief valve installed before the vessel is placed in service. In the event the pressure relief valves are left installed during a hydrostatic test, they must be gagged to prevent them from opening during the test, possibly causing damage to the valve components. When the valves are to be gagged for a hydrostatic test, gags as shown in Figure 4 should be used but at pressures no greater than 10% above the nameplate set pressure. Use of a gag will require the removal of the cap and lifting lever while the gag is in use.

WARNING

While the gag is in place the valve will not open or provide any over-pressure protection until the gag is removed. Test gags should be positioned evenly on the bonnet and care must be exercised to prevent over tightening that could damage the spindle and valve seats. Generally, a test rod that is finger tight will provide sufficient force to hold the valve closed. After the hydrostatic test, the test gag must be removed and replaced with the cap and lifting lever.

CROSBY STYLE HSL SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

9 SET PRESSURE TESTING

Although each HSL has been set and tested at the factory or the certified assembler location, sometimes it is necessary or desirable to test the valve prior to installation in order to meet local jurisdictional requirements. The valve may be tested either in a steam test facility with the capacity to over pressure the valve, or on site by using an in-line test device or by over-pressuring the boiler on which the valve will be installed. If the valve will be tested on the boiler by over-pressuring the system it may be necessary to gag any other pressure relief valves mounted on the same boiler.

NOTE

Use of an in-line test device may require dimensional information specific to the type and size valve being tested. Contact your local Emerson sales or service office for this information.

The HSL is designed to open with a sharp pop at the nameplate set pressure (within the tolerances shown in Table 1) and remain open, relieving full capacity at 3% overpressure. As pressure decays below the popping pressure, the valve will remain open until the blowdown pressure is reached. The valve will then reseal. When testing a valve on a steam test stand or on the end user's boiler without using an in-line test device, the pressure should be increased slowly until the valve opens, but no higher than 3% above the nameplate set point of the valve. To ensure the valve is adjusted accurately at least two test cycles shall be observed with the valve opening within the tolerances shown in Table 1. If the valve opens outside the tolerance shown in Table 1, or fails to open by 3% over nameplate set point, the valve may require adjustment.

WARNING

Steam under pressure can be extremely hazardous to personnel and can cause serious injuries including burns and scalds from the high temperatures of the steam. Care should be taken to protect testing personnel to prevent any exposure to released steam from the discharge or spring chamber of the valve. Appropriate safety equipment, including hearing protection, should be worn at all times when servicing a steam pressure relief valve.

Seat tightness testing

After the set pressure has been determined by testing and any final adjustments are made, the valve should be tested to assure it meets acceptable seat tightness levels. In order to perform this test it is suggested the test pressure be raised and held at 93% of set point and the valve observed for signs of any 'visible leakage'. This is accomplished most easily by viewing the discharge flange of the valve from the side against a dark background in order to see any steam leakage. In most cases, if the valve leaks by the seat, this can be remedied by re-lapping of the seating surfaces of the nozzle and disc.

10 VALVE ADJUSTMENTS

Set pressure adjustment

Set pressure adjustment should not be necessary on a new valve but if the valve is tested and does not test within the required set point tolerances, it may be necessary to adjust the spring compression by tightening the adjusting bolt (see instructions below). For parts identification see Figure 1 and 2. Before making any adjustments, reduce the system pressure under the valve 10% - 20% below the set pressure stamped on the valve. This will prevent damage to internal parts and minimize the chance of an inadvertent valve opening.

- A. Remove the cap and lifting lever device following the instruction on page 7.
- B. Loosen the adjusting bolt nut (16/19).
- C. Turn the adjusting bolt (15/18) clockwise to increase set pressure or counterclockwise to reduce set pressure.
- D. Retighten the adjusting bolt nut (16/19) following each adjustment.
- E. Repeat the testing process to determine if the valve will open within the tolerance shown in Table 1 for at least two test cycles.
- F. Continue to adjust the valve until it is observed to open within tolerance for at least two test cycles.
- G. Once the set pressure has been established, replace the cap and lifting lever device following the instruction on page 11 and install a new seal and wire.

