



CROSBY® STYLES HC AND HCA ISOFLEX™ SAFETY VALVES INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

Before installation these instructions must be read fully and understood

TABLE OF CONTENTS

1. Style HC/HCA ISOFLEX - parts.....	2
2. Introduction	3
3. Description of safety valve	4
4. Storage.....	4
5. Installation.....	5
6. Hydrostatic testing.....	6
7. Operation	9
8. Testing.....	10
9. Valve maintenance	12
General information.....	12
Disassembly	12
Repair procedure	14
10. Valve assembly.....	16
11. Spare parts	18
12. Field service requirements.....	19
13. Maintenance equipment.....	19

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.

NOTE

An operating procedure or condition which is highlighted, underlined or printed in bold type for emphasis.

These precautionary statements are by no means exhaustive. Emerson cannot be expected to know, evaluate and advise customers of all conceivable ways in which tasks might be performed, or of the possible hazardous consequences of each way.

Consequently, Emerson has not included such comprehensive evaluation and disclaims liability for work performed by other than Emerson personnel. All personnel working with Crosby products should be trained adequately and be thoroughly familiar with the contents of this manual.

Emerson cannot evaluate all conditions that might injure personnel or damage equipment.

However, Emerson does offer the following general safety precautions:

- Hearing and eye protection should be used when working on a valve which is under pressure.
- Never strike a valve which is under pressure. Premature actuation can result.
- Never stand in front of the discharge outlet of a pressure relief valve which is under pressure.

Always approach and use any pressure relief valve with great care.

Often, the safety of lives and property depends on the proper operation of the safety valves. Consequently, the valves should be kept clean and should be tested periodically and reconditioned to make sure they function properly.

WARNING

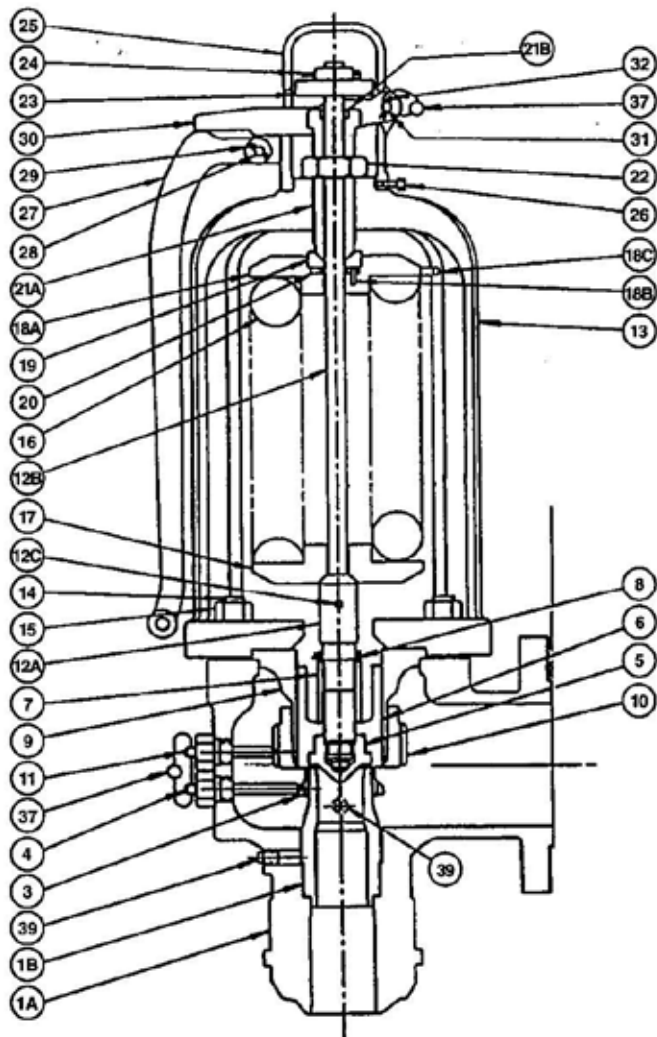
Suitability of the material and product for the use contemplated by the buyer is the sole responsibility of the buyer. Also storage, installation and proper use and application are the sole responsibility of the purchaser. Emerson disclaims any and all liability arising out of same. Any installation, maintenance, adjustment, repair and testing performed on safety 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 sales office or our factory for a service engineer should you wish assistance with your field needs.

Engineering Doc. #IS-V3147A

CROSBY® STYLES HC AND HCA ISOFLEX™ SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

FIGURE 1 - STYLE HC ISOFLEX SAFETY VALVE



PARTS LIST

Part	Part name	Spare parts*
1A	Body	
1B	Nozzle	
3	Nozzle ring	3
4	Nozzle ring set screw	
5	Disc insert	1
6	Disc holder	2
7	Disc holder retaining nut	
8	Disc holder retaining cotter	1
9	Guide	3
10	Guide ring	3
11	Guide ring set screw	
12A	Spindle point	3
12B	Spindle rod	3
12C	Spindle rod pin	3
13	Bonnet	
14	Bonnet stud	
15	Bonnet stud nut	
16	Spring	3
17	Bottom spring washer	3
18A	Top spring washer	3
18B	Bearing pin	3
18C	Locking pin	3
19	Bearing adapter	
20	Bearing	
21A	Adjusting bolt	
21B	Adjusting bolt bearing	
22	Adjusting bolt nut	
23	Spindle nut	
24	Spindle nut cotter	1
25	Cap	
26	Cap set screw	
27	Lever	
28	Lever pin	
29	Lever pin cotter	1
30	Forked lever	
31	Forked lever pin	
32	Forked lever pin cotter	1
34	Test clamp	
36	Test rod	
37	Seal and wire	
38	Protective hood	
39	Drain plug	
40	Hydro test plug assembly	
41	Nameplate	
42	Drive screw	
43**	Cooling spool	
44**	Cooling spool stud	
45**	Cooling spool stud nut	

NOTES

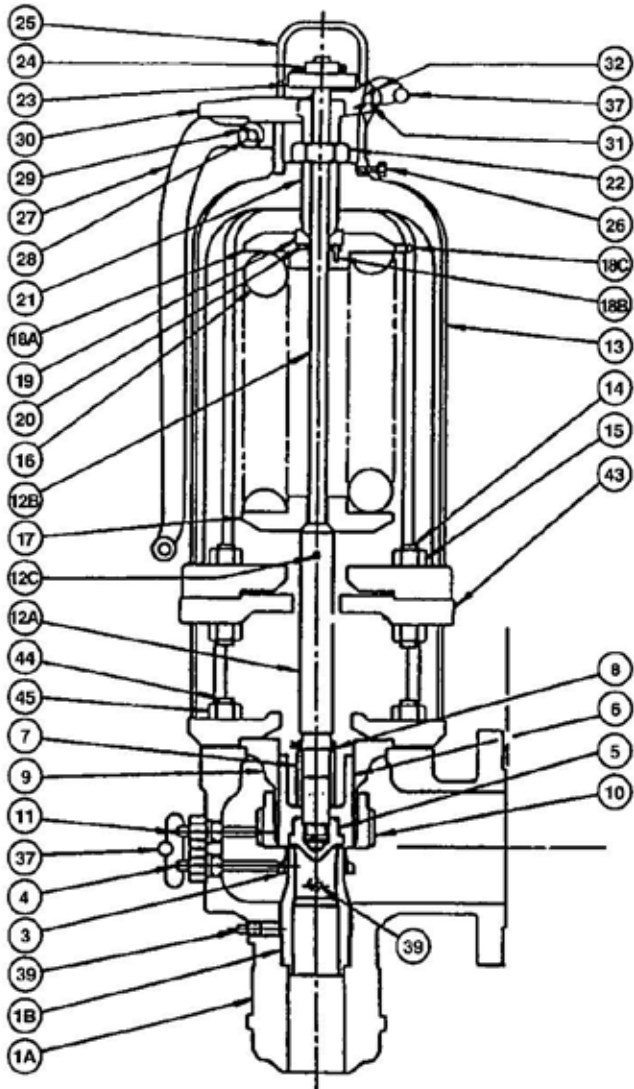
* Spare parts designation (see notes 1, 2, 3 in Section 2)

** For Crosby Style HCA ISOFLEX only

CROSBY® STYLES HC AND HCA ISOFLEX™ SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

FIGURE 2 - STYLE HCA ISOFLEX SAFETY VALVE



2 INTRODUCTION

Crosby Style HC and HCA ISOFLEX safety valves have been selected because of their performance features, reliability and ease of maintenance.

This manual contains information on installation, hydrostatic testing, field testing and adjustments and maintenance of these valves. It is specific to the Isoflex design K through M₂ orifice sizes. Adherence to the installation and maintenance procedures specified in this manual will provide the utmost in safety, a minimum of maintenance and a long service life.

Style HC is a high capacity reaction type safety valve designed for saturated and superheated steam applications to temperatures of 750°F. Crosby Style HCA is a high temperature version of the Style HC, with an alloy steel construction suitable to temperatures up to 1020°F. Typically Style HCA valves are used for superheaters and reheater outlets.

