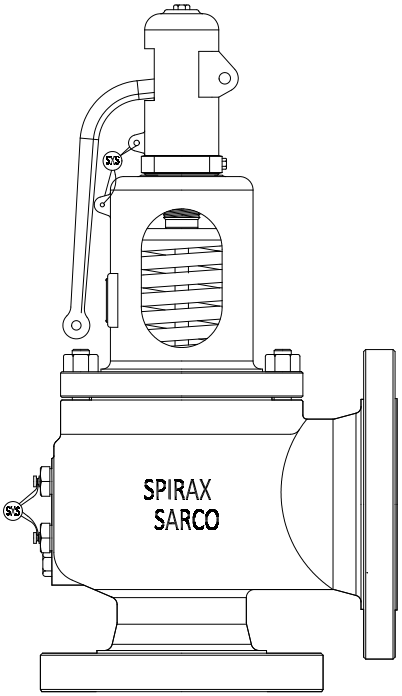
IM-S41-04
CTLS Issue 1

spirax sarco

SV47H/SV44H
Safety Valve
Installation and Maintenance Instructions



1. Warranty

Spirax Sarco guarantees, subject to the conditions described below, to repair and replace free of charge, including labour, any components that fail within 1 year of delivery of the product to the end customer. Such failure must have occurred as a result of a material or manufacturing defect, and not as a result of the product not having been used in accordance with the instructions in this manual.

This warranty does not apply to products that require repair or replacement as a result of normal wear and tear from use of the product or products that are subject to accidents, misuse or improper maintenance.

Spirax Sarco's sole obligation under the Warranty is to repair or replace any product that we deem to be defective. Spirax Sarco reserves the right to inspect the product at the customer's premises or request the return of the product freight prepaid by the buyer.

Spirax Sarco may replace with new equipment or upgrade any parts judged to be defective without further liability. All repairs or services carried out by Spirax Sarco that are not covered by this warranty will be charged in accordance with the current Spirax Sarco price list.

THIS IS SPIRAX SARCO'S SOLE TERM OF WARRANTY AND SPIRAX SARCO HEREBY EXPRESSES AND BUYER HEREBY WAIVES ALL OTHER WARRANTIES, IMPLIED BY LAW, INCLUDING ANY WARRANTY OF MERCHANTABILITY FOR A PARTICULAR PURPOSE.

2. General safety information

2.1 Access
Ensure safe access and if necessary a platform and/or workbench before starting work on the product and/or installation. If necessary, provide a device that can lift the product properly.

2.2 Lighting
Ensure adequate lighting, particularly where work is to be carried out and where there is electrical wiring.

2.3 Dangerous liquids or gases in the pipework
Check what is or has been present in the pipework, such as: vapours, flammable substances hazardous to health, high temperatures.

2.4 Dangerous environment around the product
Consider: areas of explosion risk, lack of oxygen (e.g. in tanks and pits), dangerous gases, extreme temperatures, hot surfaces, fire hazard (e.g. during welding), excessive noise, moving machinery.

2.5 The System
Consider, for example, whether closing shut-off valves or depressurising would put another part of the system or a person at risk. When opening and closing shut-off valves, do so gradually to avoid shocks to the system.

2.6 System pressure
Make sure that all existing pressure is isolated or the system is depressurised.
Do not assume that the system is depressurised, even when the pressure gauges indicate zero pressure.

2.7 Temperature
Wait for the temperature to drop after blocking the systems to avoid the danger of burns.

2.8 Tools and consumables
Before starting work, make sure you have the appropriate tools and/or consumables.

2.9 Protective equipment
Always wear the personal protective equipment required to carry out the work.

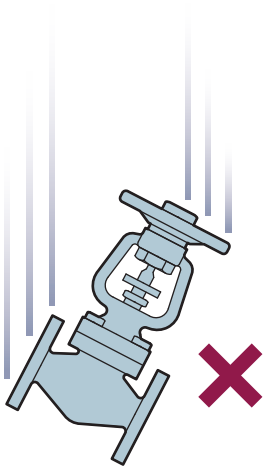
2.10 Work permits
All work must be carried out and/or supervised by a qualified person. Post notices whenever necessary.

2.11 Electrical work
Before starting work, study the wiring diagram and wiring instructions and check all special requirements. Consider in particular: main source and phase voltage, local insulation of main systems, fuse requirements, earthing, special cables, cable entries, electrical selection.

2.12 Commissioning
After installation or maintenance, ensure that the system is working correctly. Test all alarms and protective devices.

2.13 Working safely with steam cast iron products
Grey cast iron products are commonly found in steam and condensate systems.
condensate systems. If installed correctly using good steam engineering practices, it is perfectly safe. However, due to its mechanical properties, it is less forgiving compared to other materials, such as nodular iron or carbon steel. The following are the good engineering practices needed to avoid water hammer and ensure safe working conditions in a steam system.

2.14 Safe handling
Cast iron is a fragile material. If the product has been dropped during installation and there is no risk of damage, the product should not be used unless it has been fully inspected and tested by the manufacturer.



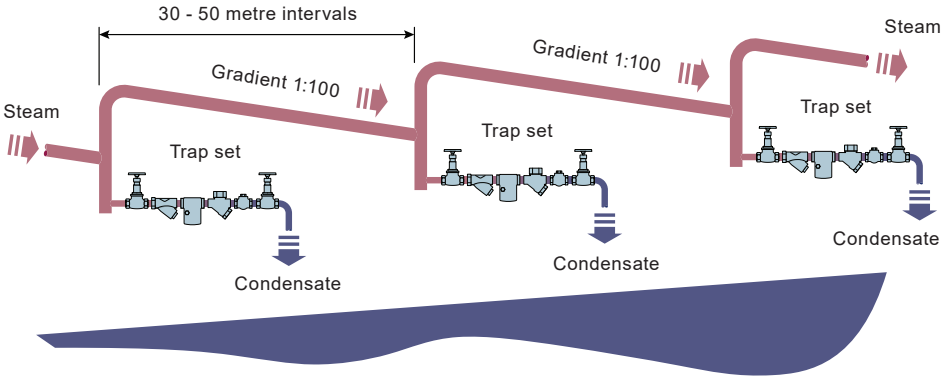
2.15 Disposal
Equipment and materials must be stored in a safe place. See item 5.

2.16 Product disposal
The product is recyclable. No harm to the environment is expected from the disposal of the product, if done properly.

