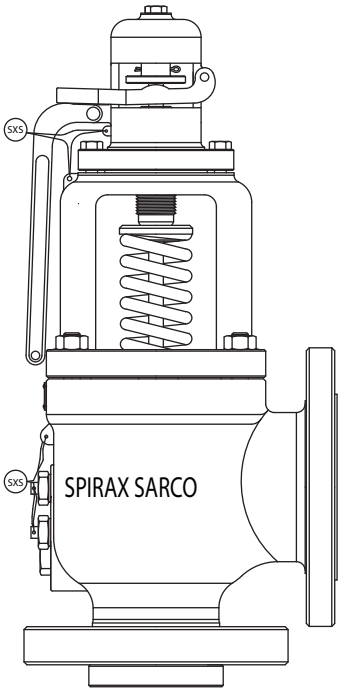
SV66H
Safety Valve
Installation and Maintenance Instructions



1. Warranty term of guarantee

Spirax Sarco guarantees, subject to the conditions described , 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 guarantee does not apply to products that require repair or replacement as result of normal wear and tear or products that are subject to accidents, misuse or improper maintenance.

Spirax Sarco's sole obligation under the Warranty Agreement 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. Any repairs or services carried out by Spirax Sarco which are not covered by this warranty will be charged in accordance with the Spirax Sarco price list in force.

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.

2. General safety information

2.1 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.

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

2.3 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.

2.4 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.

2.5 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.

2.6 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.

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

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

2.9 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.

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

2.11 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.

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

2.13 Storage
Equipment and materials shall be stored in a proper place and securely.

2.14 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.

2.15 Additional Information
Additional information and help is available worldwide at any Spirax Sarco service centre.

3. Materials

Nº	Part		Material
1	Body	up to 425 °C	SA 216 Gr WCB
		426 °C to 538 °C	SA 217 Gr WC9
2	Drain plug		Carbon Steel
3	Lower Locking Screw.		Stainless Steel
4	Upper Locking Screw.		Stainless Steel
5	Stud		SA 193 Gr B7
6	Nozzle **		Stainless Steel T 316
7	Lower Adjustment Ring.		Stainless Steel T 316
8	Upper Adjustment Ring.		Stainless Steel T 316
9	Disc **	up to 425 °C	Hardened Stainless Steel (17-4-PH)
		426 °C to 538 °C	Inconel
12	Disk Holder	up to 425 °C	Stainless Steel T 316
		426 °C to 538 °C	Monel
17	Guide	up to 425 °C	Stainless Steel T 316
		426 °C to 538 °C	Monel
19	Stem		Stainless Steel
20	Spring Washer		Carbon Steel
21	Spring	up to 230 °C	Carbon Steel
		231 °C to 400 °C	High Temperature Alloy Steel
		400 °C to 538 °C	Inconel
22	Bonnet		SA 216 Gr WCB

Nº	Part		Material
23	Nut		SA 194 Gr 2H
24	Adjustment Screw		Stainless Steel
25	Lock Nut		Stainless Steel
27	Lever Disc		Carbon Steel
28	Cotter pin		Carbon Steel
29	Cap		ASTM A 216 Gr WCB
30	Screw		ASTM A 193 Gr B7
33	Lever		Carbon Steel
34	Fork		Carbon Steel
38	Washer		Carbon Steel
39	Pin		Carbon Steel
40	Cotter pin		Carbon Steel
44	Screw Cap		Carbon Steel
45	Test Gag		Carbon Steel
46	Nameplate		Stainless Steel
47	Seal		Plastic / Lead
57	Retaining ring **	until 425 °C	Inox T 302
		426 °C to 538 °C	Inconel