TABLE 1 - TORQUE VALUES FOR VALVE ASSEMBLY

Set pressure, psi (MPa)	Tolerance - plus or minus from set pressure
≤ 70 (0.5)	2 psi (15 kPa)
> 70 (0.5) and ≤ 300 (2.1)	3% of set pressure
> 300 (2.1) and ≤ 1.000 (7.0)	10 psi (70 kPa)
> 1.000 (7.0)	1% of set pressure

CROSBY STYLE HSL SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

Adjusting the nozzle and guide rings

The HSL pressure relief valve is supplied with two adjusting rings to allow adjustments affecting the opening and re-closing properties of the valve. The nozzle ring (4) and guide ring ((8) for F thru J orifices and (11) for K thru Q orifices) adjustments are made at the factory but resetting in service sometimes is necessary. Should it be necessary to adjust the rings in order to change blowdown or reduce valve simmer, the following steps should be taken:

CAUTION

Should any ring adjustments be made while the valve is installed on a pressurized vessel, the valve should be gagged. Care must be exercised to prevent excessive tightening of the gag that could damage the valve spindle and valve seats. However, sufficient force must be applied to the gag to prevent the valve from lifting. Whenever either the nozzle ring or the guide ring is adjusted, a record should be kept of the number of notches and the direction the ring was moved. This will make it possible to return to the original setting in case of an error.

IMPORTANT

Crosby Style HSL valves have the factory ring settings stamped on the machined surface on the bonnet, directly under the cap.

Guide ring adjustment

The guide ring is the principal blowdown control ring in the valve. To change the guide ring position, remove the guide ring set screw (9/12) and insert a screwdriver to engage one of the notches. Turning the guide ring to the right raises it and decreases the blowdown. Turning the guide ring to the left lowers the ring, thereby increasing the blowdown. The guide ring should never be moved more than ten notches either way without resetting the valve. After each adjustment always replace, tighten and seal wire the guide ring pin, being careful that its point fits in the notch in the ring, without making contact with the ring or bearing on top of a tooth.

Nozzle ring adjustment

The nozzle ring adjustment is determined carefully by factory testing and resetting in service seldom is necessary. Should it be necessary, the nozzle ring is adjusted by removing the nozzle ring set screw (5) and inserting a screwdriver to engage the ring notches. Turning the ring to the right raises and results in a strong 'pop' action that will increase blowdown. Moving the ring to the left lowers the ring, decreasing the blowdown and may result in excessive warn or simmer if lowered too far.

The range of adjustment of this ring is limited and it should not be moved more than one notch at a time from its set position. The valve performance should be checked after each adjustment. After each adjustment always replace, tighten and seal wire the guide ring pin, being careful that its point fits in the notch in the ring, without making contact with the ring or bearing on top of a tooth.

NOTE

It is very important not to allow the valve to pop prior to reinstalling the nozzle ring set screw.

Marking the new ring settings

If different ring settings are obtained after testing, re-stamp the valve bonnet with the new (tested) ring settings.

11 VALVE MAINTENANCE

The functioning and service life of a safety valve depends primarily upon methods used in its maintenance. For this reason, the following maintenance procedures are recommended. When possible, remove the valve from the system before dismantling. There should be no system pressure when a valve is dismantled in place or removed for shop repair.

Disassembly of cap and lifting lever gear

For parts identification, see Figures 1 and 2.

The cap and lifting lever gear consists of the cap (17/20), spindle nut (21/25) and spindle nut cotter pin (22/27), fork assembly [forked lever (20/23), forked lever pin (24/27) and cotter pin (23/26)] and the lever assembly [lever (19/22), lever pin (29/32) and cotter pin (23/26)]. The cap cannot be removed from the safety valve without first removing the fork assembly which is seal wired to prevent tampering with the adjusting bolt. To disassemble the cap and lifting lever gear, proceed as follows:

- A. Remove the fork pin cotter pin (23/26), forked lever pin (24/27) and forked lever (20/23).
- B. Loosen the two cap screws (18/30) and remove the cap (17/25) and lever assembly.
- C. Remove the spindle nut cotter pin (22/27) and unscrew the spindle nut (21/25) off the spindle (14/17).

To complete disassembly of the valve proceed as follows:

- A. Remove the nozzle ring set screw. Check the nozzle ring setting by turning the nozzle ring to the right and counting the number of notches turned until it makes contact with the disc. Record the number of notches. This location is given as minus (-) notches from this contact position.