Details of Style HC and HCA safety valves, materials of construction, sizes, pressure-temperature ratings, dimensions, weights and certified capacities are available on request. No special tools are necessary for the maintenance of Style HC and HCA safety valves. However, tools and equipment are available to ease disassembly and on site testing of the valves. Such tools and equipment include the hydraulic set pressure device, the air set pressure device (see Figure 15) and the hydraulic jacking device (see Figure 14). Detailed instructions on their use can be found in instructions I-11288, T-1652 and I-1167 respectively.

Whenever Style HC/HCA safety valve parts names are used in this manual, parts numbers in parenthesis follow. The parts numbers are an aid to identifying the parts in Figures 1 and 2 and the correlating parts list.

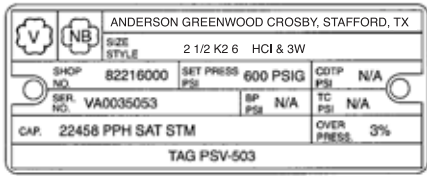
NOTES

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.

CROSBY® STYLES HC AND HCA ISOFLEX™ SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS



Crosby Style HC/HCA ISOFLEX nameplate
(With sample information for illustrative purposes only)

Ordering spare parts

When ordering spare parts, the valve size, style and shop number and/or serial number should be given together with set pressure, part name and reference number. The valve assembly number is shown on the valve nameplate as 'Shop number'. Spare parts may be ordered from any Emerson sales office or representative.

3 DESCRIPTION OF SAFETY VALVES

Crosby Style HC/HCA safety valves are shown in Figures 1 and 2. These drawings illustrate the safety valves assembled in cross-section, and cover the essential elements of the valves. Approved drawings supplied with the valves should be used when installation and/or specific information is required. Inside the body (1A) is housed the upper portion of the nozzle (1B), nozzle ring (3), and the guide ring (10). The disc insert (5) is held in place in the disc holder (6) by the spindle and disc holder retainer nut (7). The nozzle ring and adjusting rings are held in place by the nozzle ring set screw (4) and the guide ring set screw (11), which are threaded into the body.

The guide (9) is retained between the body (1A) and the bonnet (13) by the bonnet studs (14) and the bonnet studs nuts (15). In the case of Style HCA valves, a cooling spool (43) is placed between the body and bonnet to protect the spring from exposure to extreme temperatures. The bonnet (13) contains the spring (16), spring washers (17 and 18) and the spindle assembly (12). The spindle point is held in compression between the back face of the disc insert (5) and the bottom spring washer. The spring is compressed between the stationary point of contact with the spindle and the adjusting bolt (21A) atop the valve bonnet. The adjusting bolt (21A) is locked in place by the adjusting bolt nut (22) on top of the bonnet and within the cap assembly. A means of manual lifting is provided by the lever (27), lever pin (28), forked lever (30), forked lever pin (31) and the spindle nut (23).

4 STORAGE

Often, safety valves are on the job site months before they are installed. Unless they are stored properly and protected, their performance may be affected seriously. Rough handling may damage flanges or cause misalignment of the parts. It is best to leave the safety valves in their shipment cases and store them in a dry place under cover until they are to be installed.

FIGURE 3 - VALVE BODY AS SHIPPED

TOP VIEW - BODY



HYDRO COMPONENTS (see note 1, page 5)



FIGURE 4 - VALVE SUPERSTRUCTURE AS SHIPPED



CROSBY® STYLES HC AND HCA ISOFLEX™ SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

Factory preparation of welded inlet valves for shipment

All Crosby Style HC and HCA welded inlet safety valves are equipped with hydrostatic test plugs and shipped in two parts: valve body and valve superstructure. This makes handling easier for installation welding (see Figures 3 and 4).

The welded inlet Style HC and HCA safety valves are specially prepared for shipment from the factory.

After the safety valve is tested as a complete assembly for set pressure and tightness, the spring set compression is held by spacer blocks under the bottom spring washer as illustrated in Figure 4.

The safety valve superstructure is then removed from the valve body. The two portions are boxed and shipped separately. Each portion, ready for shipment, is illustrated in Figures 3 and 4.

Figure 3 shows the safety valve body as shipped to the installation site. It is tagged as follows:

- Install and/or weld in place as required
- Prepare for hydrostatic test. See instruction Hydrostatic plug in place
- Install O-ring and backup ring prior to hydrostatic test.

Figure 4 shows the safety valve superstructure as shipped to the installation site. It is boxed separately from the valve body and is tagged as follows:

- Hold for assembly after hydrostatic test.

NOTES

Note 1 to Figure 3

Delivered with the body and packaged in small bag are the following:

- One O-ring (for hydrostatic test)
- One backup ring (for hydrostatic test)
- One hydrostatic test plug pin

Note 2 to Figure 4

Delivered with the superstructure and packaged in a small box are the following:

- Valve nozzle ring*
- Valve nozzle ring set screw*
- Valve guide ring set screw*
- Seal wires

* Marked with valve identification number.

NOTE

When the above parts are removed from their boxes, be sure that the identification of parts to valve number is maintained and that the parts are stored to facilitate later recovery for assembly.

5 INSTALLATION

Inlet piping

Many safety valves are damaged when first placed in service because of failure to clean the connections properly before installation.

The safety valve inlet, the vessel and the line on which the safety valve is mounted must be cleaned thoroughly of all foreign matter.

Safety valves should be mounted in a vertical position, directly on the pressure vessel.

The ASME boiler and pressure vessel code limits the distance between the safety valve inlet and the boiler to the length of a standard tee fitting.

The nozzle should have a well-rounded approach that provides smooth, unobstructed flow between the vessel and the safety valve.

A safety valve should never be installed on a fitting having an inside diameter smaller than the inlet connection of the valve.

Such restriction of flow can cause faulty valve operation.

Inlet piping (nozzles) must be designed to withstand the total resultant forces due to the safety 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 safety valve and the discharge piping. Determination of outlet reaction forces is the responsibility of the designer of the vessel and/or piping.

Outlet piping

Discharge piping should be simple and direct. Back pressures built up by discharge flow affect the operation of safety valves.

Where possible, a short vertical pipe connected through a long radius elbow discharging directly into the atmosphere is the most desirable type of outlet piping.

Discharge piping should not impose any loading on the safety valve. Excessive discharge piping loads may cause seat leakage or faulty valve operation. The inside diameter of the discharge pipe must never be less than that of the safety valve outlet.

Valve effluent must discharge to a safe disposal area.

Safety valve bodies have pipe thread openings for drains. These should be connected to prevent any accumulation of fluid in the valve body. In addition, discharge piping also should be drained to prevent any accumulation of fluid. Care must be taken to ensure that the drains are directed or piped to a safe disposal area.

Welding of welded inlet valve body to boiler

Welded inlet safety valve bodies should be welded to the boiler in accordance with applicable Code requirements. The protective cover (Figure 3) should be left in place until ready for the hydrostatic test of the unit.

If visual inspection is necessary, the protective cover may be removed, but should be replaced.

CROSBY® STYLES HC AND HCA ISOFLEX™ SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

6 HYDROSTATIC TESTING

General information

Depending on the type of inlet, hydrostatic testing of safety valves may be carried out by one of three means: blank flanges, test plugs or test gags. In all cases, hydrostatic test pressure must be limited to 1½ times the nameplate set pressure of the valve.

CAUTION

Additionally, hydrostatic test pressure must be limited to 10% above nameplate set pressure when a test gag is used.

Welded inlet safety valves

All Style HC/HCA welded inlet safety valves are prepared for shipment from the factory with hydrostatic test plugs, as detailed in Section 4 - paragraph 'Factory preparation of welded inlet valves for shipment' and Figure 3. Hydrostatic tests of these valves shall be conducted using hydrostatic test plugs as detailed in paragraph below 'Hydrostatic testing using hydrostatic test plugs'.

Flanged inlet safety valves

Flanged inlet safety valves should not be installed for hydrostatic testing. Blank flanges should be used instead of gagging the safety valves. This prevents possible damage to the safety valves due to excessive tightening of the gag screws or leakage during hydrostatic test which may result in costly repairs. Blank flanges must be removed and the safety valve reinstalled before the vessel is placed in service. If blank flanges are not used and the safety valves are to be installed for hydrostatic tests, Emerson recommends that hydrostatic test plugs be used for hydrostatic test. The detailed procedure is outlined in the paragraph following. Hydrostatic test plugs for flanged valves are optional equipment and are provided only when ordered.

Hydrostatic testing using hydrostatic test plugs

Before imposing the hydrostatic test pressure on the vessel or system, perform the following operations:

CAUTION

Before hydrostatic testing, the O-ring and backup ring must be installed.

• Preparation for hydrostatic testing - Welded inlet safety valves

The O-ring, backup ring and the test plug pin are shipped in a box attached to the superstructure (see Figure 3). The contents of the box are marked for identification. To install the O-ring and backup ring refer to Figure 3.