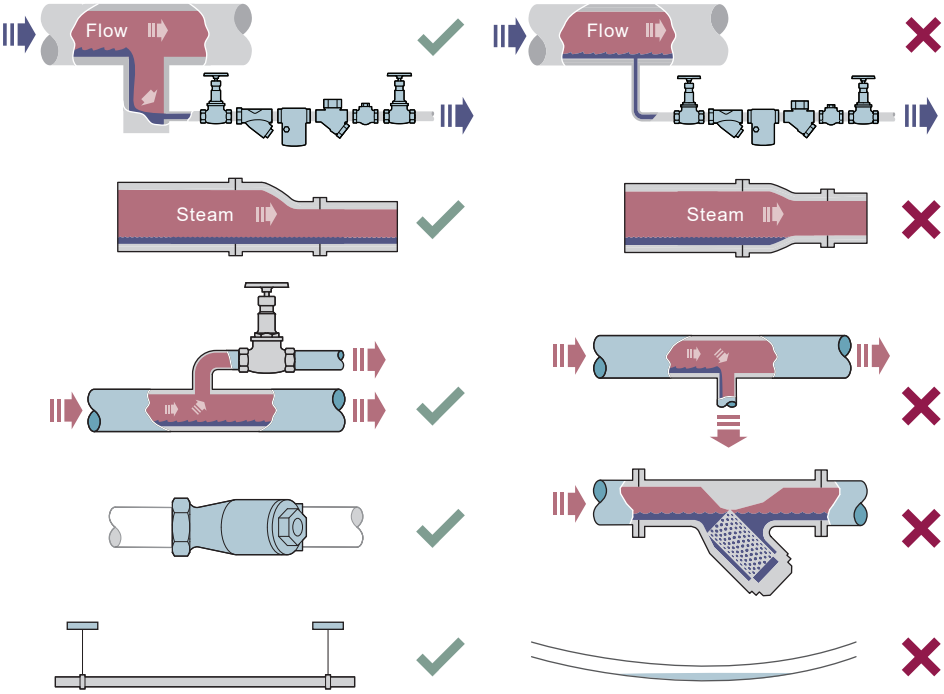
2.17 Additional information
Additional information and help is available worldwide from any Spirax Sarco service centre.

Prevention of waterhammer

Steam trapping on steam mains:

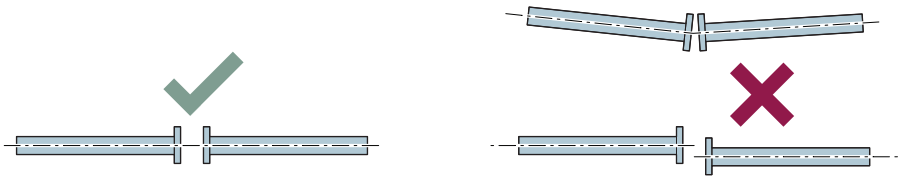


Steam Mains - Do's and Don'ts:



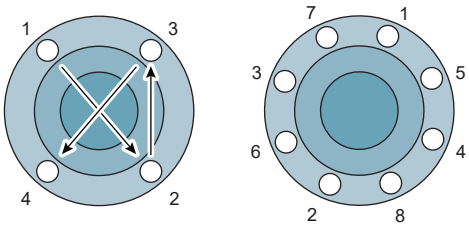
Prevention of tensile stressing

Pipe misalignment:



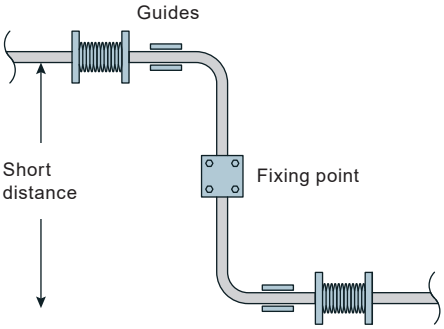
Installing products or re-assembling after maintenance:

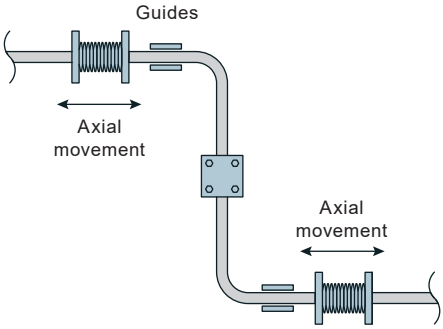
Do not over tighten.
Use correct torque figures.

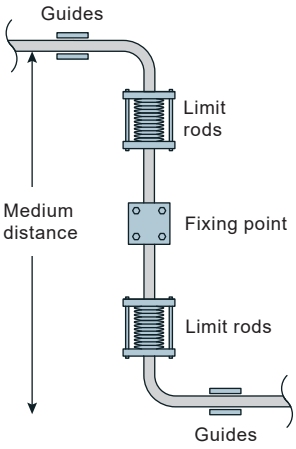


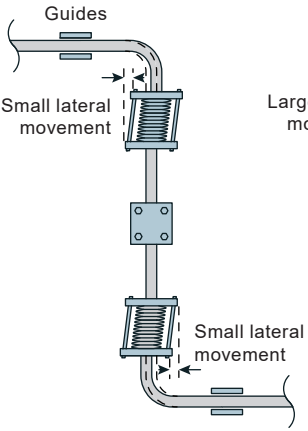
Flange bolts should be gradually tightened across diameters to ensure even load and alignment.

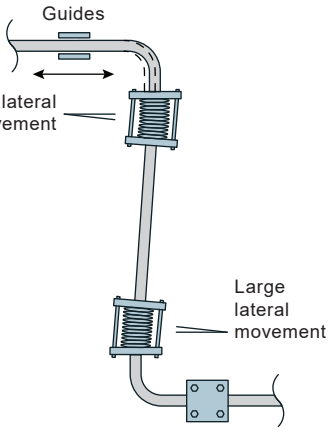
Thermal expansion:







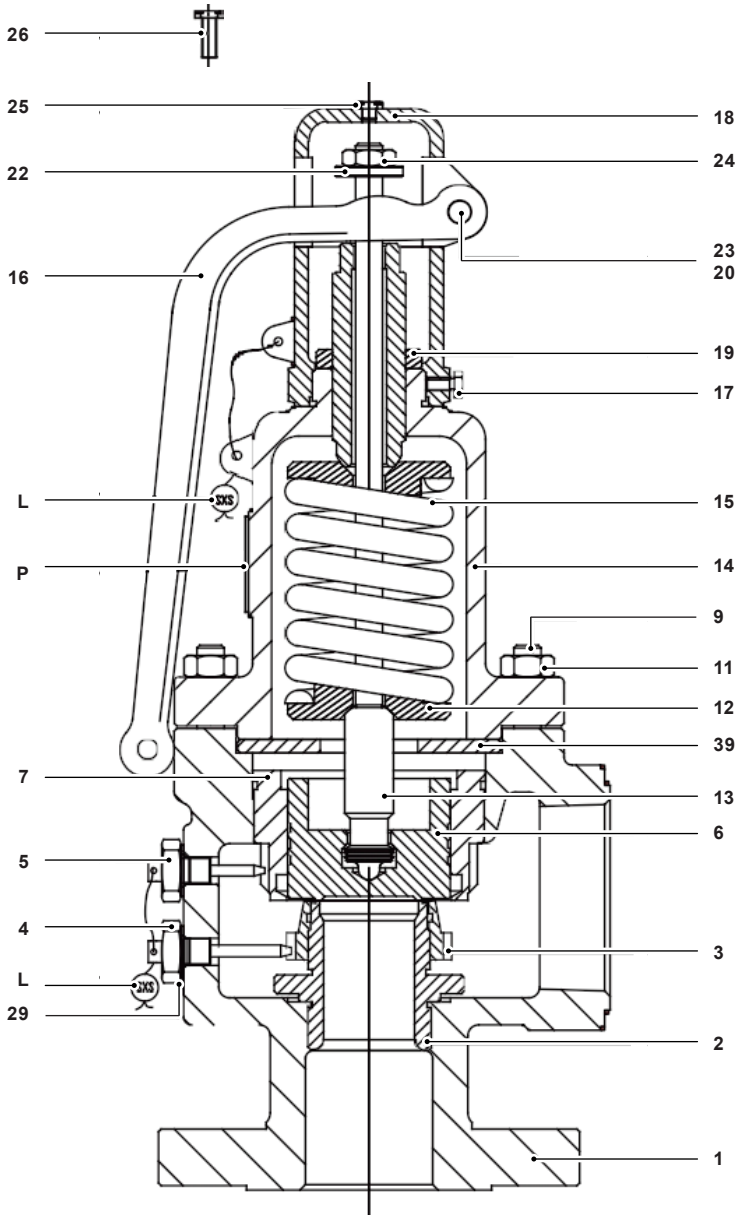




3. Parts

Item	Description
1	Body
2	Seat
3	Lower Regulating Ring
4	Lower Locking Screw
5	Upper locking screw
6	Disc **
7	Upper adjusting ring
9	Stud
11	Nut
12	Spring support
13	Rod
14	Castle
15	Spring **
16	Lever
17	Hood screw
18	Hood
19	Locking nut
20	Adjusting screw
22	Stem nut
23	Lever pin
24	Counter nut
25	Cap Screw
26	Test Lock (GAG)
28	Fork
29	Drain
39	Guide plate
P	Plate
L	Seal

** - Spare parts recommended for 2 years of operation.


26
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4. Introduction

The SV47H / SV44H Safety and Relief Valves are built in accordance with the requirements of the ASME Section I code. They have excellent performance characteristics for working with steam, both in boilers and other process equipment. Correct storage, handling, installation and testing of the valves guarantees performance compatible with the product specifications.

This manual contains basic concepts on the storage, installation, operation and maintenance of SV47H / SV44H safety valves, but does not replace the technical knowledge and experience required to carry out valve repair and maintenance services. For identification of valve parts, see section 3.

5. Terminology

5.1 Safety Valves
Automatic pressure relief device characterised by instantaneous opening ("pop") once the opening pressure has been reached. Used in service with compressible fluids (gases and vapours).

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

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

5.4 Maximum Allowable Working Pressure (MAWP)
This is the maximum working pressure of a vessel, compatible with the design code, the strength of the materials used, the dimensions of the equipment and its operating parameters.

5.5 Operating Pressure
A reasonable margin must be established between the operating pressure and the maximum allowable working pressure. For safe operation, the operating pressure must be at least 10 per cent lower than the PMTA, or 0.34 bar, whichever is greater.

5.6 Set Pressure
The gauge pressure at which the valve is set to open.

5.7 Cold Set Pressure
This 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).

5.8 Relief Pressure
This is the pressure at which the valve relieves the maximum capacity for which it was designed. It is equal to the opening pressure plus the overpressure.

5.9 Overpressure
This is the pressure increase above the valve's opening pressure that will allow maximum discharge capacity, normally expressed as a percentage of the opening pressure.

5.10 Accumulation
This is the increase in pressure above the vessel's PMTA during discharge from the safety device, expressed as a percentage of that pressure.
Overpressure can coincide with build-up when the safety device is set to open at PMTA.

5.11 Closing Pressure
This is the pressure at which the Safety and/or Relief Valve closes, returning to its original position once operational normality has been restored, and is equal to the opening pressure minus the Blowdown Differential.

5.12 Blowdown Differential
This is the difference between the valve's opening pressure and closing pressure. It is normally expressed as a percentage of the opening pressure.

5.13 Maximum Stroke (Lift)
The amount of displacement of the Safety and/or Relief Valve disc during valve discharge, measured from its closed position.

5.14 Discharge Capacity
The flow rate of a given fluid that the valve can release under the operating conditions for which it was designed.

5.15 Discharge Coefficient
The quotient of the actual capacity (measured in the laboratory) divided by the theoretical capacity.

5.16 Back pressure

This is the pressure at the outlet connection of the Safety and/or Relief Valve:

5.16.1 Superimposed

4.16.1.1 Constant

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

4.16.1.2 Variable

When there is pressure variation on the discharge side of the valve before opening.

5.16.2 Developed

This is the pressure in the valve's discharge system resulting from the fluid flow after the valve is opened.

5.17 Simmer

Audible or visible leakage of compressible fluid between the seating surfaces that occurs at a value just below the opening pressure, and of non-measurable capacity.

5.18 Chatter

Abnormal situation characterised by opening and closing in rapid succession, which can cause serious damage to the valve

6. Storage and Handling

Valves should always be stored in their original packaging and should not be removed from the packaging until they are installed.

Store valves in a covered, clean and dry environment. The protection of the inlet and outlet connections prevents impurities from entering the inside of the valves, only remove them when installing them.

- When moving them, avoid vibrations, shocks and rough handling.
- Never transport or move the valves using the test lever.

7. Installation

7.1 General requirements

7.1.1 The valves must be installed according to the requirements in Figure 01 below:

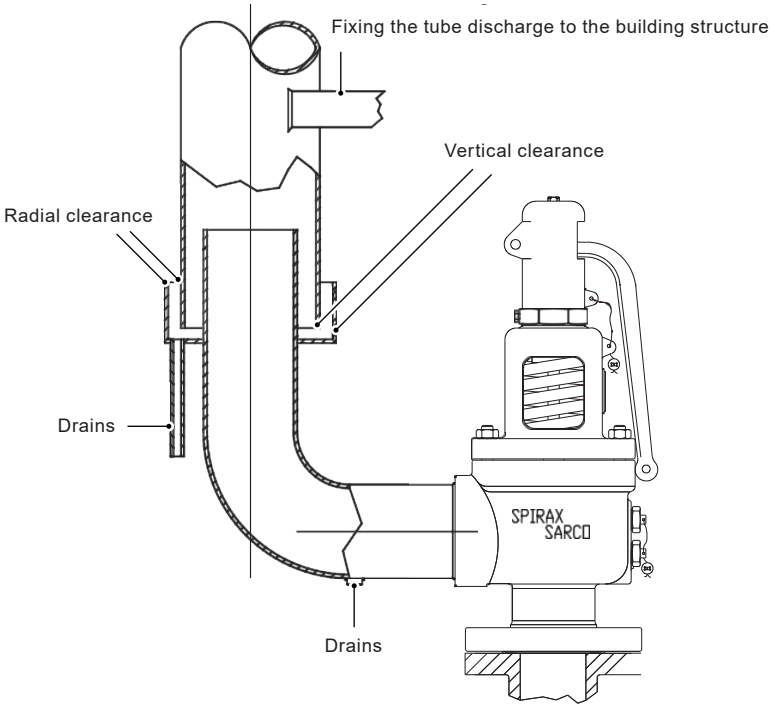


Fig. 1

7.1.2 It is recommended that the valves be inspected before installation. Calibration and tightness should be checked. To do this, use a bench suitable for testing with compressed air or inert gas. Tests should be carried out by qualified professionals in the presence of an equipment inspector.

7.1.3 Make sure that the equipment to be protected has undergone a purging process to remove all debris and particles, such as welding residue, pieces of gasket or any other solid materials.

Please note that any impurities that become lodged between the sealing surfaces or even pass between them at high speed will cause grooves and marks that will cause the valves to leak.

7.1.4 Safety valves must be periodically serviced to guarantee satisfactory performance. To do this, they must be installed in easily accessible areas.