Remove the guide ring set screw. Check the guide ring setting by returning the guide ring to its level position. The guide ring is in level position when the bottom face of the guide ring is level with bottom face of the disc. The guide ring position is recorded as minus (-)(down) or plus (+) (up) notches from this level position.

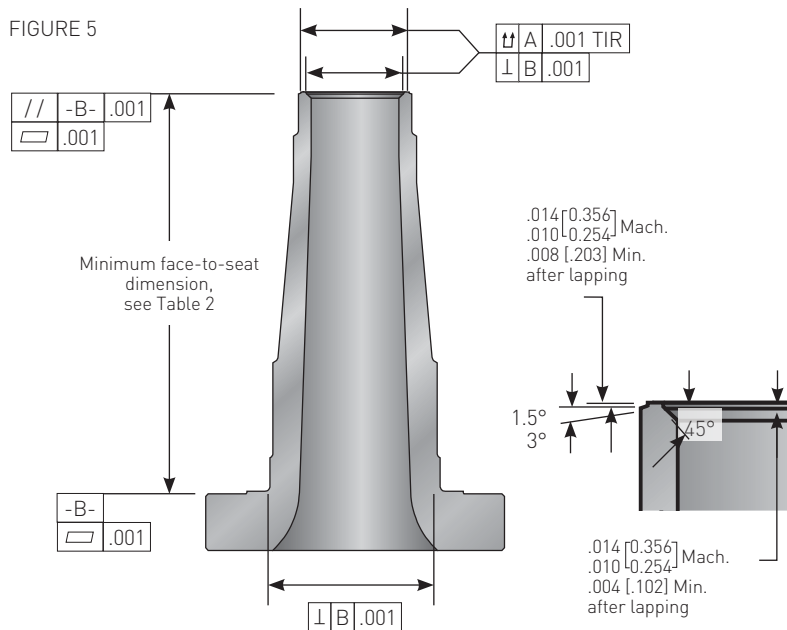
- B. Before releasing the spring load, measure and make note of the height of the adjusting bolt over the top of the bonnet. This information will help when reassembling the valve to its approximate original setting.
- C. Loosen the adjusting bolt nut. Count the number of turns required to remove the spring load by rotating the adjusting bolt in a counterclockwise direction.
- D. Loosen and remove bonnet stud nuts.
- E. Lift the bonnet straight up carefully to clear the spindle and valve spring. Exercise care when lifting the bonnet as the spring and spindle will then be free to fall aside.
- F. Lift the spring and spring washers off the spindle. 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.
- G. The disc holder assembly or disc and spindle can now be removed from the valve body by lifting the spindle.

CROSBY STYLE HSL SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

TABLE 2 - MINIMUM NOZZLE FACE TO SEAT DIMENSIONS

Orifice and series	Dimensions	
	NPS	DN
F -3(), -4()	3.826	97.181
G -3(), -4()	3.807	96.703
H -3(), -4()	4.160	105.664
J -3(), -4()	4.230	107.442
K -3(), -4()	4.762	120.955
L -3(), -4()	5.153	130.892
M -3(), -4()	5.934	150.724
N -3()	5.807	147.496
N -4()	6.240	158.496
P -3()	6.039	153.391
P -4()	6.275	159.385
Q -3()	8.082	205.283
Q -4()	8.515	216.281



- H. Remove the guide and guide ring from the body as an assembly and unscrew the guide ring from the guide.
- I. If the valve has a 2-piece disc holder, remove the disc insert cotter pin and the disc insert from the disc holder assembly.
- J. Remove the spindle from the disc holder assembly or disc by pulling up on the spindle rod to engage the spindle point threads in the disc holder. Turn the spindle counterclockwise while holding the disc/holder still and remove the spindle rod.
- K. Unscrew the nozzle ring from the nozzle.
- L. Unscrew the nozzle from the body (the Crosby Style HSL utilizes a removable full nozzle design).

Inspection and refurbishment

All the parts should be cleaned thoroughly. Guiding surfaces may be polished using a fine emery cloth. All parts should be examined to determine their condition. Inspection of valve components is important to ensure proper valve performance.

Measure the nozzle height using Table 2 and Figure 5. If the nozzle measures below the minimum dimension it should be replaced. Discs and disc inserts should be measured using Table 3 and Figure 8. Parts not meeting these dimensions should be replaced.