Remove the protective cover from the valve body. Unscrew the cap from the nozzle. Remove the test plug from the nozzle bore.

• Preparation for hydrostatic testing - Flanged inlet safety valves

Flanged inlet safety valves are shipped from the factory fully assembled. To use the hydrostatic test plug, the valve must be disassembled according to Section 9 - paragraph 'Disassembly retaining spring compression'.

• Installation of hydrostatic test plug (see Figure 3)

Inspect the hydrostatic test plug O-ring groove.

Note: make sure the groove in the plug is clean.

Install the O-ring and backup ring in the test plug groove.

CAUTION

Be sure the test plug is seated on the 45° angle on the nozzle inside diameter.

Replace the test plug in the nozzle bore. Place the test plug cap over the plug and screw it down hand-tight.

CAUTION

Make sure the cap has hand-tight contact with the plug. Make sure there is enough thread engagement of the cap onto the nozzle.

Install the test plug pin. The valve is now ready for hydrostatic test.

• Hydrostatic test

After the above preparation, the safety valve is ready for hydrostatic test. Observations should be made at the start of the test to confirm that the O-rings have been installed properly and there is no leakage when pressure is applied.

CAUTION

Tightening of the cap will not reduce leakage. If leakage is evident, remove all pressure from the vessel or system. Replace the O-ring and the backup ring.

WARNING

Do not try to assemble the valve or remove the steel blocks from under the bottom spring washer without use of proper servicing and assembly equipment.

• Assembly of valve

After completion of the hydrostatic test, remove the hydrostatic test plug from the nozzle.

To aid removal, place the hydrostatic test plug pin in the hole in the plug extension. Unscrew the cap, which will engage the plug pin and exert an upward force as the cap is turned, thus lifting the plug. Remove from the valve nozzle.

Clean the nozzle bore and seat and inspect the seating surface. If seating surfaces are damaged, repair according to the directions in Section 9 - paragraph 'Repair procedure'. Assemble the valves according to the instructions in Section 6 - paragraph 'Initial safety valve assembly'.

Contact Emerson field service for service equipment (see Section 12 - paragraph 'Service equipment available').

CROSBY® STYLES HC AND HCA ISOFLEX™ SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

NORMAL GAGGING LOAD in ft-lb OF TORQUE (Nm) VS. ΔP

ΔP (Overpressure less valve set pressure) psi (bar)	Orifice psi (bar)			
	K	K ₂	M	M ₂
50 (3.45)	1 (1.4)	1 (1.4)	2 (2.7)	2 (2.7)
100 (6.89)	2 (2.7)	3 (4.1)	4 (5.4)	4 (5.4)
150 (10.34)	2 (2.7)	4 (5.4)	5 (6.8)	6 (8.1)
200 (13.79)	3 (4.1)	5 (6.8)	7 (9.5)	8 (10.8)
250 (17.24)	4 (5.4)	6 (8.1)	9 (12.2)	10 (13.6)
300 (20.68)	5 (6.8)	7 (9.5)	11 (14.9)	12 (16.3)

Hydrostatic test using gag

The safety valve test gag shown in Figure 5 can be used with both welded and flanged inlets, but at pressures no greater than 10% above the nameplate set pressure.

Gagging should be done very carefully in order not to overload the valve spindle or cause damage to the valve seats.

The following outlines the recommended procedure for gagging valves for hydrostatic test:

CAUTION

Gags should not be used when inlet pressures are more than 10% greater than the safety valve set pressure. Damage to the valve may result.

- Remove the lever (27), forked lever (30), cap (25) and spindle nut (23).
- Refer to Figure 5. Lubricate the threads and pointed end of the gag screw. Install the gag in place, being careful that the legs fit uniformly. Contacts on both legs of the gag should seat evenly on the underside of the bonnet top.
- Tighten the gag finger-tight only at this point.
- Raise the system pressure to approximately 100 psig below the nameplate set pressure of the safety valve.
- Apply the necessary torque to the gag in accordance with the value shown in the table above for the specific orifice size. This torque value is determined as follows:
 - Determine Δ by subtracting the valve set pressure from the hydrostatic test pressure.
 - Read the value of Δ on the vertical scale. Proceed horizontally to the appropriate orifice size and then down to read the torque on the horizontal scale.
 - The torque values [foot-pounds] obtained should be increased by a factor of approximately 25% to account for normal variations in friction, safety valves and test conditions.

- After applying the necessary torque to the gags, increase the hydrostatic test pressure to the required amount. Observations should be made during the rising pressure cycle to determine if any of the safety valves show seat leakage.

CAUTION

Should any safety valve show seat leakage, the pressure must be lowered until the leakage stops.

- The torque should then be increased on the gag about 10% above the initial torque value.

CAUTION

Never increase the gagging load while a safety valve shows seat leakage. This can result in damage to the valve seats and bending of the spindle.

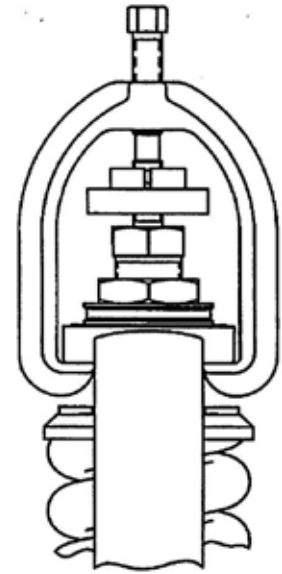
- After the hydrostatic test, the pressure on the system should be dropped to approximately 100 psi below the nameplate set pressure of the safety valve. The gags should be loosened at this point and removed from the valves.

CAUTION

Valve gags should not be left on the valves in a gagged or loaded position for an extended period or under conditions where large thermal variations are expected.

- After the hydrostatic test, the gag should be removed and the cap reinstalled according to Section 10 - paragraph 'Assembly of cap'.

FIGURE 5 - VALVE GAG POSITION GAG EVENLY ON BONNET



CROSBY® STYLES HC AND HCA ISOFLEX™ SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

Initial safety valve assembly

After hydrostatic testing using hydrostatic test plugs, the safety valves should be assembled.

NOTE

It is recommended that, on completion of all hydrostatic tests using hydrostatic test plugs on new installations, a Emerson service technician be present for assembly of the safety valves [see Section 12 - 'Field service requirements'].

Check the valve identification numbers and match the proper valve superstructure to each valve body.

The nozzle ring (3) and the set screws (4 and 11) are packaged together and shipped with the superstructure as shown in Figure 4.

CAUTION

Each valve superstructure, nozzle ring and set screw is identified and matched to a specific valve body by a tag number and should be assembled accordingly. Although all parts have been cleaned thoroughly, inspected, lubricated and protected for shipment, the parts should be inspected before installation for evidence of foreign matter or damage. Special attention should be given to the seating surfaces of the disc and nozzle. These seats should be free from surface damage. If cleaning or repair is necessary refer to Section 9 - paragraph 'Repair procedure'.

Initial assembly

Remove the body protective cover [see Figure 3].

Take the nozzle ring (3), nozzle ring set screw (4) and guide ring set screw (11) from their package (see Figure 4). Match the set screws to the body (1A) and bonnet (13) valve identification markings.

Screw the nozzle ring (3) onto the nozzle (1B).

NOTE

The top of the nozzle ring (3) should be about one ring revolution above the nozzle (1B) seating surface.

Remove the guide (9) and guide ring (10) from the superstructure. The guide ring should be screwed onto the guide. Install the guide and guide ring assembly into the top of the body (1A). Make sure the guide is seated correctly in the body. Make sure that the nozzle (1B) and disc insert (5) seats are clean and undamaged. If cleaning or repair is necessary refer to Section 9 - paragraph 'Repair procedure'.

Remove the lever (27), forked lever (30) and cap (25) from the valve superstructure. Do not remove the spindle nut (23).

Using a suitable lifting device, lift the valve superstructure with the spindle assembly (12) vertical. Inspect and clean the guide-to-bonnet fit and the body-to-guide fit. Position the superstructure so the valve identification number stamped on the bonnet (13) is opposite the valve outlet.

Lowering the valve superstructure slowly, carefully lower the disc holder (6) into the guide (9).

CAUTION

Do not permit any rocking motion of the spindle (12) or any other part while lowering the superstructure into the body (1A). Any rocking motion could damage the valve seats.

After the superstructure is in place, inspect to be sure the bonnet (13) is fully seated on the guide (9).

The nozzle ring (3) should now be lowered.

Lift the disc insert (5) slightly off the seat by lifting the spindle assembly (12).

Place a screwdriver in the lower set screw hole.

Turn the nozzle ring to the left (clockwise) with the screwdriver until the top edge of the nozzle ring is below the nozzle (1B) seating surface.

The location can be checked by looking in through the upper set screw hole while shining a light through the lower set screw hole.

Lower the spindle assembly slowly until it bottoms. Check that the nozzle ring moves freely.

Rotate the spindle clockwise several revolutions to make sure that it is seated fully on the disc insert and that the threads of the spindle are not engaged.

The seating surfaces are now in full contact.