A working area should be provided around and above the valves so that the adjusting rings and the adjusting screw can be accessed. If two or more valves are installed in close proximity, the outlets must be parallel to provide protection for maintenance personnel and personnel working in the vicinity of the valves.

7.1.5 The Safety Valves must be installed in a vertical upright position (+/- 1º), directly over the protected equipment in a pipe with a nominal diameter equal to or greater than the inlet diameter of the valves, avoiding sharp corners in the sections of this pipe.

7.1.6 No type of valve should be installed between the Safety Valve and the protected equipment.

7.1.7 Excessive pressure drop in the inlet pipe will cause the Safety Valve to open and close extremely quickly (chattering). This phenomenon can result in a loss of the valve's discharge capacity, damage to its sealing surfaces and, in extreme cases, damage to other valve components.

7.1.8 The pressure drop due to flow friction at the valve inlet must not exceed 50% of the expected blowdown differential of the Safety Valve.

7.1.9 The corners of the valve connection nozzles must be rounded to a radius greater than ¼ of the opening diameter.

7.1.10 To reduce the effects of the phenomenon known as "sonic vibration", the following recommendations must be observed:

1. Safety Valves must be installed at a distance of at least eight to ten pipe diameters downstream of any bend in the steam line. This distance must be increased when the valve is installed in the horizontal section of the line preceded by a rising section.
2. Safety Valves must be located eight to ten pipe diameters upstream or downstream of a converging or diverging Y.
3. Safety Valves should never be installed in the steam line in a position directly opposite a branch of the line.

7.1.11 Excessive vibration in the line produces changes in the opening pressure of the Safety Valve and also contributes to increased leakage from the valve. Ways of eliminating this problem should be studied before installation.

7.1.12 The effects of vibration and reaction force resulting from valve discharge on all valve and discharge pipe components must be taken into account when designing the system. Calculation of the reaction force during valve discharge is the responsibility of the vessel and/or pipework designer. Spirax Sarco can only provide these values as a technical aid and assumes no responsibility for their application.

7.1.13 The discharge area of the valve outlet pipe must not be smaller than the area of the valve outlet connection. When more than one Safety Valve is connected to a common outlet pipe, the area of the pipe must not be less than the sum of the areas of the valve outlet connections.

7.1.14 No type of valve should be installed between the outlet connection of the Safety Valve and the atmosphere.

7.1.15 All Safety Valves must have a discharge pipe directed away from walkways or platforms. The pipe must have gravity drains near the Safety Valve in places where water or condensate may accumulate.

Every Safety Valve has an open gravity drain in the body, and this drain must be channelled to a safe area.

7.1.16 If a silencer is installed at the discharge of the Safety Valve, the silencer area must be sufficient to prevent back pressure from interfering with the normal operation and discharge capacity of the valve. The silencer or other necessary components must be constructed in such a way as not to allow the formation of corrosion deposits that cause restrictions to the passage of vapour.

7.1.17 The discharge pipework must be installed in such a way as not to cause undue strain on the Safety Valve. These stresses can lead to distortions in the body and leaks. To avoid this, the following recommendations must be observed:

1. The discharge pipework must not be anchored to the valve. The maximum weight on the valve outlet must not exceed the weight of a short radius elbow with flange, plus a 12" (305 mm) long straight pipe, compatible with the class of the valve outlet flange.
2. The clearance between the discharge pipe and the chimney must be sufficient so that they do not touch due to thermal expansion of the pipe, valve and chimney. Movements caused by vibration and reactive forces of the valve must also be taken into account when dimensioning the clearance between the discharge pipe and the chimney.

7.1.18 The Safety Valve must always be lifted in the vertical upright position, and can be lifted with a cable attached around the bonnet and outlet neck. Under no circumstances should the valve be lifted by the test lever.

7.1.19 The Safety Valve must not be shocked or dropped during installation. Should this happen, it must be inspected on a test bench to check the opening pressure and seal.

7.1.20 Make sure that the joints and studs of the connections conform to the specifications of the pipework. Studs and nuts must be lubricated with an appropriate lubricant.

7.1.21 When installing the valves, the flange studs should be fitted carefully to avoid distortion of the valve body, misalignment and leaks.

7.1.22 With the valve installed in position, thread the nuts on by hand. Initially tighten each nut with a small amount of torque in the recommended sequence according to the number of nuts (Table 01), then increase the torque following the same initial tightening sequence until the final torque required is reached. The torque required varies according to the material and size of the studs and nuts, and the type of joint used. Consult your engineering company about the torque values to be applied.

Table 1

Stud No.	Tightening Sequence
4	1-3-2-4
6	1-4-2-5-3-6
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

7.1.23 Install the discharge pipework using the same procedures as for installing the valve.

7.1.24 Before finalising the installation, visually check that the test lever can be operated freely.

7.1.25 After installation, inspect the valve to ensure that all the adjustment components (locking screws for the adjusting rings, hood, etc.) are properly locked and sealed as required by ASME Code Section I PG-72 and Section VIII UG-126(c) and standard NR-13.

Safety valves that operate under the best possible conditions (with a favourable operating range, relatively stable ambient temperatures and absence of dirt) provide the maximum degree of safety, tightness and reliability.

7. Field Testing

7.1. General Information

SV47H / SV44H valves are tested at the factory for opening pressure and seal tightness. Each valve is set to open at the specified pressure and close tightly. However, due to the limited capacity available at the factory, compared to the capacities of the valves, it is necessary to adjust them at the installation site to ensure the correct position of the adjusting rings and the correct performance of the valves (ASME code Section I PG-73.4.2/ Section VIII UG-136(d)(4)).

During start-up, the test latches (GAG) must not be used until the boiler or equipment has reached operating temperature. The Safety Valve stem expands considerably as the temperature rises. If the valve is locked when the temperature rises, the stem could be seriously damaged, jeopardising the valve's performance. It is common for Safety Valves to have problems caused by over-tightening the test lock (GAG). When it is necessary to use it, it should be tightened by hand, without tools, against the valve stem. This will be enough to prevent the valve from opening when the pressure rises.

We recommend starting the tests with the valve with the highest opening pressure. Valves with lower opening pressures than the valve being tested should remain locked during the tests.

Safety Valve tests on boilers can be carried out with the unit on line or off line. However, with the unit on line at full load, a sudden drop in consumption could be dangerous, as most of the Safety Valves would be blocked. It is therefore advisable to test and adjust the valves with the unit off line. Control of the unit can then be maintained without external influence from load changes.

Please note that the adjustments to the regulating rings are preliminary adjustments made by Spirax Sarco and should not be considered as final adjustments. Final adjustments must be made on the system, under conditions similar to those of the system in actual operation. The differential set at the factory is slightly higher, in order to prevent chattering under the initial test conditions.

7.2. Initial settings of the regulating rings

The positions of the upper (07) and lower (03) adjusting rings are locked by the respective locking screws (05) (04). These screws are threaded into the valve body and fit into the respective notches in the rings. To adjust the rings, the corresponding screw needs to be removed. To turn the ring, use a screwdriver inserted into the hole in the locking screw.

Always lock the Safety Valve during adjustments. This prevents the adjustment tool from accidentally pulling the disc away from the seat, and also prevents the valve from opening as a result of an unexpected pressure rise in the system, endangering service personnel.