Spindles should be inspected to ensure they are straight using the TIR values found in Table 4. Use either V-blocks or chuck the spindle into a lathe and dial indicate to check for straightness. If necessary, the spindle may be straightened by applying force to the spindle until within tolerances. If it is not possible to straighten a bent spindle, it should be replaced.

Lapping valve nozzles and disc inserts

Good seating surfaces on the nozzle and disc insert are necessary for the valve to seal tightly when the valve is in the closed position. The HSL is a metal seated valve and the sealing surfaces of the nozzle and insert may be lapped to ensure a flat surface free from scratches and other imperfections. The sealing surface of the nozzle may be machined to remove deeper scratches or damage to the nozzle as long as the nozzle height exceeds the minimum dimensions (after machining) as shown in Table 2.

In the following sections you find information on lapping techniques, tools and materials. Lapping blocks are made of a special grade of annealed cast iron (see Figure 6). 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 the disc, or disc insert and/or the nozzle.

Before a lapping block is used, it should be checked for flatness and reconditioned after use on a lapping block resurfacing 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 7.

Lapping blocks and lapping block resurfacing plates are available from Emerson sales, service and distribution centers.

Experience has proven that medium coarse, medium, fine and polish lapping compounds will condition any damaged safety valve seat properly except where the damage requires machining.

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

LAPPING COMPOUNDS TABLE

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

CROSBY STYLE HSL SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

FIGURE 6

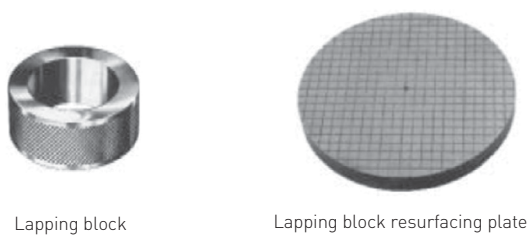


FIGURE 7

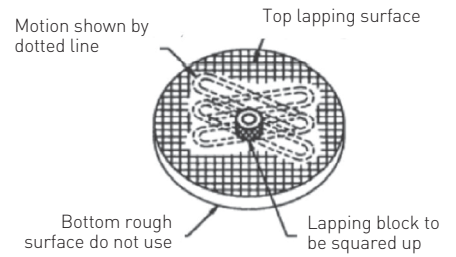


TABLE 3 - 'B' DIMENSION

Orifice	Dimensions	
	NPS	DN
F	.002	.051
G	.003	.076
H	.003	.076
J	.004	.102
K	.005	.127
L	.006	.152
M	.007	.178
N	.008	.203
P	.009	.229
Q	.012	.305

TABLE 4 - SPINDLE CONCENTRICITY (TIR) - DIMENSION

Orifice	Dimensions	
	NPS	DN
F	.002	.051
G	.002	.051
H	.002	.051
J	.003	.076
K	.003	.076
L	.002	.151
M	.003	.076
N	.003	.076
P	.003	.076
Q	.005	.127

Lapping procedure

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 or disc against the nozzle.

Lap each part separately against a cast iron lapping block of the proper size. These blocks hold the lapping compound in surface pores and must be reconditioned frequently. Lap the block against the seat. Never rotate the block continuously, but use an oscillating movement. Extreme care should be taken throughout to make certain the seats are kept perfectly flat.

- A. If considerable lapping is required, spread a thin coat of medium coarse lapping compound on the block.
- B. After lapping with this compound, lap again with a medium grade compound. The first step can be omitted unless much lapping is needed.
- C. Lap again using a fine grade compound.
- D. When all nicks and marks have disappeared, remove all compound from the block and seat.
- E. Apply polish compound to another block and lap the seat.
- F. As the lapping nears completion, only the compound left in the pores of the block should be present. This should provide a very smooth finish. If scratches appear, the cause is probably dirty lapping compound. These scratches should be removed by using compound free of foreign material.

Discs and disc inserts should be lapped in the same way as nozzles. The disc insert must be removed from the holder before to 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, affecting the action of the valve and is not recommended.

Machining nozzle seats

If machining of the nozzle seat or other major repairs is necessary, it is recommended that the valve be returned to a Emerson authorized 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.