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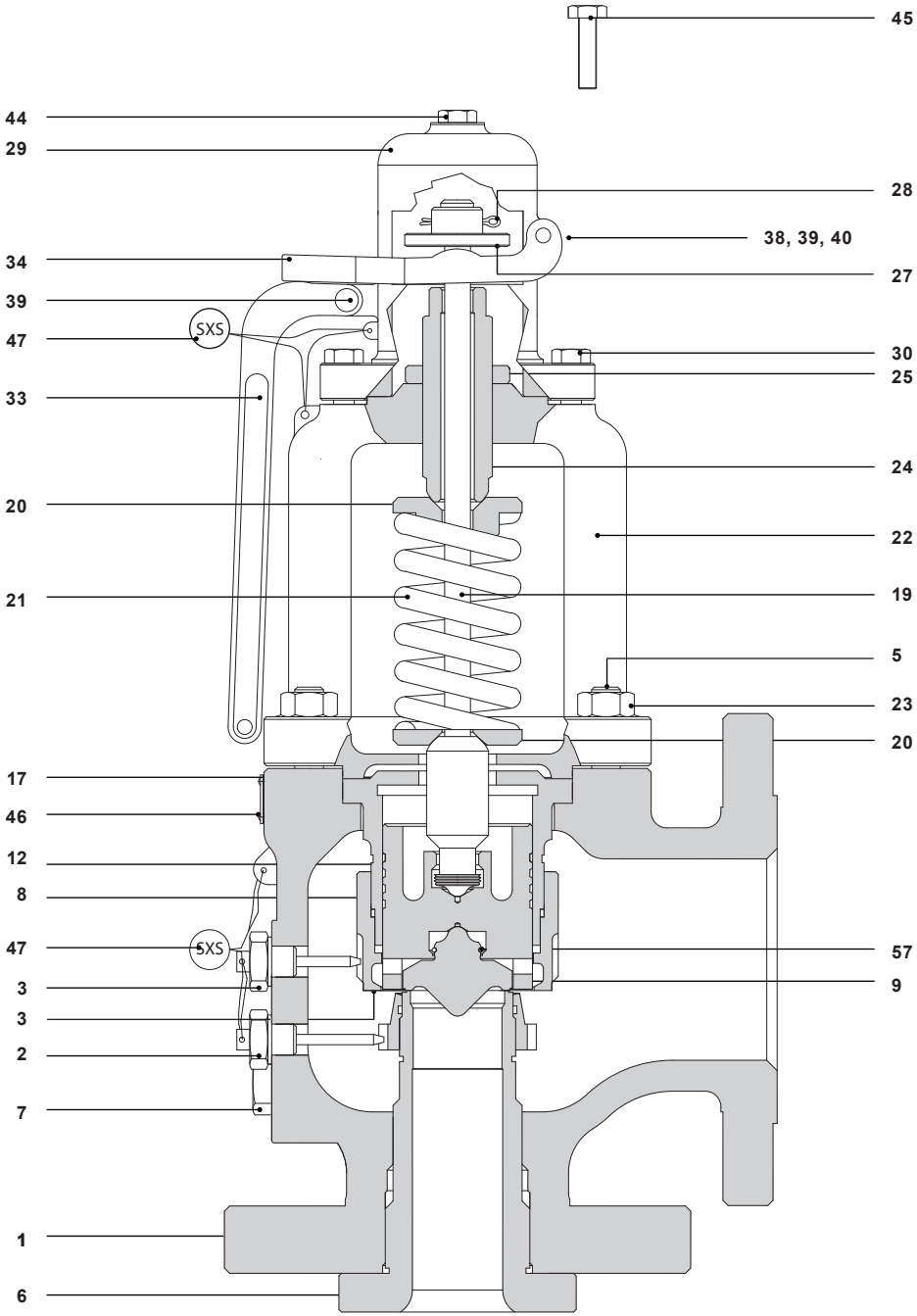
Recommended spare parts for 2 years of operation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4. Introduction

SV66H Safety 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 in other process equipment. Correct storage, handling, installation and testing of the valves guarantees performance compatible with the product's specifications.

This manual contains basic concepts on the storage, installation, operation and maintenance of SV66H 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 Materials.

5. Terms and Definitions

5.1 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).

5.2 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).

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

5.4 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.

5.5 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.

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

5.7 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).

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

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

5.10 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.

5.11 Closing pressure
Is the pressure at which the Safety and Relief Valve closes, returning to its original position after the operational normality is restored, and is equal to the opening pressure minus the blowdown.

5.12 Blowdown
The difference between the set pressure and the closing pressure of a pressure relief valve, expressed as a percentage of the set pressure or in pressure units.

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

5.14 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.

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

5.16 Backpressure
Is the pressure in the outlet connection of the Safety and / or Valve relief, it may be:

5.16.1 Superimposed backpressure

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

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

5.16.2 Build-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.

5.17 Simmer
The audible or visible escape of compressible fluid between the seat and disc of a pressure relief valve which may occur at an inlet static pressure below the set pressure prior to opening.