If there is any doubt about the position of the adjusting rings, the factory position can be restored as follows:

1. Lock the valve (GAG).
2. Remove the locking screws from the upper and lower rings (05) (04).
3. Move the upper ring (07) so that the lower face is level with the face of the disc holder (Figure 02).

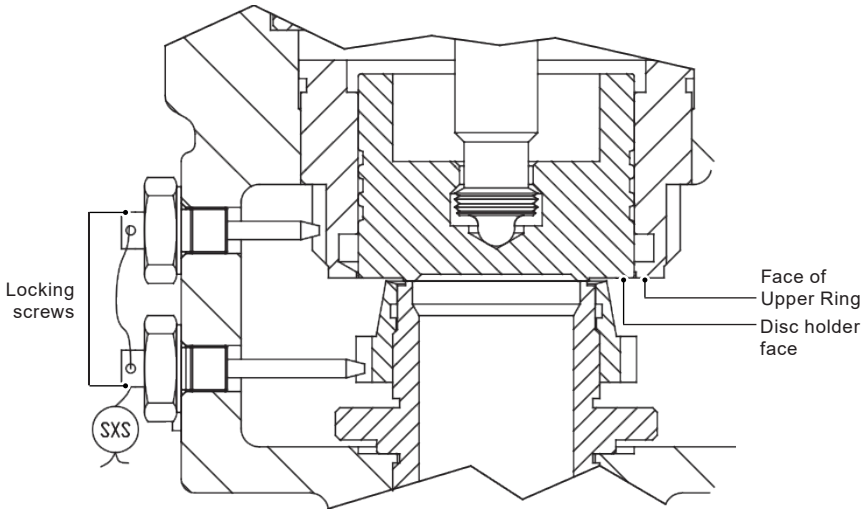


Fig. 2

4. See Table 02 for the number of notches to be lowered depending on the valve orifice (move clockwise).

Table 2

Orifice	Slot Number
F	16
G	16
H	20
J	15
K	13
L	16
M	18
N	20
p	24
Q	31
R	30

5. Move the lower ring (03) upwards (anti-clockwise) until it contacts the face of the disc (Figure 3).

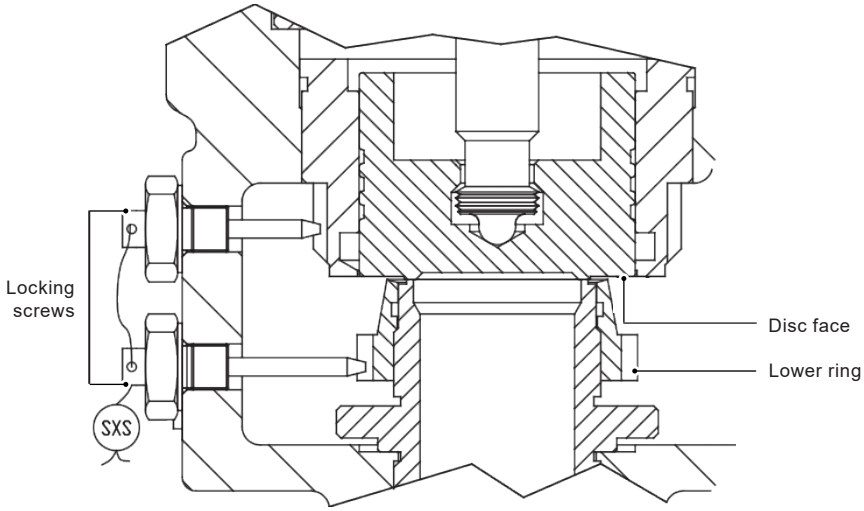


Fig. 3

Table 3

Orifice	Pressure of gap (bar g)		No. of Notches
	Min.	Max	
F	0.50	3.50	1
	3.55	6.50	2
	6.55	9.50	3
	9.55	12.5	4
	12.6	15.0	5
	15.0	17.0	6
	17.1	20.7	7
G	0.50	2.50	2
	2.55	4.50	3
	4.55	6.50	4
	6.55	8.50	5
	8.55	11.0	6
	11.1	14.5	7
	14.6	17.5	8
	17.6	20.7	9
H	0.50	1.50	3
	1.55	2.50	4
	2.55	4.00	5
	4.05	7.50	6
	7.55	10.0	7
	10.1	12.5	8
	12.6	15.0	9
	15.1	18.0	10
	19.1	20.7	11

Table 3 continued on next page

Table 3 (continued)

Orifice	Pressure of gap (bar g)		No. of Notches
	Min.	Max	
J	0.50	3.50	1
	2.55	6.50	2
	6.55	9.50	3
	9.55	12.5	4
	12.6	15.0	5
	15.1	18.0	6
	18.1	20.7	7
	20.8	26.0	8
K	0.50	2.50	2
	2.55	4.50	3
	4.55	6.50	4
	6.55	8.50	5
	8.55	11.0	6
	11.1	14.5	7
	14.6	17.5	8
	17.6	20.7	9
	20.8	26.3	10
L	0.50	1.50	3
	1.55	2.50	4
	2.55	4.00	5
	4.55	7.50	6
	7.55	10.0	7
	10.1	12.5	8
	12.6	15.0	9
	15.1	18.0	10
	18.1	20.7	11

Table 3 continued on next page

Table 3 (continued)

Orifice	Pressure of gap (bar g)		No. of Notches
	Min.	Max	
M	0.50	1.0	4
	1.05	2.50	5
	2.55	5.00	6
	5.05	7.50	7
	7.55	10.0	8
	10.1	12.5	9
	12.6	15.5	10
	15.6	18.0	11
	18.1	20.7	12
N	0.50	1.50	5
	1.55	2.50	6
	2.55	5.00	7
	5.05	7.50	8
	7.55	10.0	9
	10.1	12.5	10
	12.6	15.0	11
	15.1	17.5	12
	17.6	20.7	13
P	0.50	2.5	8
	2.55	5.0	9
	5.05	8.0	10
	8.05	12.0	11
	12.1	14.0	12
	14.1	17.5	13
	17.6	20.7	14

Table 3 continued on next page

Table 3 (continued)

Orifice	Pressure of gap (bar g)		No. of Notches
	Min.	Max	
Q	0.50	2.00	9
	2.05	4.50	10
	4.55	7.50	11
	7.55	10.5	12
	10.6	14.0	13
	14.1	17.5	14
	17.6	20.7	15
R	0.50	2.00	10
	2.05	4.00	11
	4.05	6.50	12
	6.55	9.00	13
	9.05	11.5	14
	11.5	14.5	15
	14.5	17.5	16
	17.5	20.7	17

6. Lower the lower ring according to the number of notches, as per the valve orifice in Table 03 (move clockwise).
7. Lock the adjusting rings with their locking screws. The locking screws must not rest on the adjusting rings.
8. Unlock the valve.
   - The valve is ready for the steam test.

7.3 Steam testing

Steam Safety Valves subjected to excessively high water levels may show very high blowdown differential values, which cannot be corrected by positioning the adjusting rings.

If a Safety Valve for superheated steam is set with low-temperature steam, it is advisable to increase the blowdown differential to compensate for the change in density and other thermal effects resulting from the rise in steam temperature to the superheat temperature. The rule of thumb is to add
½ to 1% of the opening pressure for every 38ºC of vapour temperature below the superheat temperature.