Install the bonnet stud nuts (15) on the bonnet studs (14) and tighten uniformly in accordance with Figure 6.

It is now necessary to remove the spacer blocks under the bottom spring washer (17), thereby transferring the spring load to the valve seats.

This should be done using the hydraulic jacking device (see Figure 14). Refer to instruction I-1167 for detailed instructions in the use of this device.

After the spacer blocks have been removed, set the nozzle ring (3) and guide ring (10) according to Section 10 - paragraph 'Setting of rings'.

Lock the nozzle ring set screw (4) and the guide ring set screw (11) in place, making sure that the proper set screws are installed and engaged fully in a notch. Lock wire them in place and seal.

CROSBY® STYLES HC AND HCA ISOFLEX™ SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

Stud thread	Torque (ft-lb) (Nm) to produce stress in stud bolts		
	30.000 psi (2.068 bar)	45.000 psi (3.203 bar)	60.000 psi (4.137 bar)
	Stress ft-lb (Nm)	Stress ft-lb (Nm)	Stress ft-lb (Nm)
5/8-11	60 (81)	90 (122)	120 (163)
3/4-10	100 (136)	150 (203)	200 (271)
7/8-9	160 (217)	240 (325)	320 (434)
1-8	240 (325)	370 (502)	500 (678)
1 1/8-8	350 (475)	525 (712)	700 (949)

Complete the valve assembly with the cap assembly as described in Section 10 - paragraph 'Assembly of cap' and seal wire the cap set screws.

NOTES

1. Valve studs and nuts shall be clean and inspected visually to ensure freedom from any objectionable foreign matter, rust, burns or physical damage.
2. With the bonnet in place, lubricate the bonnet studs threads, the nut threads and nut face with 'Never-Seez' compound (which conforms to Government specification MIL-A-907B, Federal stock number 803-286-5453) or equivalent.
3. Install nuts on the studs finger-tight.
4. Tighten the nuts in the sequence shown in Figure 6 to approximately one-half the torque value shown in the table. Repeat the same sequence of tightening to the torque value shown. Then, starting with the number 1 nut, tighten each nut in order in a clockwise or counterclockwise direction to the value shown in the table above.
5. Wipe off excess lubricant.

7 OPERATION

Crosby Style HC/HCA safety valves open with a sharp pop at the set pressure and remain open, relieving rated capacity at 3% overpressure. As inlet pressure decays below the opening pressure, the safety valve remains open until a pressure about 4% below the set pressure is reached. At that point, the safety valve closes sharply.

The sharp opening is produced in two stages. The initial lift is produced when the steam pressure under the disc insert (5) exceeds the spring pressure. To aid in starting the popping action, steam escapes between the safety valve seats and is deflected by an angle on the nozzle ring (3) as shown in Figure 7. This escaping steam acts on the face of the disc holder (6) causing an unbalance and the safety valve pops open. As the disc holder moves vertically, steam begins to react against the guide ring (10) and to push the disc holder up to a high lift as shown in Figure 8. The reaction of the deflected steam pushes against the underside of the disc holder and lifts it still higher on an accumulation of pressure. As the boiler pressure drops, the safety valve disc insert (5) settles to a moderate lift and closes sharply.

The nozzle ring (3) is primarily for ensuring sharp opening action. Raising the nozzle ring, bringing it closer to the face of the disc holder (6), eliminates 'simmer' or 'warn'. The guide ring (10) is primarily for controlling blowdown. Raising the guide ring reduces the reactive pressures against the disc holder and reduces blowdown. Lowering the guide ring increases the reactive pressures against the disc holder and increases the blowdown.

FIGURE 6 - TIGHTENING OF BONNET AND/OR COOLING SPOOL STUD NUTS

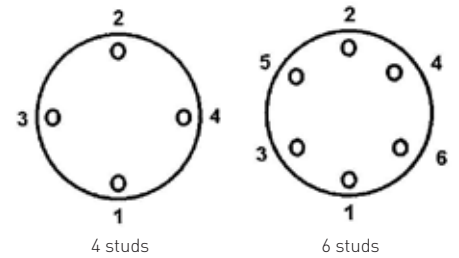


FIGURE 7 - EFFECT OF NOZZLE RING

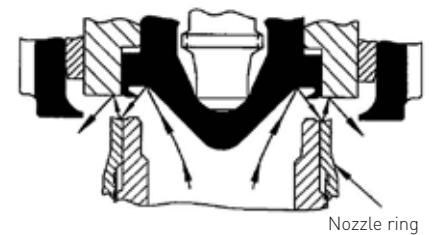
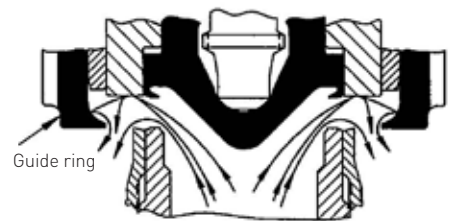


FIGURE 8 - EFFECT OF GUIDE RING



CROSBY® STYLES HC AND HCA ISOFLEX™ SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

8 TESTING

Set pressure testing and valve adjustments

The set pressure of a safety valve may be checked without removing the valve from the system by two methods described in the following paragraphs:

• Set pressure lift assist device

The first method of set pressure testing is with the use of a set pressure lift device. This allows set pressure testing of the safety valves on the system at pressures below normal system operating pressures. Two devices are available for use on Crosby Style HC/HCA safety valves: the air set pressure device and the hydraulic set pressure device. Refer to test procedure T-1652 for detailed instructions in the use of the air set pressure device and instruction I-11288 for detailed instructions in the use of the hydraulic set pressure device.

• System pressure

The second method of set pressure testing is by raising the system pressure and popping the safety valve. Set pressure testing using this method will determine the safety valve set and closing pressure (blowdown).

WARNING

Never strike a valve which is under pressure. Premature actuation can result.

Setting the safety valve with the set pressure lift device is recommended before raising the system pressure for popping pressure testing. This allows the set point to be established without raising and lowering system pressure several times to determine the safety valve set pressure.

Before set pressure testing and raising the system pressure, the following items should be checked:

- A pressure gauge with known accuracy should be located on the system being tested.
- Outlet piping should be anchored sufficiently to prevent any vibrations while the safety valve is discharging. The outlet piping should be direct and there should be no obstructions to restrict the safety valve discharging.

- Set screws should be tight and lock wired. The tapped holes in the body for drains should be connected to the drain or plugged.
- Lifting gear should be fastened securely to the safety valve to assist personnel testing the valve. A rope may be attached through the hole provided in the lever should mechanical lifting be necessary.
- Communications should be set up between the control room and personnel in the test area.

WARNING

Hearing and eye protection should be used when working on a valve which is under pressure. Never stand in front of the discharge of a safety valve which is under pressure.

CAUTION

All safety valves on the system except the valve that is to be popped should be gagged. System pressure should be 70% of valve set pressure before gagging to prevent added loads from being applied to the valve spindle due to thermal expansion. Gagging must be done with care not to overload the spindle since considerable damage may occur to the spindle and other valve internals. However, a minimum torque should be applied to the gag by hand to ensure that the valve will not open.

Install the gags as follows (refer to Figure 5):

- Remove the lever (27), forked lever (30), cap (25) and spindle nut (23).
- Lubricate the threads and pointed end of the gag screw.
- Install the gag in place, being careful that the legs fit uniformly. Contacts on both legs of the gag should seat evenly on the underside of the bonnet (13) top.
- Tighten the gag finger-tight.

Raise the system pressure until the safety valve pops.

Record the popping and reseating pressures (pressure at which the safety valve closes sharply).

CROSBY® STYLES HC AND HCA ISOFLEX™ SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

• Set pressure adjustment

If the safety valve pops before the nameplate set pressure is reached, or if it does not pop at the nameplate set pressure, the following steps for set pressure adjustment should be taken:

WARNING

Set pressure adjustment should not be made until the system pressure is 10% to 20% below the actual popping pressure of the safety valve. The adjusting bolt should never be turned when the vessel pressure is near the set pressure of the safety valve.

- Remove the lever (27), forked lever (30) and cap (25).
- Loosen the adjusting bolt nut (22).
- If the safety valve has popped below the set pressure stamped on the valve nameplate, an increase in set pressure is necessary. This is obtained by turning the adjusting bolt (21) clockwise (compressing the spring). If the safety valve popped above the nameplate set pressure, decrease the set pressure by turning the adjusting bolt counterclockwise (relieving spring compression).
- After each adjustment, the adjusting bolt nut (22) should be tightened securely to prevent loosening of the bolt. The lifting gear should be reinstalled.
- After the safety valve has been adjusted to open at the desired pressures, remove the lifting gear and make sure the adjusting bolt nut (22) is installed properly and tightened. Install the cap assembly (25) according to Section 10 - paragraph 'Assembly of cap', making sure there is approximately 1/16" clearance between the spindle nut (23) and the forked lever (30). Seal wire the cap screws (26) and set screws (4 and 11).

