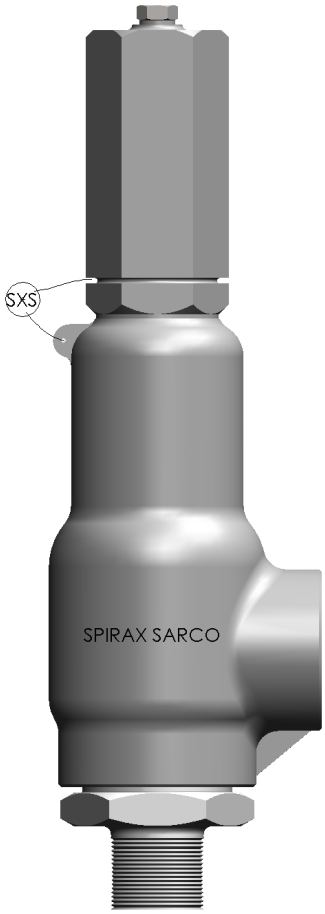
1.753.000.079

IM-D345-01
BR Rev.01

SV81H
Safety and Relif Valves
Installation and Maintenance Guide



1. Warranty

Spirax Sarco warrants, subject to the conditions described below, to repair and replace without charge, including labor costs, any components which fail within 1 year of product delivery to the customer. Such failure must have occurred because of defect in material or manufacturing and not as a result of product not being used in accordance with the instructions of this manual.

This warranty does not apply to products which require repair or replacement due to normal wear out or products that are subject to accident, misuse or improper maintenance.

Spirax Sarco only obligation with Warranty is to repair or replace any product that we consider defective. Spirax Sarco reserves the right to inspect the product in customer installations or request the return of the product with freight prepaid by the buyer.

Spirax Sarco may replace or repair any parts that are deemed defective without further responsibilities. All repairs or services executed by Spirax Sarco, which are not covered by this warranty, will be charged according to the current price list.

THIS IS THE ONLY SPIRAX SARCO WARRANTY TERM AND ONLY HEREBY SPIRAX SARCO EXPRESS.BUYER DISCLAIMS ALL OTHER WARRANTIES IMPLIED BY LAW, INCLUDING ANY MARKET WARRANTY FOR A PARTICULAR PURPOSE.

Access

Ensure safe access and if necessary a safe working platform (suitably guarded) before attempting to work on the product. Arrange suitable lifting gear if required.

Lighting

Ensure adequate lighting, particularly where detailed or intricate work is required.

Hazardous liquids or gases in the pipeline

Consider what is in the pipeline or what may have been in the pipeline at some previous time. Consider; flammable materials, substances hazardous to health, extremes of temperature.

Hazardous environment around the product

Consider; explosion risk areas, lack of oxygen (e.g. tanks, pits), dangerous gases, extremes of temperature, hot surfaces, fire hazard (e.g. during welding), excessive noise, moving machinery.

The system

Consider the effect on the complete system of the work proposed. Will any proposed action (e.g. closing isolation valves, electrical isolation) put any other part of the system or any personnel at risk? Dangers might include isolation of vents or protective devices or the rendering ineffective of controls or alarms. Ensure isolation valves are turned on and off in a gradual way to avoid system shocks.

Pressure systems

Ensure that any pressure is isolated and safely vented to atmospheric pressure.
Consider double isolation (double block and bleed) and the locking or labeling of closed valves.
Do not assume that the system has depressurized even when the pressure gauge indicates zero.

Temperature

Allow time for temperature to normalize after isolation to avoid danger of burns.

Tools and consumables

Before starting work ensure that you have suitable tools and/or consumables available. Use only genuine Spirax Sarco replacement parts.

Protective clothing

Consider whether any protective clothing required by yourself and / or others in the vicinity to protect against the hazards of, for example, chemicals, high / low temperature, noise, falling objects, and dangers to eyes and face.

Permits to work

All work must be carried out or be supervised by a suitably competent person. Post 'warning notices' if necessary.

Electrical works

Before starting work study the wiring diagram and wiring instructions, and check any special requirements. Consider special emphasis on primary and phase source, local isolation of the major systems, fuse requirements, grounding, special cables, cable entries and electrical voltage selection.

Commissioning

After installation or maintenance, ensure that the system is working properly.
Perform tests on all alarms and protective devices.

Storage

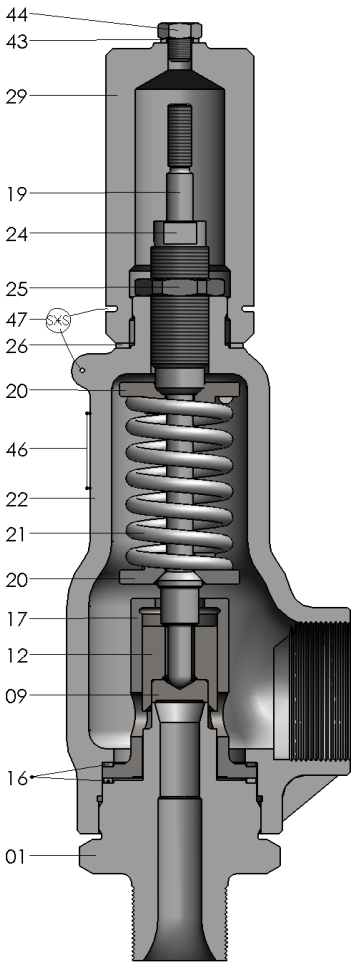
Equipment and materials shall be stored in a proper place and securely.
See Item 5.