7.3.1 Procedure

7.3.1.1 Raise the pressure of the boiler or equipment at a rate no greater than 0.14 bar per second. Record the pressure at which the valve opens with a characteristic noise (pop). After opening, reduce the pressure until the valve closes. Record the closing pressure.

7.3.1.2 If, during the pressure rise, the valve remains closed with the pressure reaching 3% above the opening pressure, open the valve by the test lever and reduce the pressure of the boiler or equipment.

7.3.1.3 Check that the valve meets the requirements of the ASME code (Table 04) for opening pressure and relief differential. The nameplate defines the construction standard of the valve.

Table 4

Construction standard	Opening Pressure		Relief Differential	
	Opening pressure (bar)	Tolerance (+/-)	Opening pressure (bar)	Maximum differential
ASME Sec.I	<= 4.8	0.13 bar	<4.6	0.28 bar
	> 4.8 and <=20.6	3% *	>= 4.6 and <= 17.2	6% *
	>20.6 and <=68.9	0.7 bar	> 17.2 and < 25.8	1.1 bar
	>68.9	1% *	>= 25.8	4% * **
ASME Sec.VIII	<= 4.8	0.13 bar	The closing pressure should be higher than the operating pressure.	
	> 4.8	3%*		

* Opening pressure percentage.
** The relief differential of a boiler's valves can be adjusted so that the valves close at a pressure of no less than 96% of the opening pressure of the lowest pressure valve.

7.3.1.4 If the valve is operating in accordance with the building code requirements, carry out step 7.3.1.7.

7.3.1.5 If the valve does not comply with the building code requirements, reduce the boiler or equipment pressure to approximately 85% of the valve's opening pressure. Lock the valve to be adjusted.

7.3.1.5.1 To adjust the opening pressure, loosen the locking nut (19) and turn the adjusting screw (20) ¼ turn (45º) clockwise to increase, or anti-clockwise to decrease the pressure. Test the valve again and note the change to ¼ turn. Calculate the number of turns required to set the opening pressure t o the desired value. Tighten the locking nut after positioning the adjusting screw.

7.3.1.5.2 If the blowdown differential is excessive, move the lower ring (03) downwards (clockwise) to reduce the blowdown differential.

If the relief differential is insufficient, move the lower ring upwards (anti-clockwise) to increase the relief differential. The lower ring should be moved 3-4 notches at a time. The lower ring should be positioned as low as possible without the valve producing excessive "simmer" (above 2% of the opening pressure).

7.3.1.5.3 If the valve produces excessive "simmer" or does not open with the characteristic noise ("pop"), the lower ring should be moved upwards (anti-clockwise) 2 notches at a time to eliminate the problem.

7.3.1.5.4 If after adjusting the lower ring the relief differential is still excessive, the upper ring (07) must be adjusted. Move the upper ring upwards (anti-clockwise). If the relief differential is insufficient, move it downwards (clockwise). The top ring should be moved 3-5 notches at a time. It is possible for the upper ring to become too high, preventing the valve from reaching its full travel. When this happens, return it to the position where the full stroke is reached and finalise the adjustment of the relief differential by adjusting the lower ring (03) by moving it 1 notch at a time.

7.3.1.5.5 When trying to adjust the blowdown differential to 4 per cent, make sure that the lower and upper adjusting rings are not too far apart as to cause the valve to lose control. The first indication of this condition is a slow jerking of the valve just before closing. If this occurs, move both rings down a little (clockwise); this adjustment will also slightly reduce the blowdown differential. When making this adjustment, lower the upper ring twice as much as the lower ring.

7.3.1.5.6 Unlock the valve and repeat step 7.3.1.1, continuing with the adjustments according to the following steps, until the requirements of the valve's construction code are met.

7.3.1.5.7 Repeat the test two more times to check the repeatability of the opening pressure and blowdown differential values, observin

8. Maintenance

SV47H / SV44H Safety Valves can be easily dismantled for inspection, maintenance or replacement of parts. The maintenance period for each valve must at least follow the requirements of the NR13 standard for the protected equipment, and must also take into account the specific characteristics of the process and operating conditions.

Before dismantling or removing the valve for maintenance work, make sure that the equipment or process line is depressurised.

8.1. Dismantling

8.1.1 Remove the lever pin (23) and pull it out. Loosen the hood screws (17) and remove the hood.

8.1.2 Remove the lock nut (24) and the stem nut (22).

8.1.3 Make a note of dimension A, as shown in Figure 04. You will need this information to position the adjusting screw (20) when reassembling the valve.

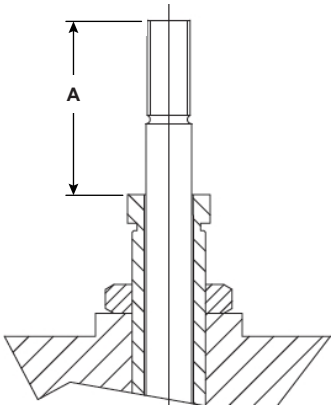


Fig. 4

8.1.4 Loosen the locking nut (19) and turn the adjusting screw (20) anti-clockwise to fully decompress clockwise to fully decompress the spring (15).

8.1.5 Remove the nuts (11) from the studs and remove the bonnet (14).

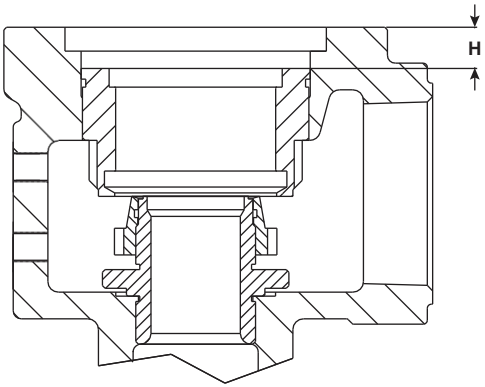
8.1.6 Remove the spring and support assembly (15) (12).

8.1.7 Remove the stem (13) and disc (06) assembly by pulling the stem up vertically. Protect the sealing surface of the disc.

8.1.8 To remove the disc from the stem, support the disc, lift and turn the stem anti-clockwise to engage the threads.

8.1.9 Remove the upper locking screw (13B). Remove the guide plate (39). Note the position of the upper adjusting ring (07) (dimension H, Figure 05). Remove it by turning it anti-clockwise. This procedure will help to position the upper adjusting ring exactly in the position it was in before disassembly.

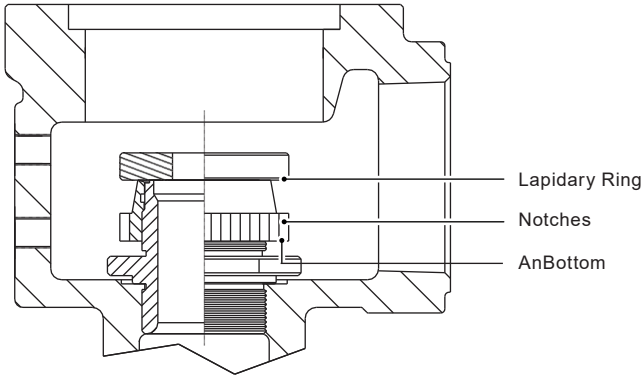
Fig. 5



8.1.10 Loosen the lower locking screw (04), moving it slightly away from the lower adjusting ring (03). Place a lapping ring on the sealing surface of the nozzle (02), taking care not to alter the position of the lower ring.