The nozzle ring and guide ring settings are determined at the factory. Their locations are stamped on the valve bonnet (13) where the cap is seated. Adjusting (guide) ring positions are recorded as plus (+) or minus (-) numbers from the level position. An illustration of the guide ring sign convention is presented in Figure 9. However, if the desired blowdown was not obtained, it will be necessary to adjust the rings. The following steps should be taken:

WARNING

Never make ring adjustments with the vessel under pressure without gagging the safety valve properly. Be careful to use only enough torque to hold the valve closed. Over-gagging may damage the valve internals.

• Nozzle ring and guide ring adjustment

The guide ring (10) is the principal blowdown control ring in the safety valve. To change the guide ring position, remove the guide ring set screw (11) from the body (1A). Insert a screwdriver or similar tool and engage one of the notches (these can be seen through the set screw hole).

The guide ring can then be turned to the right or left as desired. Moving the guide ring to the right (counterclockwise) raises it and decreases the blowdown. The guide ring should never be moved more than ten notches either way without retesting the valve.

After each adjustment, always replace, tighten and lock wire the set screw, being careful that its point engages a notch. The nozzle ring (3) is necessary for obtaining the pop action of the safety valve. This ring setting is determined at the factory and rarely needs further adjustment.

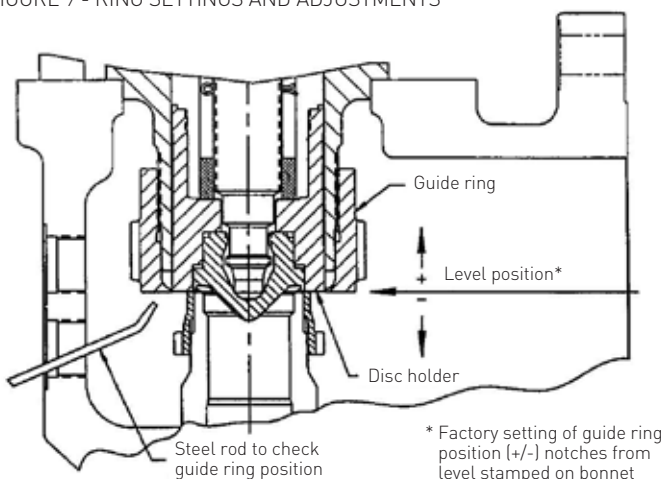
However, in case the guide ring (10) does not give the desired operating characteristics under all conditions of operation, the nozzle ring may be adjusted to control the valve operation for very fine adjustment. The nozzle ring is adjusted by removing the nozzle ring set screw (4) from the valve body (1A).

Turning the ring to the right (counterclockwise) raises it and results in a strong pop action. Blowdown will increase. Turning the ring to the left (clockwise) lowers the ring, decreases the blowdown and may result in warn or simmer if lowered too far. The range of adjustment of the nozzle ring is limited and it should not be moved more than one notch at a time.

The valve performance should be checked after each adjustment. After each adjustment, always replace, tighten and lock wire the set screw, being careful that its point engages a notch.

Whenever ring adjustments are changed, a record should be kept of the number of notches and the direction in which the ring was moved. This will make it possible to return to the original setting in case of error. After the safety valve has been adjusted to close at the desired pressure, remove the lifting gear and make sure the adjusting bolt nut (22) and the set screws (4 and 11) are installed properly and tightened. If different ring locations are obtained after testing, restamp the top of the valve bonnet (13) with the new (tested) ring settings. Install the cap assembly (25) according to Section 10 - paragraph 'Assembly of cap', making sure there is 1/16" clearance between the spindle nut (23) and forked lever (30). Seal wire the cap screws (26) and set screws (4 and 11).

FIGURE 9 - RING SETTINGS AND ADJUSTMENTS



CROSBY® STYLES HC AND HCA ISOFLEX™ SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

9 VALVE MAINTENANCE

General information

When possible, remove the safety valve from the system before dismantling (flanged inlet). Nozzle and guide ring set screws are custom fitted to each safety valve and should never be interchanged.

The spring washers are fitted to each end of the spring. The spring and washers must be kept intact as a unit.

Before disassembly, spare parts and service equipment such as lapping compound, lapping blocks and jacking gear should be available.

WARNING

There should be no system pressure when a safety valve is either dismantled in place or removed for shop repair.

Disassembly

• Disassembly retaining spring compression

If the safety valve is to be reconditioned without retesting, the original set pressure can be retained by use of a hydraulic jacking device (see Figure 14). This device is a service tool that can be obtained from Emerson (see Section 13 - 'Maintenance equipment'). Refer to detailed instructions in the use of this device in instruction I-1167.

Remove the lever (27), forked lever (30), cap (25) and spindle nut (23).

Remove the nozzle ring set screw (4). Check the setting of the nozzle ring (3) by turning it to the right (counterclockwise), counting the number of notches turned until it contacts the disc holder (6) (see Figure 9). Record the number of notches. This location is given as minus (-) notches from this contact position. Remove the guide ring set screw (11).

The guide ring (10) should be turned to the right (counterclockwise) or left (clockwise) whichever is necessary to return it to its level position. The guide ring is in level position when the bottom face of the guide ring is level with the bottom face of the disc insert (5) or disc holder (6). This position is illustrated in Figure 9. The guide ring position is recorded as minus (-) (down) or plus (+) (up) notches from this level position.

Measure the distance between the bottom face of the bottom spring washer (17) and the bonnet flange (13) and record the dimension. Cut three pieces of bar stock $\frac{1}{8}$ " longer than the recorded dimension for spacer blocks.

Install the hydraulic jacking device in accordance with the following (referring to Figure 14):

- Install the bonnet spacer (5) on the bonnet. Position the jacking device assembly by lifting over the spindle and lowering down on the bonnet spacer.

CAUTION

The piston (2) should be seated within the housing (1) before continuing. This seated position is reached when the first notch on the piston (2) is level with or below the top of the housing (1) as illustrated in Figure 14.

- Lubricate the spindle threads with a light coat of 'Never-Seez®', 'Molykote®-G' or equivalent. Thread the appropriate spindle adapter (6) on the spindle until it comes in contact with the jacking device piston.
- Attach the hand-operated hydraulic pump (7) and hose (8).
- To raise the valve spindle, pressure is applied to the jacking device assembly with the hand-operated hydraulic pump. This activates the piston (2) which will rise, compressing the spring in the process.

CAUTION

This device has a limited piston stroke that should not be exceeded. If the piston stroke is exceeded, the second notch on the piston (2) will be above the top of the housing (1) and hydraulic fluid will flow from the bleed hole located in the housing. If hydraulic fluid is flowing from the bleed hole but the piston stroke has not been exceeded, the O-ring (3) and the backup ring (4) should be inspected for wear or damage and replaced if necessary.

After the spring load has been taken up and the valve has been jacked about $\frac{1}{8}$ ", place the spacer blocks under the bottom spring washer (17). See Figure 4.

Release the hydraulic pressure to allow the spring load to rest on the spacer blocks. If so desired, the jacking device can now be removed by releasing pressure in the pump. Thread the spindle nut (23) on the spindle (12) to hold the spindle in position during disassembly or leave the jacking device in place. Loosen and remove the bonnet stud nuts (15).

Using suitable lifting means, lift the superstructure carefully straight up and out of the body.

CAUTION

Do not permit any rocking motion of the spindle or any other parts while lifting the superstructure out of the body. Any rocking motion could damage the valve seats.

Lay the superstructure down with the spindle horizontal. Care must be exercised to prevent the parts from being damaged.

Remove the spindle nut (23) or jacking device from the spindle (12). Carefully slide the spindle and disc holder (6) as an assembly from the jacked and blocked spring (16) and bonnet (13). Proceed with disassembly of the internals according to Section 9 - paragraph 'Disassembly of internal structure'.

CROSBY® STYLES HC AND HCA ISOFLEX™ SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

• Disassembly without retaining spring compression

To disassemble the safety valve completely and not retain the spring compression, the following procedure should be used:

- Remove the lever (27), forked lever (30), cap (25) and spindle nut (23).
- Remove the nozzle ring set screw (4). Check the setting of the nozzle ring (3) by turning it to the right (counterclockwise), counting the number of notches turned until it contacts the disc holder (6) [see Figure 9]. Record the number of notches. This location is given as minus (-) (down) or plus (+) (up) notches from this level position.
- Remove the guide ring set screw (11). The guide ring (10) should be turned to the right (counterclockwise) or left (clockwise) whichever is necessary to return it to its level position. The guide ring is in level position when the bottom face of the guide ring is level with the bottom face of the disc holder. The guide ring position is recorded as minus (-) (down) or plus (+) (up) notches from this level position.
- Measure and record spindle (12) to adjusting bolt (21A) dimension A; and adjusting bolt to bonnet (13), dimension B. See illustration below.
- Release spring tension by loosening the adjusting bolt nut (22) and then the adjusting bolt (21A).

WARNING

Never loosen the bonnet stud nuts (15) before releasing the spring tension with the adjusting bolt (21A).