Disposal

Unless otherwise stated in the Installation and Maintenance Instructions, this product is recyclable and no ecological hazard is anticipated with its disposal providing due care is taken.

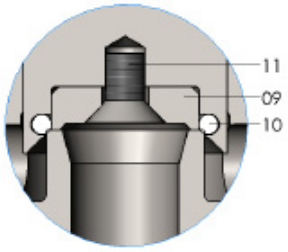
Additional information

Additional information and support are available worldwide at any Spirax Sarco service center.

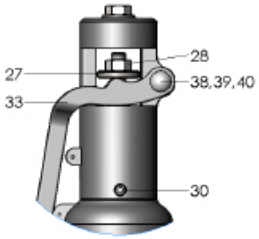


Item	Descrição	
01	Body (Base)	
09	Disc	**
10	O'Ring	**
11	Retainer Lockscrew	
12	Disc Holder	
16	Guide Gasket	**
17	Guide	
19	Spindle	
20	Spring Washer	
21	Spring	**
22	Bonnet	
24	Adjusting Screw	
25	Adjusting Screw Locknut	
26	Cap Gasket	**
27	Disc Lever	
28	Nut	
29	Cap	
30	Screw	
31	Cam	
33	Lever	
35	Bushing	
37	O'Ring	
38	Washer	
39	Rivet	
40	Cotter Pin	
41	Gasket	
43	Sealing Plug Gasket	
44	Sealing Plug	
46	Nameplate	
47	Seal	
55	Test GAG	

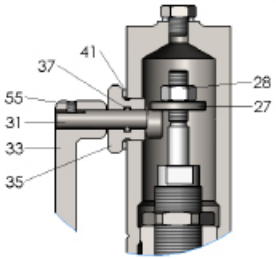
** Spare parts recommended for 2 years of operation.



O'Ring Seal



Open Lever



Packed Lever

3. Introduction

Safety Relief Valves SV81H are designed to meet the requirements of ASME Code Section VIII. They may be used for various media such as air, gases, process steam, liquid and hydrocarbons, it can operate as a safety or relief valve, depending on our application.

Proper storage, handling, installation and testing of valves, ensuring performance is consistent with the product specifications. This manual contains basic concepts of storage, installation, operation and maintenance of Safety Relief Valves SV81H, but does not replace the expertise and experience required for the execution of repair and maintenance of valves.

Relevant parts nomenclature for the model are defined in SV81H drawing on page 5.

4. Terms and Definitions

4.1 Safety Valves
Automatic pressure relief device characterized by an instantaneous opening ("pop") upon reaching the set pressure. Used in service with compressible fluids (gases and vapors).

4.2 Relief Valves
Automatic pressure relief device characterized by a progressive opening proportional to the pressure increase above the set pressure opening. Used in service with incompressible fluids (liquids).

4.3 Safety Relief Valves
Automatic pressure relief device, suitable for working as a safety or relief valve, depending on the desired application.

4.4 Maximum Allowable Working Pressure (MAWP)
It is the maximum working pressure of a vessel, according to the design code, the strength of the materials used, the equipment dimensions and its operating parameters.

4.5 Operating Pressure
It is the pressure at which the vessel is subject to normal operating conditions. A reasonable margin must be established between the operating pressure and maximum allowable working. For safe operation, the operating pressure must be at least 10% less than the MAWP, or 0.34 bar(g), whichever is greater.

4.6 Opening Pressure (Set Pressure)
It is the gauge pressure at which the valve is set to open.

4.7 Cold Differential Test Pressure
It is the pressure at which the valve is set to open on the test bench. This pressure includes corrections for service conditions (back pressure and / or temperature).

4.8 Relief Pressure
The pressure increase over the set pressure of the relieving device. Overpressure is expressed in pressure units or as a percentage of set pressure.

4.9 Overpressure
A pressure increase over the set pressure of a pressure relief valve, usually expressed as a percentage of set pressure.

4.10 Accumulation
It is the increase in pressure above the MAWP of the vessel during discharge of the safety device, expressed as a percentage of that pressure. Overpressure is the same as accumulation only when the relieving device is set to open at the maximum allowable working pressure of the vessel.

4.11 Closing Pressure
The value of decreasing inlet static pressure at which the valve disk reestablishes contact with the seat or at which lift becomes zero and is equal to the opening pressure minus the blowdown.

4.12 Blowdown
The difference between actual popping pressure of a pressure relief valve and actual reseating pressure expressed as a percentage of set pressure or in pressure units.

4.13 Lift
The actual travel of the disc way from closed position when a valve is relieving.

4.14 Relieving Capacity
It is the flow of a determined fluid that a valve is able to relieve in the operating conditions in which it was sized.

4.15 Coefficient of Discharge
The ratio of the measured(in laboratory)relieving capacity to the theoretical relieving capacity.

4.16 Backpressure
Is the pressure in the outlet connection of the Safety and Relief Valve, it may be:

4.16.1 Superimposed Backpressure

4.16.1.1 Constant
When there is no pressure variation on the discharge side of the valve at any operating condition, with the valve closed.