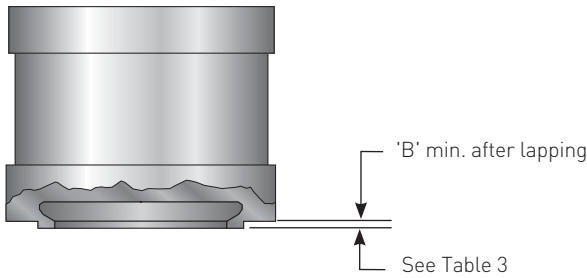
The most satisfactory way to machine a nozzle is to remove it from the body. However, it may also be machined while assembled within the valve body. In any event it is vitally important that the seating surfaces run absolutely true and the original nozzle profile is re-established as shown in Figure 5. Machining dimensions for Crosby Style HSL valves are shown in Table 2 and Figure 5. Remove only enough metal to restore the surface to its original condition. Turning to the smoothest possible finish will facilitate lapping. After machining, measure the nozzle height to ensure it still exceeds the minimum dimension from Table 2 and then lap the nozzle seat before re-installation into the valve body. The nozzle must be replaced when the minimum face to seat dimension is reached.

CROSBY STYLE HSL SAFETY VALVES

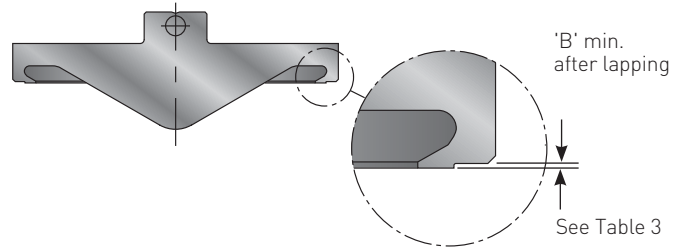
INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

FIGURE 8

F thru J orifice disc



K thru Q orifice disc insert



Refurbishing discs and disc inserts

When the damage to the disc or disc insert seat is too severe to be removed by lapping, the disc or disc insert should be replaced. Re-machining of the disc or disc insert seating surface is not recommended. The disc or disc insert seating surface may be lapped provided that the minimum overall disc height shown in Figure 8 is maintained.

Valve assembly

All components should be clean. Before assembling the following parts, lubricate with pure nickel 'Never-Seez' or equivalent.

- Nozzle and body threads
- Nozzle and body sealing surfaces
- All stud and nut threads
- Spindle bearing surfaces and threads
- Set screw threads
- Spring washer bevels
- Adjusting bolt and bonnet threads

For parts identification, refer to Figures 1 and 2.

- A. Before installing the nozzle, lubricate the flange surface in contact with the valve body and on the nozzle threads. Then screw the nozzle into the valve body and tighten until the nozzle flange is seated fully against the valve body.
- B. Screw the nozzle ring onto the nozzle.

Note: the top of the nozzle ring should be approximately one ring revolution above the nozzle seating surface.
- C. Thread the spindle assembly into the disc holder or disc. Turn the spindle until it drops off the internal threads and contact is made between the spindle ball and the disc or disc holder bushing.