- After making sure all spring tension has been released, loosen and remove the bonnet stud nuts.
- Strap the spring (16) into the bonnet (13) to prevent the spring from falling out from between the bonnet struts. Using suitable lifting means, lift the spring and bonnet assembly carefully straight up and over the spindle (12). Set the assembly aside.

- Lift the spindle and internals carefully straight up and out of the body (1A).

CAUTION

Do not permit any rocking motion of the spindle or any other parts while lifting the spindle and internals out of the body. Any rocking motion could damage the valve seats.

- Lay the spindle down horizontally.
- Proceed with disassembly of the internals according to paragraph below 'Disassembly of internal structure'.
- Should lack of overhead space prevent the bonnet (13) being lifted over the spindle (12), the spindle nut (23) may be installed to hold the spindle in position. Using suitable lifting means, lift the superstructure carefully straight up and out of the body.

CAUTION

Do not permit any rocking motion of the spindle or any other parts while lifting the spindle and internals out of the body. Any rocking motion could damage the valve seats.

- Lay the superstructure down so the spindle is horizontal. Care must be exercised to prevent the parts from being damaged.
- Remove the spindle nut (23) from the spindle (12). Remove the spindle, spring (16) and washers (17 and 18A) carefully from the bonnet (13).
- Proceed with disassembly of the internals according to the following paragraphs.

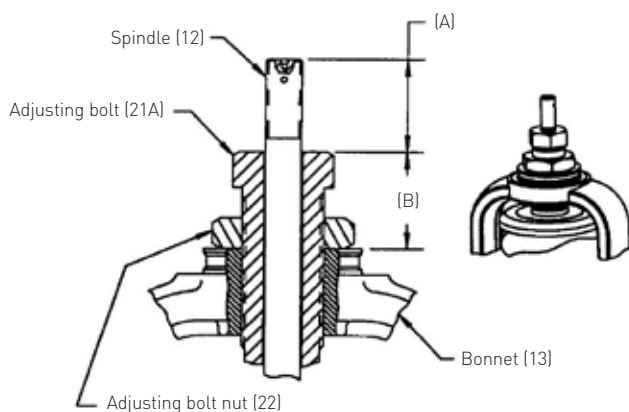
• Disassembly of internal structure

Remove the guide (9) and guide ring (10) from the body (1A) as an assembly and unscrew the guide ring from the guide.

Remove the spindle (12) from the disc insert (5) by lifting the spindle slightly to engage the threads and unscrewing the spindle from the disc insert.

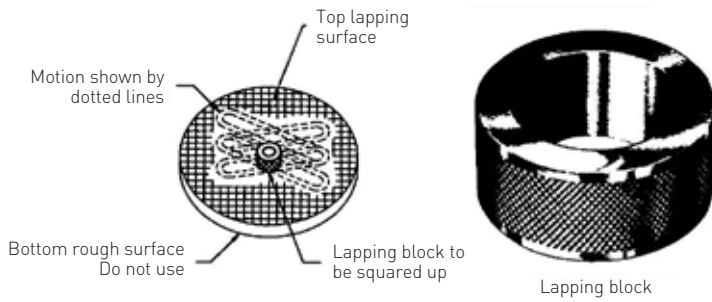
Unscrew the nozzle ring (3) from the nozzle (1B).

All the parts should be cleaned thoroughly, paying special attention to guiding surfaces. The seats should be lapped according to section following 'Lapping or refurbishing of valve seats'. If replacement parts are required, refer to Section 2 - 'Ordering spare parts'.



CROSBY® STYLES HC AND HCA ISOFLEX™ SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS



• Repair procedure

Lapping or refurbishing of valve seats

Good seating surfaces on the nozzle (1B) and disc insert (5) are of the greatest importance when reconditioning safety valves. The seats should be flat and free from surface scratches.

Lapping block

This is made of a special grade of annealed cast iron, perfectly flat on both sides. It must remain flat to produce a flat seating surface. In checking the lapping block and for restoring flatness after use, a lapping block resurfacing plate should be used.

Lapping block resurfacing plate

This is also made of a special grade of annealed cast iron, machined and lapped on the side that has small squares. This is the surface on which lapping blocks are reconditioned.

Lapping compound

Experience has proven that three grades of compound - medium, fine and polish - will condition almost any damaged valve seat properly except where the damage requires remachining. A medium coarse compound may be used for fast cutting as a first operation after machining, if desired. The following lapping compounds, or their commercial equivalents, are suggested:

Grit compound number	Description
320	Medium coarse
400	Medium
600	Fine
900	Polish

CAUTION

Never lap the disc insert against the nozzle.

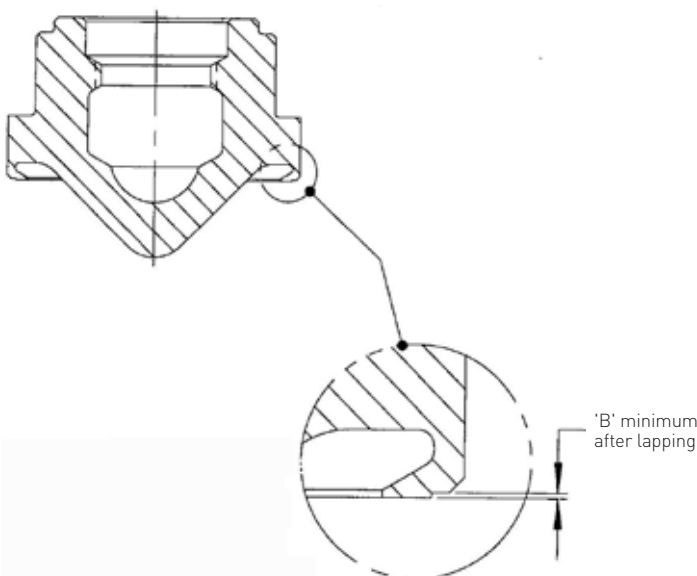
Lapping procedure

Different individuals have different methods of lapping valve seats, but certain essential steps must be taken to get satisfactory results. The following procedure is suggested for lapping of valve seats:

- Lap each part separately against a cast iron lapping block of the proper size. These blocks hold the lapping compound in their surface pores but must be recharged and reconditioned frequently.
- Check the lapping block frequently on a good lapping block resurfacing plate to make certain that it is perfectly flat on both sides.
- If considerable lapping is required, spread a thin coat of medium lapping compound on the block. After lapping with this compound, lap again with fine compound using a new lapping block surface. The first step can be omitted unless much lapping is called for. Next, lap again using a polish compound.

Orifice	K	K ₂	M	M ₂
'B' minimum dimension after lapping	0.005 in (0.127 mm)	0.006 in (0.152 mm)	0.007 in (0.178 mm)	0.007 in (0.178 mm)

FIGURE 10 - DISC INSERT MINIMUM SEAT HEIGHTS



CROSBY® STYLES HC AND HCA ISOFLEX™ SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

Lap the block against the seat. Never rotate the block continuously, but use an oscillating movement.

When all the nicks and marks have disappeared, remove all the compound from the block and seat. apply polish compound to another block and lap the seat with this. 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 of foreign material.

Be extremely careful to keep the seats flat.

Refurbishment of disc and disc insert seats

When the damage to the disc insert (5) seat is too severe to be removed by lapping, the disc insert should be replaced. Disc inserts should never be remachined. Remachining the insert will change critical dimensions, affecting the operation of the safety valve. The disc insert seating surface may be lapped if the minimum seat height shown in Figure 10 is maintained.

Refurbishment of nozzle seats

If machining of the nozzle (1B) seat or other major repairs are necessary, it is recommended that a reseating machine be used (see Section 13 - 'Maintenance equipment'). All parts must be accurately machined per Emerson specifications. No safety valve will be tight nor will it operate properly unless all parts are machined correctly.

Machining dimensions for Crosby Style HC/HCA safety valves are shown in Figure 11. Remove only enough metal to restore the surface to its original condition. Turning to the smoothest possible finish will facilitate lapping.

The nozzle (1B) must be replaced when the maximum 'A' dimension is exceeded.

This critical dimension is shown in Figure 12.