4.16.1.2 Variable
When there is variation in pressure on the discharge side of the valve prior to opening.

4.16.2 Buil-up Backpressure
The increase in pressure at the outlet of a pressure relief device that develops as a result of flow after the pressure relief device opens.

4.17 Simmer
The audible or visible escape of fluid between the seat and disk at an inlet static pressure below the popping pressure and at no measurable capacity. It applies to safety or safety relief valves on compressiblefluid service.

4.18 Chatter
Abnormal rapid reciprocating motion of the movable parts of a pressure relief valve in which the disk contacts the seat,causing serious damage to the valve.

5. Handling and Storage

• The storage should always be done in the original packaging with valves standing in the upright position.

• Store the valves in covered, clean and dry environment. The protection of input and output connections prevents the entry of impurities inside the valve; remove them only at the moment of installation.

• When moving them, avoid vibrations, sudden shocks and heavy impacts, keeping them in an upright position, with the entry down.

• **Never carry or move the valves using the test lever**.

6. Installation

6.1 General Requirements

• It is recommended that valves be inspected prior to installation. Calibration and seat tightness should be verified, for this, a suitable testing bench with compressed air or inert gas and water shall be used. The tests shall be performed by qualified professionals, in the presence of an equipment inspector.

• Make sure that the equipment to be protected underwent a process of purging to remove all debris and particles, such as welding residue, pieces of gaskets or other solid materials. We caution that any impurities that lodge between the seating surfaces or even pass between them at high speed may damage the surfaces and cause the valves to leak.

• The Safety and Relief Valves must receive periodic maintenance to ensure satisfactory performance. For this it is necessary to install them in easily accessible areas.

• A working area around and above the valves shall be predicted. If two or more valves are installed too close together, the outputs should be parallel in order to provide protection to those working in the vicinities or in the maintenance of the valve.

• When lifting a valve, the valve should always remain in a vertical position. The valve may be lifted by using a sling around the valve yoke and the valve outlet neck. In no case should the valve be lifted by the lifting lever.

• The valve should not be bumped or dropped during installation. If the valve is dropped, an inspection for damage should be made, and the set pressure of the valve rechecked.

• Make sure that threaded connections, gaskets and connection's studs are in compliance with specifications of the pipeline. The studs and nuts should be properly lubricated. In the case of threaded connections, when required by the construction standard, use thread sealants suitable for operating conditions.

• Valves with threaded connections must be installed using the wrenching tool in the body **(01)**. Never use the bonnet **(22)** or this thread for this purpose, this will affect the set pressure and valve performance **(Figure 01)**.

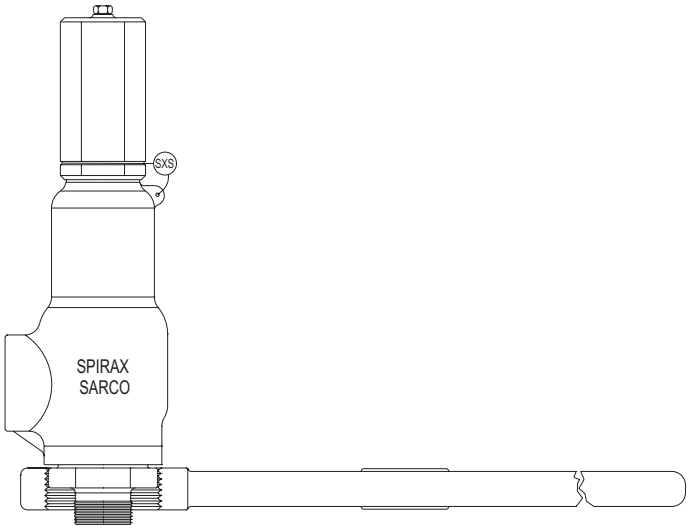


Figure 01

• When installing the flanged valves, the flange's studs shall be fitted carefully to avoid distortions up in the valve body, misalignment and leaks.

With the valve installed in position, screw the nuts manually. Initially with small torque, tighten each nut in the recommended sequence depending on the number of prisoners **(Table 01)**, then increase the torque following the same sequence of initial tightening, until the final torque required. The required torque varies with the material and size of the studs and nuts, and type of gasket used. Refer to your engineering on the torque values to be applied.

Table 01

Nº of Studs	**Tightening Pattern**
4	1-3-2-4
8	1-5-3-7 → 2-6-4-8
12	1-7-4-10 → 2-8-5-11 → 3-9-6-12
16	1-9-5-13 → 3-11-7-15 → 2-10-6-14 → 4-12-8-16

• Install discharge piping using the same procedures used in the valve installation.

• Prior to completing the installation, a visual check should be made to ensure that the valve lifting lever is free to operate.

• For valves with test lever, before finishing the installation, check visually if this can be operated freely.

• After installation, an inspection of the valve should be made to confirm that all adjustment components are properly locked and sealed, as required by ASME Section VIII UG126 (c).

• Safety Relief Valves operating under the best possible conditions (with favorable operating cycles, relatively stable ambient temperatures and no dirt) provide the maximum level of security, tightness and reliability.

6.2 Inlet Piping

• Safety and Relief Valves intended for relief of compressible fluids (gases or vapors) shall be connected to the vessel in the vapor space above any contained liquid or to piping connected to the vapor space in the vessel which is to be protected. Safety and Relief Valves intended for relief of liquids shall be connected below the normal liquid level. (ASME code Section VIII, UG135 (a)) **(Figure 02)**.