Turn the lower adjusting ring anti-clockwise and count the number of notches that pass in front of the locking screw until they come into contact with the lapping ring (Figure 06). Make a note of this information, as it will help to position the lower ring in the same position as before disassembly.

Fig. 6



8.1.11 Remove the lower adjustment ring from the nozzle.

8.1.12 The valve is ready for cleaning and inspection.

8.2 Cleaning

The parts should be cleaned using sandpaper and suitable solvents. During the cleaning process, special attention should be paid to the sealing surfaces, guided surfaces and threads. Remove all scale from the body (01) and bonnet (14) by scraping, wire brushing or, if necessary, abrasive blasting. Abrasive blasting is not recommended for cleaning the valve's internal parts.

8.3 Inspection

Carefully inspect each of the valve's internal components for possible defects such as cracks, corrosion, heavy wear or other mechanical defects. For the parts below, some aspects should be observed:

8.3.1 Seat (02)

Check for cuts, marks or other damage to the sealing surface. The threads of the adjusting ring and of the fixing ring on the body must be in good condition, with no abrasions, tears or other damage. Check the seat for defects such as cracks (for liquid penetrant) and/or severe corrosion. After re-machining, if necessary, and lapping, check the G dimension (Figure 08).
If it is badly damaged, or the G dimension is less than the minimum indicated in Table 04, the seat must be replaced.

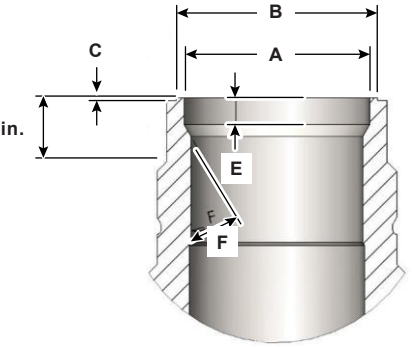


Fig. 7

Table 5

	Metric units (mm)					
Seal	**Metal/Metal Seal**					
Orifice	**G Min.**	**A + 0.10 / - 0.00**	**B + 0.00 / - 0.10**	**C + 0.10 / - 0.00**	**E + 0.10 / - 0.00**	**F + ½° / - ½°**
F	6.0	20.7	23.3	0.7	3.0	30°
G	6.0	23.7	26.3	0.7	3.5	30°
H	8.5	28.5	31.5	0.7	4.0	30°
J	9.0	36.5	39.6	0.7	5.0	30°
K	14.4	43.6	46.8	0.7	6.0	30°
L	14.4	54.3	57.8	0.7	7.4	30°
M	14.4	61.1	64.6	0.7	8	30°
N	14.4	67.0	71.0	0.7	9	30°
P	20.3	81.2	85.2	0.9	11	30°
Q	27.0	106.8	110.8	0.9	16	30°
R	32.4	128.6	132.6	0.9	16	30°

8.3.2 Disc (06)

Make sure that the outer diameter is not ovalised and that the surface is smooth with no marks or grooves. If there are any imperfections, these surfaces can be polished with suitable sandpaper. The stem threads must be in good condition, with no abrasions, tears or other damage.
Check the sealing surface for cuts, marks or other damage. The disc can be reused, if necessary, until dimension A (Figure 09) is reduced to the minimum indicated in Table 05.
Dimension B is entered to ensure that the disc is not machined beyond the limit.
Failure to observe this limit will result in a significant change in the flow configuration of the disc and upper ring assembly and will result in a significant increase in the "simmer" before the valve opens.
If the disc is badly damaged or the B dimension is smaller than the minimum indicated in Table 05, it must be replaced.

Fig. 9

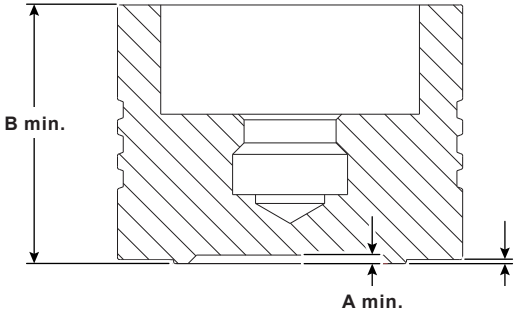


Table 6

Disk (Millimetres)			
Orifice	**A Min.**	**B Min.**	**C + 0.1 / - 0.0**
F	1.1	37.1	0.7
G	1.2	36.4	0.7
H	1.2	46.3	0.7
J	1.2	44.4	0.7
K	1.2	44.4	0.7
L	1.2	54.4	0.7
M	1.2	54.8	0.7
N	1.2	67.8	0.7
P	1.2	64.2	0.9
Q	1.2	87.7	0.9
R	1.2	105	0.9

8.3.3 Upper adjustment ring (16)

Make sure that the inner diameter of the ring is not ovalised and that the surface is smooth, w i t h no marks or grooves.
If there are any imperfections, these surfaces can be polished with suitable sandpaper.
If it is badly damaged, the upper adjusting ring should be replaced. In cases where the clearance between the inner diameter of the ring and the guided outer diameter of the disc is greater than the dimension given in Table 07, both the upper adjusting ring and the disc must be replaced.

Table 07

Dlametral Clearance (mm) Superior Adjustment Disc I		
Orifice	**Nominal Disc Width (mm)**	**Max.**
F	33.1	0.30
G	40.1	0.30
H	50.1	0.31
J	60.1	0.31
K	72.1	0.31
L	90.1	0.31
M	101.1	0.31
N	112.2	0.45
P	135.2	0.45
Q	177.3	0.60
R	231.3	0.60

8.3.4 Body (01)

Check the body for defects such as cracks (for liquid penetrant) and/or severe corrosion.
Inspect the condition of the inlet and outlet flange grooves for corrosion, tears, abrasions or other damage. If necessary, the grooves can be reworked, observing the minimum flange thickness defined by the valve's construction standard.
Valves with a threaded outlet must be in good condition, with no abrasions, tears or other damage.
If it is badly damaged, the body should be replaced.

8.3.5 Spring (16)

Inspect the spring for defects such as cracks (for liquid penetrant), severe corrosion and warping (parallelism and perpendicularism). When in doubt as to the proper performance of the spring, it is recommended to perform a load test in accordance with ASME Code Section VIII UG-136 (a)(2). The spring and its supports must be kept as a single assembly. Replace the spring if it shows heavy wear.

8.3.6 Rod (13)

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

8.4 Lapping

The SV47H / SV44H valves have their sealing surfaces (nozzle and disc) lapped using a lapping machine, which guarantees the best sealing characteristics. For maintenance work, if you don't have a lapping machine, use a cast iron block or another perfectly flat surface (e.g. glass), using the conventional lapping method (Figure 10).

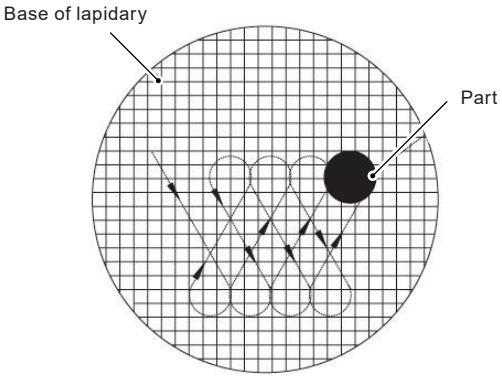


Fig. 9

We recommend the following diamond compounds for cutting:

Table 8

Grain	Lapping Function
20 - 40 Micron	Initial roughing
10 - 20 Micron	Fast Roughing and Pre-polishing
6 - 12 Micron	Fine polishing
3-6 Micron	Very fine polishing

8.5 Assembly

Model SV47H / SV44H valves can be reassembled easily, without the need for special tools. Make sure that the internal parts are clean, especially the sealing surfaces and guided parts. Use a lubricant with anti-seize properties on all threads and bearing surfaces.