Note: If spindle does not thread into disc, check the design version number in the model number for compatibility. Do not force the spindle to thread into the disc. Reference Valve Design Version and Interchangeability Section for more detail on the design version numbers, and contact Emerson to get the correct disc and spindle.
- D. If the valve has a 2 piece disc design, place the disc insert into the disc holder. Turn the insert until the alignment is achieved between the hole in the button end of the insert and the hole in the bottom end of the holder. Insert disc insert cotter pin to hold in place.
- E. Thread the guide ring onto the guide.
- F. Install the guide and guide ring assembly into the top of the body. The guide of valve should be seated directly on the top surface of the valve body. Maintain proper alignment between the guide and the body to ensure that the guide is seated correctly in the body.
- G. Lower the spindle and disc or disc holder assembly into the guide and onto the nozzle.
- H. Place the spring and washers assembly onto the spindle. Lower the bonnet over the spindle and spring, onto the bonnet studs in the body. In closed bonnet valves, the bonnet vent should be aligned with the valve outlet. Position the bonnet counter bore on the OD of the guide and lower the bonnet onto the guide.
- I. Screw the bonnet stud nuts onto the bonnet studs and tighten down evenly to prevent unnecessary strain and possible misalignment.
- J. Lift the disc insert slightly by lifting the spindle rod. Lower the nozzle ring below the seats. Release the spindle slowly to permit the disc insert to contact the nozzle seat gently. Check that the nozzle ring moves freely.
- K. Screw the adjusting bolt and nut into the top of the bonnet the same number of turns originally required to remove the spring load. The original set pressure can be approximated by screwing the adjusting bolt down to the height above the bonnet measured during disassembly.
- L. Move the nozzle ring up until it touches the disc holder. From this position lower it to the original recorded position. Move the guide ring until the bottom of the guide ring is at the same level as the bottom face of the disc or disc holder assembly. If the guide ring position originally recorded is a positive number, raise the guide ring by the number of notches indicated. If a negative number, lower the ring that number of notches. Rings are moved up by turning them to the right and lowered by turning them to the left.
- M. Screw the set screws into the body, engaging both the nozzle ring and the guide ring. Both rings should move back and forth slightly after the set screw is tightened.
- N. The valve is now ready for testing per test procedure T-16758. After testing, the following steps should be taken:
 1. Be sure that adjusting bolt nut is locked.
 2. Install the cap assembly (see overleaf).
 3. Seal wire the cap and set screws to prevent tampering.

For test/adjustment procedures refer to page 6.

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Assembly of the lifting lever cap

The assembly of the cap is referred to several times in this instruction. The cap and lifting lever gear consists of the cap, spindle nut and spindle nut cotter pin, fork assembly: forked lever, forked lever pin and cotter pin, and the lever assembly: lever, lever pin and cotter pin. The cap cannot be removed from the safety valve without first removing the fork assembly, which is seal wired to prevent tampering with the compression screw. To assemble the cap and lifting lever gear, proceed as follows:

- A. Screw the spindle nut onto the spindle.
- B. Place the cap on the bonnet.
- C. Install the forked lever and forked lever pin.
- D. Attach the lever to the cap using the lever pin and secure the lever pin with the lever pin cotter.
- E. Adjust the spindle nut until the forked lever rests on the lever and there is a 1/16 inch (1.6 mm) minimum of play between the forked lever and the spindle nut. The spindle nut is adjusted by removing the fork pin, forked lever and cap. When the spindle nut is in proper adjustment, install the spindle nut cotter pin.
- F. Replace the cap and forked lever and install the forked lever pin and fork pin cotter.
- G. Position the lever opposite the valve outlet; install the two cap set screws and tighten them against the groove in the top of the bonnet.

Sealing and name plating a repaired valve

After the valve has passed the set pressure and seat tightness test successfully, the externally adjustable elements of the valve should be sealed, typically with sealing wire and a lead seal. For HSL valves, the guide and nozzle ring adjustment screws should be seal wired as well as the cap. This will prevent unauthorized personnel from making adjustments to the valve after it has been serviced. This also will provide identification of the repair organization who last serviced the valve.

It is customary and prudent to attach a repair nameplate to the valve after servicing to serve as a record of when service has been performed to the valve. Most repair certification programs, such as the NBBI 'VR' program, provide specific minimum requirements for their program and guidelines for use of their certification mark.

At minimum, it is best practice for the repair nameplate to provide:

1. The name of the repair company
2. The date of the repair
3. The set point at which the valve was tested
4. A unique number to enable traceability of the repair

NOTE

The original nameplate affixed to the valve when first built should never be removed from the valve. The repair nameplate (or any other informational nameplates) should be attached in addition to the original nameplate not in place of the original.

11 VALVE DESIGN VERSION AND INTERCHANGEABILITY

The design version number is used to distinguish specific versions of the HSL valve design where the updated parts are not interchangeable with the previous version. The design version number is needed for reference when ordering spare parts and servicing the valve. If the design version does not match the current design version, new spare parts may not be compatible in the valve and the valve may need to be upgraded to the new version. The design version number will be at the end of the model number, and any model number with no design version number will be considered "-01".

Reference Table 5 for current version of HSL design.

TABLE 5 - DESIGN VERSION TABLE

Pressure Class	Orifice									
	F	G	H	J	K	L	M	N	P	QQ
300#	02	02	02	02	01	01	01	01	01	01
600#	02	02	02	02	01	01	01	01	01	01

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