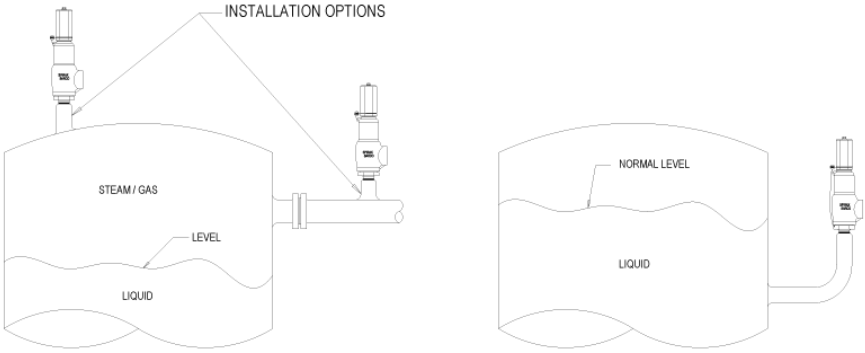


Figure 02

• A Safety and Relief Valves must be installed in upright standing position (+ / - 1) directly on the protected equipment in a pipe with nominal diameter equal or greater than valves diameter, and no longer than the face-to-face dimension of a standard “T” of the applicable pressure class. Sharp edges must be avoided in this pipe section **(Figure 03)**.

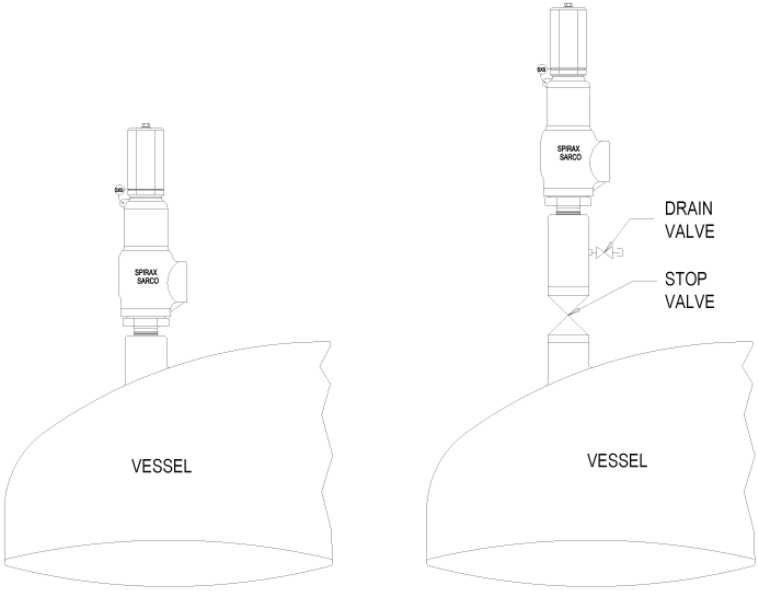


FigurE 03

• Header nozzle corners must be rounded to a radius of not less than 1/4 of the opening diameter.

• The safety and relief valve inlet should not be positioned at the end of a horizontal pipe in which there is normally no flow. Foreign materials or liquids may get stuck and interfere with the operation of the valve and increase the need for maintenance.

• A shutoff valve may be installed between the Safety and Relief Valve and the protected equipment, provided they meet the recommendations of API RP 520 Part 2, of the ASME Code Section VIII UG135 (d) and of Appendix M of the same code. If installed, the shutoff valve must be full bore and have a nominal diameter equal or greater than the Safety and Relief Valve inlet diameter.

• Excessive pressure loss at the inlet of the safety valve will cause extremely fast opening and closing of the valve, which is known as “chattering”**(4.18)**. Chattering may result in lowered capacity as well as damage to the seating surface of the valve. Severe chattering can cause damage to other parts of the valve. Pressure drop from the protected equipment to the Safety and Relief Valve shall not exceed 3% of set pressure when the valve is relieving the maximum flow rate for which it was sized.

• To reduce the effects of excessive turbulence at the inlet of Safety Relief Valves, the following recommendations should be observed **(Figure 04)**:

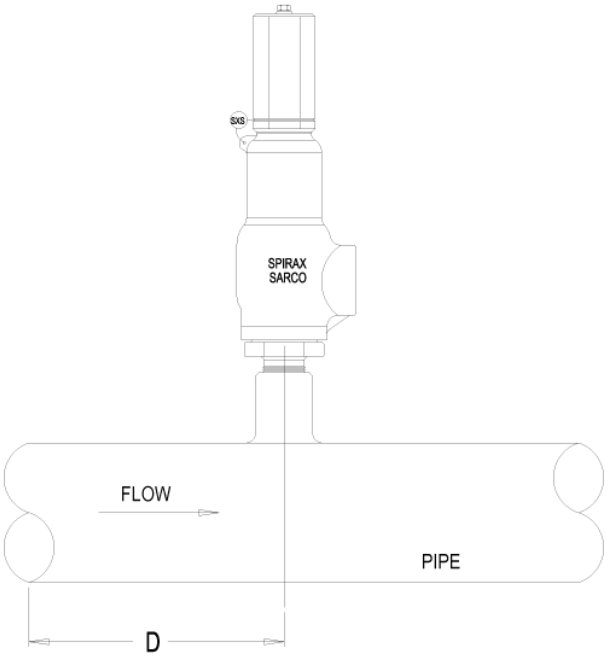


Figure 04

• Safety valves should be installed at least eight to ten pipe diameters downstream from any bend in a process line. This distance should be increased when the valve is installed on the horizontal section of a header which is preceded by an upward section.