8.5.1 Fit the lower adjusting ring (03) to the seat and the lower locking screw (04) to the body. The lower ring must be positioned using the same procedure and number of notches noted when dismantling the valve. If there is any doubt about the position of the lower ring, the factory position can be restored. Once the ring has been positioned, lock it with the lower locking screw. Check that the ring accepts a slight movement. If it doesn't, the screw is too long. Remove it and grind the tip a little, keeping the original profile, then reinstall it.

8.5.2 Screw the upper adjustment ring (07) into the body (01), adjust the position of the ring according to the dimension noted during disassembly. If there is any doubt about the position of the upper ring, the factory position can be restored according to the adjustment item. Once the ring has been positioned, lock it with the upper locking screw. Check to see if the ring will accept a slight movement. If it doesn't, the screw is too long. Remove it and grind the tip a little, keeping the original profile, then reinstall it.

8.5.3 Screw the rod (13) into the disc (06). Check that the disc moves freely, resting on the spherical surface of the stem. Install the assembly, resting the disc on the nozzle, taking care not to damage the sealing surfaces.

8.5.4 Install the spring (15) and support (12) assembly.

8.5.5 Fit the bonnet (14) and the nuts (11) of the studs. Tighten the nuts in the recommended sequence depending on the number of studs and using the torque values recommended in Table 09.

Use the same table to determine the torque required for each turn of the tightening sequence.

Table 9

Gauge	Torque in Nm + 10%-0%	Required torque per clamping turn (Nm)				
		1°	2°	3°	4°	5°
½"	60	Tightening the key	15	40	60	60
⅝"	120		30	75	120	120
¾"	210		55	130	210	210
⅞"	340		90	210	340	340

8.5.6 Screw the locking nut (19) onto the adjusting screw (20) and install the assembly in the bonnet. Compress the spring (15) by turning the adjusting screw clockwise until the original distance between the end of the rod and the top of the adjusting screw is reached. This procedure of compressing the spring will approximately restore the original setting pressure. The valve should still be set to the required pressure. When compressing the spring, hold the stem with pliers to prevent it from turning in the valve disc holder.

8.5.7 The valve is ready for final adjustment.

8.6 Bench test

Although final adjustment of the valve must be carried out under service conditions (ASME Code Section I PG-73.4.2 / Section VIII UG-136(d)(4)), it is recommended to adjust the valve, and check the tightness of the seal, on a test bench.

8.6.1 The test bench must have an accumulator.

8.6.2 The valve must be set to open at the opening pressure (AJ) indicated on the valve nameplate (Figure 11). A temperature correction must be made to the opening pressure value, according to Table 10.

Fig. 11

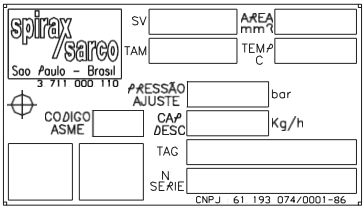


Table 10

Opening Temperature	Percentage increase in Opening Pressure
Until 120 °C	None
121 °C to 200 °C	1%
201 °C to 350 °C	2%

8.6.3 The bench test procedure for Safety Valves must be in accordance with API Standard STD 527.

8.6.4 With compressible fluids, the opening pressure is defined as the pressure at which the valve opens abruptly (Pop) and not the pressure at which the leak begins (simmer).

8.6.5 Before installing the valve on the test bench, remove all debris and particles, such as pieces of gasket or any other solid materials, from the test bench and the valve inlet. Select the pressure gauge according to the valve's opening pressure, between 25% and 75% of the scale. Make sure the pressure gauge is calibrated and within its expiry date.

8.6.6 Install the valve on the test bench. If the valve opens below the desired pressure, the spring must be compressed. Hold the stem (13) to prevent it from turning on the disc and turn the adjusting screw (20) clockwise. If the valve doesn't open at the desired pressure, lower the bench pressure by about 20 per cent and slowly reduce the spring compression by turning the adjusting screw anti-clockwise. Continue adjusting until the valve opens to the desired pressure. Hold the stem while turning the adjusting screw. The valve stem must be centred with the adjusting screw. Friction of the stem against the sides of the adjusting screw can impair the valve's function.

8.6.7 If it is difficult for the valve to pop because there is little volume available on the bench, the lower adjustment ring (03) can be lifted (turn anti-clockwise) until it touches the disc, then it will return 2 to 3 notches.

Depressurise the bench to make this adjustment. After testing, replace the lower adjustment ring.

8.6.8 Check that the valve meets ASME code requirements for opening pressure.

8.6.9 Lock the locking nut (19) and repeat the test. At least two repetitions of opening at the same pressure must be obtained in order to be sure that the valve has been adjusted correctly.

8.6.10 Check the valve for leaks in accordance with API STD 527.

8.6.11 Install the stem nut (22) and lock it with the lock nut (24), install the hood (18) and lever (21).

8.6.12 After adjustments and checks on the bench, the valve is ready to be installed and regulated under service conditions.

8.6.13 Once the adjustments and checks have been completed, the valve must be sealed (ASME code ASME Section I PG-72 and Section VIII UG136(a) and NR-13 standard). Notes:

- Unless the capacity of the test bench is equal to or greater than the capacity of the valve, it is not possible to adjust the relief differential. Position the adjusting rings.
- Incorrect positioning of the adjusting rings will affect the correct performance of the valve.

8.7 Service Installation Test

8.7.1 Install the valve in accordance with item 6 of this manual.

8.7.2 Adjust the valve according to the procedures described in this manual.

8.8 Opening the valve manually (under flow conditions)

Every safety valve that operates with water vapour or compressed air must have a manual operating device (test lever) in accordance with ASME Section I PG-73.1.3 and ASME Section VIII UG-136(a)(3). For test lever actuation, the system pressure must be at least 75 per cent of the valve opening pressure. Under flow conditions, the disc (06) must be lifted completely from its seat so that dirt, sediment and solid particles are not trapped on the sealing surfaces. To allow the valve to close underneath, release the lever completely.

8.9 Hydrostatic testing

When hydrostatic testing is required after the Safety Valves have been installed, they must be removed and replaced with a blind plug or flange.
If it is not possible to remove them, the test lock (GAG) must be used (Figure 12). It is common for Safety Valves to have problems caused by over-tightening the test lock (GAG). When it is necessary to use it, it should be tightened by hand, without tools, against the valve stem. This will be enough to prevent the valve from opening during hydrostatic testing.

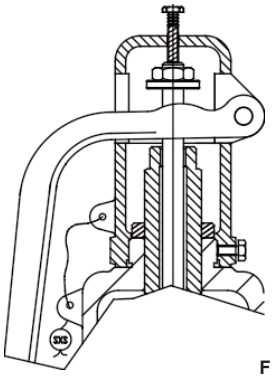


Fig. 12

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