NOTES

1. Maximum tolerance zone for surface parallel to datum axis:
for orifice K₂ through M₂ .009"
2. Maximum tolerance zone for surface perpendicular to datum axis:
for orifice K₂ through M₂ .0015"

MAXIMUM 'A' DIMENSION - ORIFICE AND VALVE CLASS

K 3() - 9() in (mm)	K ₂ 3() - 6() in (mm)	K ₂ 7() - 9() in (mm)	M and M ₂ 3() - 7() in (mm)	M and M ₂ 8() - 9() in (mm)	K and K ₂ 11() in (mm)	M and M ₂ 11() in (mm)
4.203 (106.756)	4.203 (106.756)	5.141 (130.581)	4.953 (125.806)	5.641 (143.281)	5.453 (138.506)	6.328 (160.731)

FIGURE 11 - NOZZLE SEAT CRITICAL DIMENSIONS

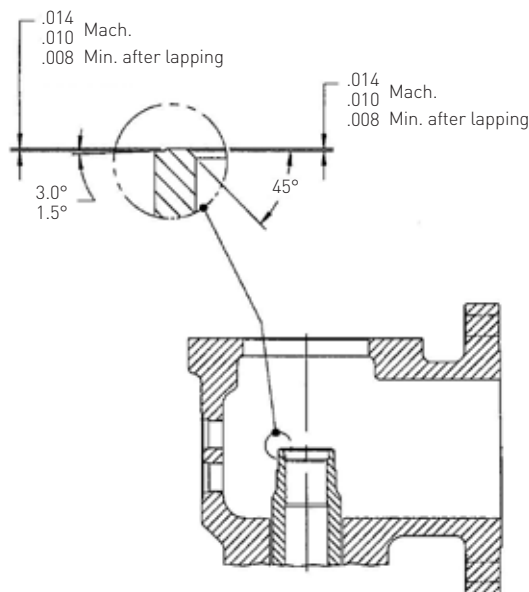
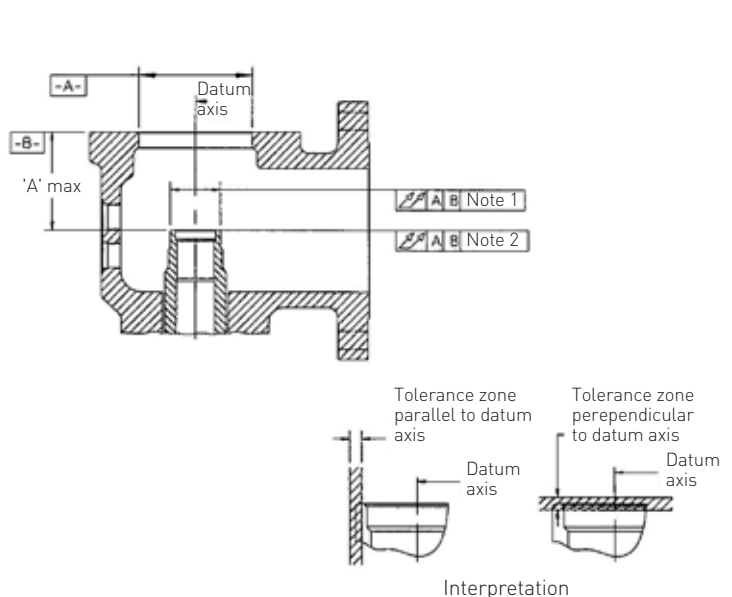


FIGURE 12 - BODY TO NOZZLE SEAT DIMENSIONS



CROSBY® STYLES HC AND HCA ISOFLEX™ SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

10 VALVE ASSEMBLY

General information

Apply a light coat of 'Never-Seez'^{®(1)} lubricant on the new nozzle ring (3) threads. Screw the nozzle ring on the nozzle leaving the top of the ring slightly above the seating plane. This will help protect the seating surface of the nozzle during the assembly process.

Spot lap the disc insert (5) to the spindle (12) and clean thoroughly. Apply a thin coat of 'Molykote'[®] 321R⁽²⁾, or equivalent, dry film lubricant to the bearing surface of the disc insert and spindle tip.

Apply a light coat of 'Never-Seez'[®] to the threads of the spindle (12), disc insert (5) and disc holder retainer (7). Thread the disc holder retainer on the spindle and slide the disc holder (6) over the lower end of the spindle. Thread the disc insert onto the spindle and set the retainer clearance (see Figure 13).

Spot lap the guide (9) with the mating surface on the body (1A) and clean the surface thoroughly. Then place the guide into position on the body.

With the disc holder (6), disc insert (5), disc holder retainer (7) and spindle (12) assembled, place the assembly into position in the body and guide.

Place the spring and washer assembly into position on the bonnet/cooling spool assembly. Note that the anti-rotation pins of the top spring washer should be straddling the bonnet.

The valve can be assembled further using either of the following two methods.

One method may be preferred over the other depending on the valve size and/or set pressure.

Assembly of the valve superstructure and the compression of the spring may be accomplished by two different methods as follows:

- **Valve assembly without using the hydraulic jacking device**

Utilizing a suitable lifting device, place the bonnet/spring assembly over the spindle (12) and into position on the body (1A). Note that the adjusting bolt (21A) will be in the retracted position thereby allowing the bonnet (13) to be seated on the body.

With the assembly in place, turn the nozzle ring (3) clockwise (with a screwdriver through the set screw hole) until the top surface is below the seating plane. The bonnet stud nuts (15) may now be torqued in place.

Note that a criss-cross torquing pattern should be utilized to ensure even compression as illustrated in Figure 6.

Once the bonnet stud nuts (15) are in place, the adjusting bolt (21A) may be turned, thereby compressing the valve spring (16).

Tighten the adjusting bolt until the distance is the same as that recorded when the valve was disassembled (see page 11). At this point, the adjusting bolt nut (22) shall be tightened in place.

NOTE

The setting of the spring compression by this method is only a very rough estimate of the valve set pressure. The valve will require set pressure testing prior to returning to service (refer to Section 8 - paragraph 'Set pressure testing and valve adjustment').

CAUTION

The cotter pin head should be turned so that it fits between and into the retainer notch and makes contact with the spindle. The split ends of the cotter pin should both be bent downward.

Stand assembly on a clean surface making certain that the end of the spindle rotates freely on the disc insert bearing surface (not loading on the insert threads). Thread the disc holder retainer down until it makes contact with the disc holder.

Locate the hole in the spindle relative to a notch on the retainer. Back off the retainer by turning it counterclockwise to establish the proper clearance.

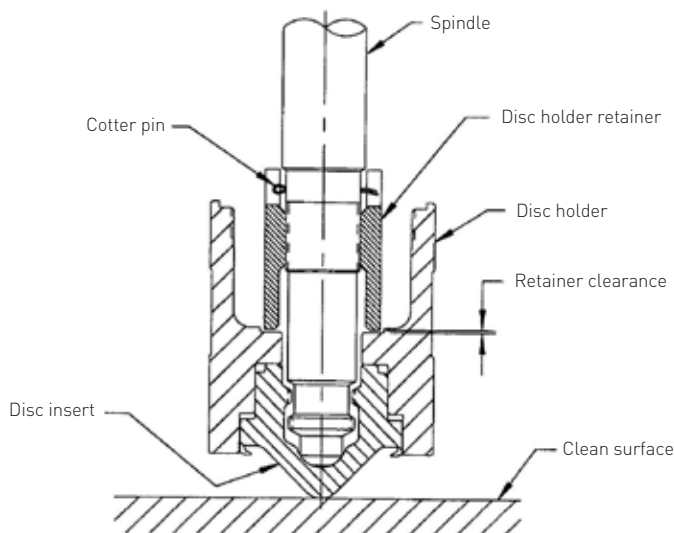
The clearances, and the corresponding number of notches, are listed in the table. With the proper clearance established, install the retainer cotter pin through the appropriate notch and spindle.

NOTES

1. Never-Seez is manufactured by Bostik Corporation.
2. Molykote is manufactured by Dow Corning Corporation.

Valve orifice size	Retainer clearance (inches)	Corresponding number of retainer notches
K	.008 - .012	4 - 6
K ₂	.010 - .012	5 - 6
M/M ₂	.010 - .012	5 - 6

FIGURE 13 - RETAINER NUT CLEARANCE



CROSBY® STYLES HC AND HCA ISOFLEX™ SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

• Valve assembly using the hydraulic jacking device

Utilizing a suitable lifting device, place the bonnet/spring assembly over the spindle (12) and into position on the body. Note that because the adjusting bolt is in a down position, the bonnet (13) (or cooling spool (43)) will be raised slightly above the surface of the body (1A).

Replace the bonnet stud nuts (15) and tighten. Referring to Figure 14:

- Install the bonnet spacer (5) on the bonnet. Position the jacking device assembly by lifting over the spindle and lowering down on the bonnet spacer.

- Lubricate the spindle threads with a light coat of 'Never-Seez®', 'Molykote®-G' or equivalent. Thread the appropriate spindle adapter (6) on the spindle until it comes in contact with the jacking device piston.
- Attach the hand-operated hydraulic pump (7) and hose (8).
- To raise the valve spindle, pressure is applied to the jacking device assembly with the hand-operated hydraulic pump. This activates the piston (2) which will rise, compressing the spring in the process.
- Lift the valve spindle approximately 1/8" and remove the spacer blocks.