• Safety valves should not be installed closer than eight to ten pipe diameters either upstream or downstream from a diverging, or a converging, “Y”.

• Safety valves should never be installed, in a process line, in a position directly opposite to a branch line.

• Excessive vibration in line produces changes in the Safety and Relief Valve set pressure, it also may cause leakage in the valve. Ways to eliminate this problem before installation should be analyzed.

• ASME Section VIII code requires that the design of the inlet connection consider the stress conditions that occur due to reaction forces during valve operation, external loads, vibration and loads resulting from thermal expansion of the discharge pipe.

• The calculation of reaction force during valve relief is responsibility of the designer of the ves-

sel and / or piping. Spirax Sarco can provide this information only as technical assistance but assumes no liability for the calculations.

• External loads resulting from support systems and poorly designed piping may be the cause of excessive stresses and distortion in the valve and inlet pipe. The accumulation of stress may cause the valve to malfunction or leak.

• Vibrations in the inlet piping systems may cause leaks, premature wear of certain parts of the valve and / or pipe failure by fatigue. The high frequency vibrations cause more damage to the tightness of Safety and Relief Valves than low frequency. This effect can be minimized, allowing a greater difference between the operating pressure of the system and the opening pressure of the valve, especially under conditions of high frequency.

6.3 Outlet Piping

• The discharge area of the outlet piping from a safety valve should not be less than the area of the outlet connection. Where more than one safety valve is connected to a common outlet pipe, the area of the pipe should not be less than the combined area of the outlet connections to the safety valves.

• All safety valve discharges should be piped so that the effluent is discharged clear from running boards or platforms. Ample provision for gravity drain should be made in the discharge pipe at, or near, each safety valve where water, or condensation, may collect. Each valve has an open gravity drain through the body, below the level of the valve seat, and this drain should be piped to a safe discharge area.

• A shutoff valve may be installed at the outlet connection, provided it meets the recommendations of API RP 520 Part 2, of the ASME Code Section VIII UG135 (d) and of Appendix M of the same code. If installed, the shutoff valve must be full bore and have a nominal diameter equal or greater than the Safety and Relief Valve outlet diameter **(Figure 05)**.

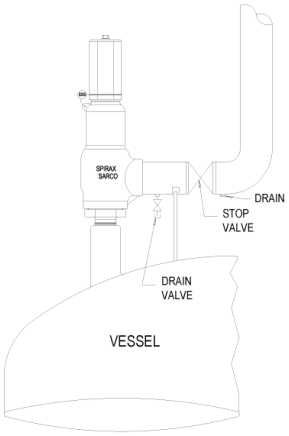


Figura 05

• If a silencer is installed at the outlet of the valve, the area of the silencer shall be sufficient to prevent back pressure from interfering in the operation and in the valve relief capacity. The silencer or other necessary components shall be constructed so as not to allow the formation of corrosion deposits that may cause restrictions to process fluid passage.

• The discharge pipe must be installed so that no undue stress is imposed to the Safety and Relief Valve. Excessive stress may cause body distortions and leakage. To avoid them, the following recommendations should be observed:

1. The discharge pipe should not be anchored to the valve. The maximum weight on the valve outlet should not exceed the weight of a short radius elbow with flange, plus a small vertical pipe compatible with the valve connection.

2. It must be ensured that the thermal expansion of the brackets and piping system will not produce tensions on the valve. Spring Holders are recommended where needed.

3. The discharge pipe should be designed to allow the expansion of the vessel as well as its own. This is especially recommended for long pipelines.

7. Maintenance and Testing

• SV81H series valves can be easily disassembled for inspection, maintenance or parts replacement.

• SV81H series valves are designed to meet ASME Section VIII requirements for pressure relief valves having non adjustable blowdown (4.12), on all types of media. No blowdown adjustment required when setting or testing the valve.

• The period for maintenance of each valve shall meet at least the requirements of NR13 Standard for the protected equipment; the specific characteristics of the process and operating conditions shall also be considered.

• Before disassembling or removal of the valve for maintenance, make sure that the equipment or process line is depressurized.

• Safety and Relief Valves might be installed on vessels or equipment containing hazardous materials. Decontaminate and clean the valve before disassembly, following applicable recommendations for cleaning and decontamination of the vessel or equipment.

7.1 Disassembly

7.1.1
Remove the cap **(29)**, including the lever system if present.

7.1.2
Remove cap gasket **(26)**.

7.1.3
Note the dimension A, as shown in **Figure 06**, this information will be necessary to position the adjusting screw **(24)** when reassembling the valve.

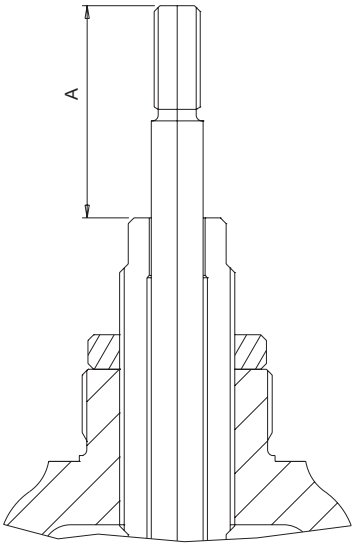


Figure 06

7.1.4
Loosen the lock nut **(25)** and turn the adjusting screw **(24)** counterclockwise to fully decompress the spring **(21)**.

7.1.5
Unscrew the bonnet **(22)** from the base **(01)** fixing the body and turning the castle in an anti-clockwise direction.

7.1.6
Remove the spindle **(19)**, the spring and spring washers set **(21) (20)**.

7.1.7
Remove the guide **(17)**, disc holder **(12)**, and disc **(09)** from the base **(01)**.

7.1.8
Remove the guide gasket **(16)**.

7.1.9
The valve is ready for cleaning and inspection.

7.2 Cleaning

The parts should be cleaned using sandpaper and a suitable solvent. During the cleaning process special attention must be paid to the seating surfaces, guided surfaces and threads. Remove any encrustations from the Bonnet **(22)** by scraping, wire brushing or if necessary, abrasive jets. It is not recommended to use abrasive jet for cleaning the internal parts of the valve.

7.3 Inspection

Carefully inspect each internal valve component, noting any defects such as cracks, corrosion, excessive wear or other mechanical defects. For the following parts some details must be observed:

7.3.1 Base (01)

Look for cuts, nicks or other damage on the seating surface. The threads must be in good condition without abrasions, tears or other damage. Verify if the base has defects like cracks (w / dye penetrant) and/or severe corrosion. After re-machining, if necessary, and lapping, check the F **(Figure 07)** dimension.

If it is too badly damaged or the dimension E is less than the minimum indicated in Table 02, the base should be replaced.

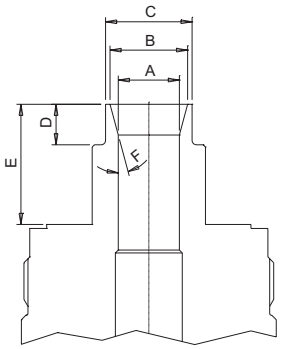


Figure 07

Orifice	Dimensions (mm)					
	A	B +0.0 -0.1	C +0.1 -0.0	D +0.1 -0.0	E Min.	F +1/2° -
1	8.4	10.2	12.6	5.6	20.2	15°
2	10.3	12.1	14.3	7.1	20.1	15°
3	13.7	17.4	19.4	9.1	26.5	15°
4	17.2	20.0	24.4	11.0	40.6	15°
5	21.6	25.4	30.0	13.8	39.5	15°

Table 02

7.3.2 Disc (09)

Look for cuts, nicks or other damage on the seating surface. Check the disc for defects such as cracks (w/ dye penetrant) and/or severe corrosion. Make sure that the outside diameter is not egged and the surface is smooth not showing marks or galled. The disc may be re-machined,If necessary, until the C dimension **(Figure 08)** is reduced to the minimum indicated in **Table 03**. Dimension B is informed to ensure that the disk is not machined beyond the limit. Failure to observe this limit will result in a significant change in the flow configuration of the disc, disc holder and guide assembly and will result in a significant increase in simmer **(4.17)** before the valve opening or change of blowdown **(4.12)**. If the disc is too badly damaged or the B dimension is less than the minimum indicated in **Table 03**, the disc must be replaced. For disc with O-Ring, the O'ring must be replaced every maintenance.

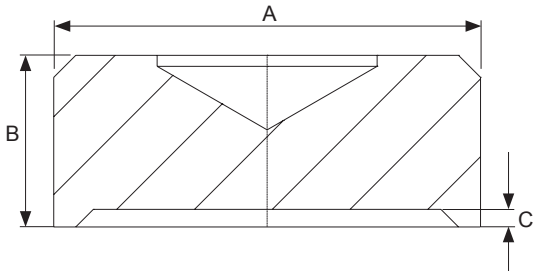


Figure 08

Orifice	Dimensions (mm)		
	A Ref.	B Mín.	C Mín.
1	12.6	6.1	0.6
2	14.3	6.1	0.6
3	19.4	7.5	0.6
4	24.4	11.6	0.6
5	30.0	12.0	0.6

Table 03

7.3.3 Disc Holder (12)

Make sure the outside diameter is not egged and the surface is smooth. If any small indication of galling is present, a polishing of the surface can be done with proper sandpaper. If serious or large scale galling is present, the disc holder should be replaced.

7.3.4 Guide (17)

Make sure the inside diameter is not worn, egged or galled. If some imperfection is found, the surfaces can be polished with a proper sandpaper. Make sure if there is no corrosion on the gasket sealing areas. If it is badly damaged, the guide should be replaced.

7.3.5 Spring (21)

Inspect the spring for defects such as cracks (w/ dye penetrant), high corrosion and warping (parallelism and perpendicularity). When the proper performance of the spring cannot be guaranteed, it is recommended to perform a load test according to ASME code Section VIII UG136 (a)(2). Spring and its washer should be kept as a single assembly. Replace the spring if it presents excessive wear.

7.3.6 Spindle (19)

Inspect for warping, corrosion and wear. If it is warped, the spindle should be straightened before being reused, taking care not to damage the supporting surface of the disc and threads.