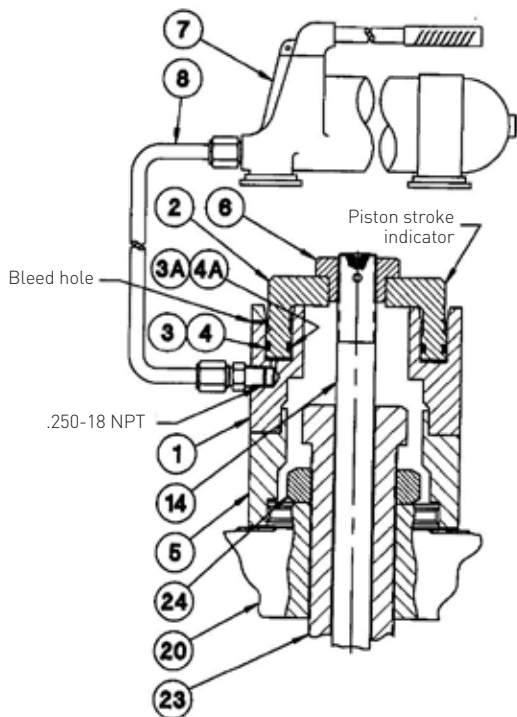
CAUTION

The piston (2) should be seated within the housing (1) before continuing. This seated position is reached when the first notch on the piston (2) is level with or below the top of the housing (1) as illustrated in Figure 14.

Piece description	Orifice and valve class			
	K 7() - 9()	K ₂ 7() - 9()	M 7() - 9()	M ₂ 7() - 9()
Bonnet spacer	086418	None	None	None
Spindle adapter	082893	083508	083508	083508

Tabulation of Crosby part numbers for manual jacking device for Crosby Style HC and HCA valves assembly SA-52980 is always required. The spacer and adapter are required as shown in table above.

FIGURE 14 - HYDRAULIC JACKING DEVICE



PARTS LIST

Part no.	Description
1	Housing
2	Piston
3*	O-ring
3A*	O-ring
4*	Back-up ring
4A*	Back-up ring
5	Bonnet spacer
6	Spindle adapter
7	Hydraulic pump
8*	1/4" hose
14	Valve spindle
20	Bonnet
23	Adjusting bolt
24	Adjusting bolt nut

* Recommended spare part

NOTES

- Assembly SA55848 consists of Pc. Nos. 1, 2, 3, 3A, 4, 4A, 7, 8.
- Spacer [Pc. No. 5] and adapter [Pc. No. 6] must be selected from table.
- Assembly SA52980 consists of Pc. Nos. 1, 2, 3, 3A, 4, 4A.

CAUTION

This device has a limited piston stroke that should not be exceeded. If the piston stroke is exceeded, the second notch on the piston (2) will be above the top of the housing (1) and hydraulic fluid will flow from the bleed hole located in the housing. If hydraulic fluid is flowing from the bleed hole but the piston stroke has not been exceeded, the O-ring (3) and the backup ring (4) should be inspected for wear or damage and replaced if necessary.

CROSBY® STYLES HC AND HCA ISOFLEX™ SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

Setting of rings

The nozzle ring (3) setting is stamped on the machined surface of the bonnet (13) where the cap (25) sits. For example, NR-15 means set the nozzle ring fifteen notches below contact with the disc holder (6). To set the nozzle ring, turn it to the right (counterclockwise) until it touches the disc holder. From this position, lower it by the number of notches indicated to the stamped position.

The guide ring (10) setting is obtained in the same manner as the nozzle ring above. For example, GR +30 means thirty notches above level position. Level is when the bottom of the guide ring is even (level) with the bottom of the disc holder. This position is illustrated in Figure 9. With the safety valve already on the system, level can be obtained by inserting a metal rod with a hook on the end through the lower set screw hole and feeling the position of the ring in relation to the disc holder.

To set the guide ring, move it to the level position. If the stamped guide ring position is a positive number, turn the ring to the right (counterclockwise) to raise the guide ring by the number of notches indicated. If the stamped guide ring position is a negative number, turn the ring to the left (clockwise) to lower the ring that number of notches.

Lubricate the set screws (4 and 11) threads. Screw the set screws into the body (1A) engaging both the nozzle ring (3) and guide ring (10). Both rings should be able to move back and forth slightly after the set screws are tightened.

Assembly of cap (see Figure 1)

The assembly of the cap is referred to several times in this instruction. The cap assembly consists of the spindle nut (23); cap (25); forked lever assembly: forked lever (30), forked lever pin (31) and forked lever pin cotter (32); and the lever assembly: lever (27), lever pin (28) and lever pin cotter (29).

The lever assembly can be removed from the safety valve independently of the cap. The cap cannot be removed from the safety valve without first removing the forked lever assembly.

The cap set screws (26) are seal wired to prevent tampering with the adjusting bolt (21). To assemble the cap assembly, proceed as follows:

If the spindle nut (23) was removed, lubricate the spindle rod (12B) threads and install the spindle nut (23) and the spindle nut cotter (24). Install the lever (27), lever pin (28) and lever pin cotter (29). Place the cap in position but do not tighten the cap set screws yet.

Install the forked lever (30), forked lever pin (31) and forked lever pin cotter (32). Be sure that the forked lever is free to move from 1/16" to 1/8" before coming into contact with the spindle nut (23).

If travel is excessive, remove the forked lever and cap and turn the spindle nut clockwise or counterclockwise to increase or decrease the forked lever travel.

Be sure the spindle nut cotter (24) is installed after the final adjustment.

11 SPARE PARTS

Emerson recommends spare parts as shown on the parts list with corresponding notes. When ordering spare parts, the valve assembly number should be given together with part number and valve size and style. The valve assembly number is shown on the valve nameplate as shop number (see Section 2 - paragraph 'Crosby Style HC/HCA ISOFLEX nameplate'). Any Emerson sales office or representative can expedite your spare parts requirements.

CROSBY® STYLES HC AND HCA ISOFLEX™ SAFETY VALVES

INSTALLATION, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS

12 FIELD SERVICE REQUIREMENTS

Field service

Crosby operates an extensive field service organization capable of adjusting, setting and maintaining Crosby valves worldwide. Emerson service technicians, factory trained and long experienced in servicing safety valves, are located throughout the world for fast response to our customers' needs. It is strongly recommended that on new installations a Emerson service technician be present for assembly and testing of safety valves.

Service equipment available

All service equipment mentioned in this instruction is available for purchase or rental. Any Emerson sales office, representative or service manager can expedite your service equipment requirements.

13 MAINTENANCE EQUIPMENT

Reseating machines

Reseating machines will remachine the nozzle seats in place without removing the safety valve from the installation. Form cutters are used to cut a new seat to exact dimensions. Reseating machines, cutters and auxiliary equipment may be rented or purchased. Contact the factory.

Jacking devices

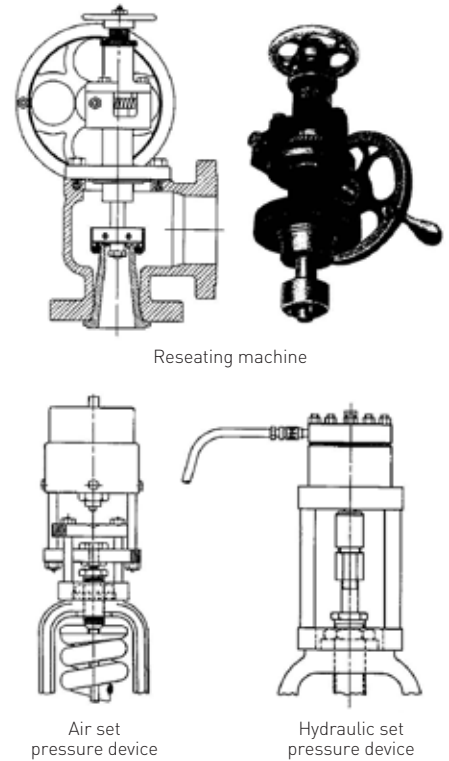
When a safety valve is to be disassembled and it is desired to retain spring compression, i.e., the set pressure, a mechanical or hydraulic jacking device may be used. Jacking devices are used to lift the bottom spring washer sufficiently to allow the disc or disc insert to lift clear of the nozzle (permitting the entire bonnet assembly to be removed). Jacking devices may be rented or purchased. Contact the factory.

Air (ASPD) and hydraulic (HSPD) set pressure devices

The set pressure of safety valves may be determined without raising system pressure to the popping pressure of the valves by using a set pressure device which may be rented or purchased.

The apparatus consists of a lifting device mounted on the bonnet and connected to the spindle of the safety valve. The differential force required to open the safety valve when the system (steam) pressure is less than the valve set pressure is applied by the operator. The differential force at which the valve opens is determined and the safety valve set pressure is calculated from this measurement. Contact the factory.

FIGURE 15



Neither Emerson, Emerson Automation Solutions, nor any of their affiliated entities assumes responsibility for the selection, use or maintenance of any product. Responsibility for proper selection, use, and maintenance of any product remains solely with the purchaser and end user.

Crosby is a mark owned by one of the companies in the Emerson Automation Solutions business unit of Emerson Electric Co. Emerson Automation Solutions, Emerson and the Emerson logo are trademarks and service marks of Emerson Electric Co. All other marks are the property of their respective owners.

The contents of this publication are presented for informational purposes only, and while every effort has been made to ensure their accuracy, they are not to be construed as warranties or guarantees, express or implied, regarding the products or services described herein or their use or applicability. All sales are governed by our terms and conditions, which are available upon request. We reserve the right to modify or improve the designs or specifications of such products at any time without notice.