7.4 Lapping

SV81H series valves have its seating surfaces (nozzle and disc) lapped in an automatic lapping machine, which ensures the best tightness characteristics. In maintenance services, where de lapping machine is not available, a cast iron block or another perfectly flat surface (e.g. glass) can be used, performing lapping according to the conventional method **(Figure 09)**.

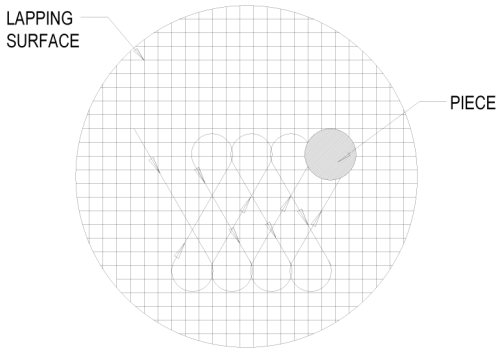


Figure 09

For lapping, it is recommended the following diamond compounds:

Micron Size	Lapping Phase
20 - 40 Micra	Initial Thinning
10 - 20 Micra	Quick Thinning and Polishing
6 - 12 Micra	Fine Polishing
3 - 6 Micra	Extra fine Polishing

Table 04

7.5 Assembly

SV80H valves can be easily reassembled, without the need of any special tools. Make sure that the internal parts are clean, especially the seating surfaces and the guided parts. Replace the gaskets. Use a lubricant with anti-seize properties in all threads and bearing surfaces.

7.5.1
Place a lapped disc **(09)** on the base **(01)** with lapped surfaces facing each other.Place the disc holder **(12)** onto the disc and base.

7.5.2
Install the lower gasket **(16)**, place guide **(17)** over disc holder onto base and install the upper gasket **(16)**.

7.5.3
Lubricate the spindle nose with a small amount of lubricant and insert the spindle (19) into the disc-holder spindle pocket. Apply a small amount of lubricant on the bearing surface of the lower spring washer **(20)** and slip it over the spindle. Install the spring **(21)** and upper spring washer **(20)**.

7.5.4
Install the bonnet **(22)**, threading (clockwise) in the body.Before tightening the bonnet completely, adjust the position of the guide so that one of the holes is lined up with the discharge of the valve. Tighten the bonnet using suficiente torque from **Table 05**.

Orifice	Area (cm^2)	Set Pressure (bar)	Required Torque in Nm (bar)
1	0.554	< 105	150
		>105	210
2	0.838	< 105	150
		>105	210
3	1.474	< 105	180
		>105	250
4	2.324	Todas	380
5	3.664	Todas	380

Table 05

7.5.5
Thread the adjusting screw locknut **(25)** onto the adjusting screw **(24)**. Apply a small amount of lubricant to the tip of the adjusting screw. Install the adjusting screw in the bonnet, rotating the number of times required to compress the spring slightly. Adjust the adjusting screw to the measurement recorded during disassembly **(see 7.1.3)** This procedure will restore approximately the original pressure setting. The valve should be further regulated the pressure required. When compressing the spring,use pliers to hold the spindle **(19)** in position and prevent galling.

7.5.6
The valve is ready for final setting and testing.

7.5.7
Although the valve can be set on the service installation, it is recommended to set the valve and check seat tightness on a test bench.
Any spring replacement shall be in accordance with current Spirax Sarco guidelines.

7.6 Bench Testing and Setting

7.6.1
The test bench shall have an adequate receiver volume for the valve to be tested and to achieve proper operation.

7.6.2
The valve must be set to open at the cold differential test pressure (AJ/F) (4.7), indicated on the nameplate of the valve **(Figure 12)**.

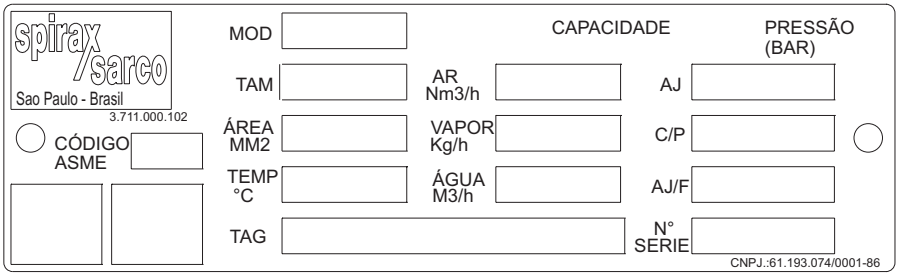


Figure 10

7.6.3
The Safety and Relief Valves bench testing procedure shall be in accordance with API Standard 527 STD and ASME Seç. VIII - UG 136 (d) **(4)** for the marked fluid.

7.6.4
Valves shall be tested by type as fallows:
- Steam valves are tested on saturated steam or air
- Air, gas or vapor valves are tested on air or gas at ambient temperature.
- Liquid valves are tested on water at ambient temperature.

7.6.5
For compressible fluids, the opening pressure is defined as the pressure at which the valve opens abruptly (Pop) and not the one that leakage (simmer) **(4.17)** starts.

7.6.6
For liquids, the opening pressure is indicated by the first continuous flow of water through the valve outlet.

7.6.7
Before installing the valve on the test bench, remove all debris and particles, such as gasket pieces or any other solid material, from the test bench and valve inlet. Select the gauge according to the valve opening pressure, between 25% to 75% of the scale. Make sure that the pressure gauge is calibrated and within the period of validity.

7.6.8
Install the valve on the test bench. If the valve opens below the desired pressure, it is necessary to compress the spring. Hold the spindle **(19)** to prevent it from rotating on the disc and turn the adjustment screw **(24)** clockwise. If the valve does not open at the desired pressure, decrease pressure on the bench in about 20% and slowly decrease the spring compression by turning the adjustment screw counter-clockwise. Continue the adjustment until the valve opens at the desired pressure. Hold the spindle while turning the screw. The valve spindle should be centralized with the screw. Hard rubbing of the spindle against the side of the adjusting screw can cause poor valve action

7.6.9
Verify that the valve's opening pressure meets the requirements of ASME Section VIII **(Table 06)**.

Code Section	Set Pressure	
	Set Pressure (bar)	Tolerance (+/-)
ASME Sec.VIII	<= 4.8	0.13 bar
	> 4.8	3% *

* Percentage of set pressure

Table 07

7.6.10
Lock the screw locknut **(25)** and repeat the test. At least two replicates of the same opening pressure must be obtained in order to make sure that the valve was adjusted correctly.

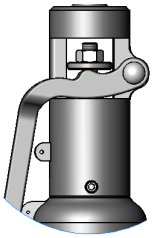
7.6.11
Check the seat tightness according to API STD 527 standard.

7.6.12
Install cap **(29)** and lever assembly, if present.

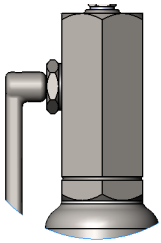
7.6.13
Use the backpressure value (C/ P) indicated on the identification plate **(Figure 12)**, when not indicated (sealing bellows) use of 1.5 bar(g). Check the gasket tightness for 2 minutes after application of pressure.

7.8 Manually opening the valve (Under flow)

• Every safety and relief valve operating on air, water at the valve inlet that exceeds 60ºC, excluding overpressure or relief events, or steam services shall have a substantial lifting device, in accordance with ASME Section VIII **(UG-136 (a) (3))**. To activate the lever, the system pressure should be at least 75% of the opening pressure **(4.6)** of the valve. Under flow conditions, the disc **(09)** must be fully lifted from its seating, so that dirt, sediment and solid particles do not become trapped in the seating surfaces. To allow closing of the valve, completely release the lever.



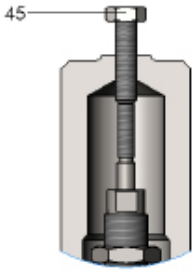
Open Lever



Packed Lever

7.9 Hydrostatic testing

• When hydrostatic tests are required after installation of Safety and Relief Valves, these should be removed and replaced by a cap or blind flange. If the valve cannot be removed, a test gag **(Figure 15)** must be used. It is common for Safety and Relief Valves to have problems caused by excessive tightening of the test gag. When the use is required, the gag must be tightened manually, without the use of tools. This will be enough not to allow the valve to open during the hydrostatic test.



Test (GAG)

Figure 13

8. Trouble Shooting

KEYWORD	PROBLEM	EFFECT	DIAGNOSIS	CORRECTIVE ACTION
CHATTER	CHATTER	VALVE WILL BE DAMAGED	The PSV is oversized for the installation - The flow is less than 25% of the required capacity	Check the required capacity and replace PSV if necessary
			The inlet piping is of excessive length	Redesign inlet piping so that the pressure drop is less than 3% of the set pressure
			Inlet piping undersized for PSV	Increase inlet piping so to at least inlet size of PSV
			The outlet piping is of excessive length - Built up back pressure	Redesign outlet piping so that back pressure doesn't build up
			Outlet piping undersized for PSV - Built up back pressure	Increase outlet piping to at least outlet size of PSV
SET PRESSURE	INCORRECT SET PRESSURE	THE PROCESS CAN BE DAMAGED DAMAGE TO THE PRESSURE VESSEL AND STAFF	Misreading the PSV nameplate - Back pressure and temperature	Adjust PSV to compensate the temperature and/or back pressure, according to the nameplate
			Internals are misaligned - Alignment is critical to operation	Disassemble PSV and inspect all components - Repair or replace if necessary
			Compression screw lock nut loose	Adjust set pressure and tighten lock nut
			Rough handling - A PSV is a precision instrument, handle with care	Pop PSV once or twice to realign parts after rough handling
			Pressure surge - Sudden impact of fluid may cause premature opening of PSV	Increase the pressure gradually to set pressure
LEAKAGE	SEAT LEAKAGE	THE PROCESS CAN BE DAMAGED DAMAGE TO THE PRESSURE VESSEL AND STAFF	PSV seats are damaged - Foreign particles may score seats	Lap seats to restore proper finish (machine if required)
			Operating pressure is too close to the set point - 10% differential is recommended	Lower operating pressure to increase differential
			Misaligned lifting gear - Lift nut may be holding seats open	Adjust lift nut to approx. 1/8" clearance
			Excessive external loads on outlet - Extra weight pulls PSV seats apart	Support outlet piping
			Horizontal mounting - Causes excessive friction on guide	Remounting PSV vertically to improve alignment and performance
			Misaligned internals - May be caused by external forces	Disassemble and inspect internals - Repair or replace if necessary - Check for bent spindle - Excessive spring washer clearance - Excessive guide and holder clearance - Check for piping stress
SIMMER	SIMMER	NOISE	- Alignment	- Check internals alignment

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