5.18 Chatter
Abnormal condition characterized by rapid openings and closings in succession, causing serious damage to the valve.

6. 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.
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7. Installation

7.1 General requirements

7.1.1 The valves must be installed according to the requirements in Figure 1 below:

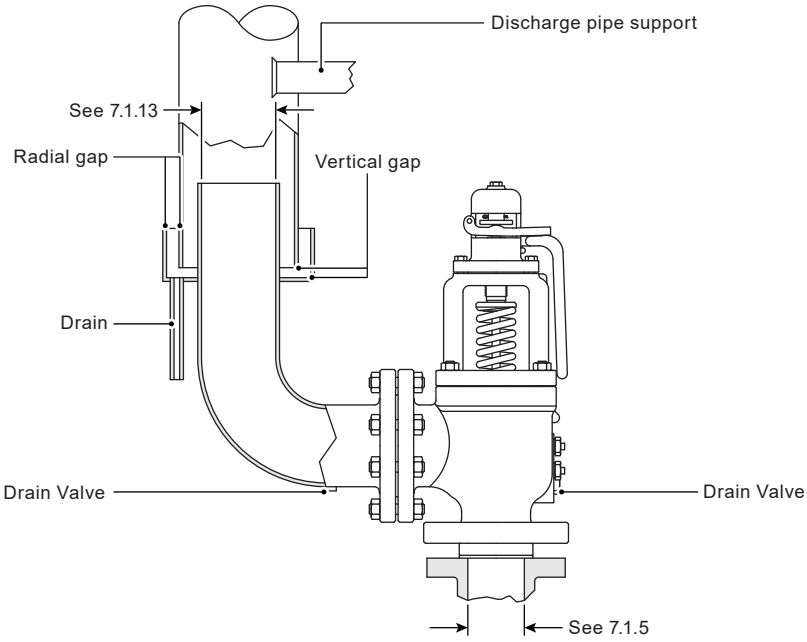

Fig. 1

7.1.2 It is recommended that valves be inspected before installation (See 9.6). Calibration and tightness must 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 residues, 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 need to be serviced regularly to guarantee satisfactory performance. To do this, they must be installed in easily accessible areas.

A working area must 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.

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 lead to an extremely rapid opening and closing cycle of the Safety Valve (chattering) (5.18).

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 the 50 per cent blowdown differential expected from the Safety Valve.

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

7.1.10 To reduce the effects of the phenomenon known as "sonic vibration", the following recommendations should 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 diameters from the pipe, upstream or downstream of a converging or diverging Y.

3. Safety Valves must 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 Safety Valve'opening pressure and also contributes to an increase in valve leakage. Ways of eliminating this problem should be studied before installation.

7.1.12 The effects of vibration and reaction force resulting from the valve discharge on all valve and discharge pipe components must be taken into account when designing the system.

The calculation of the reaction force during valve discharge is the responsibility of the designer of the vessel and/or pipework. 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 pipe area must not be less than the sum of the valve outlet connection areas.

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 passageways or platforms. The pipe must have gravity drains next to 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 area of the silencer 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 pipe 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) length of 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 build-up back pressure (5.16.2) generated by the discharge connection and/or silencers must be a maximum of 0.5 barg.

7.1.19 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.

7.1.20 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.

7.1.21 Make sure that gaskets and connection's studs are in compliance with specifications of the pipeline. The studs and nuts should be properly lubricated.

7.1.22 When installing the 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 1

No. of studs	Tightening pattern
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 ->

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

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

7.1.25 Valves with bellows should have the plastic cap removed from castle vent during installation.

7.1.26 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) and Standard NR-13.

7.1.27 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.

8. Field test

8.1 General Information

- SV66H Safety Valves are tested at the factory to check the opening pressure and the tightness of the seals. Every valve is set to open at the specified pressure and close tightly. However, due to the limited capacity available at the factory compared the capacities of the valves, it is necessary to adjust them at the installation site to ensure the correct positions of the adjusting rings and the correct actuation of the valve (ASME Section I PG- 73.5.2.1).
- It is important to note that the adjustments to the adjusting rings made by Spirax Sarco are preliminary adjustments and should not be considered as final adjustments.
- The valves are factory-set with a long blowdown differential to prevent chattering (5.18) in the initial start-up conditions.
- 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 blocked when the temperature rises, the stem could be seriously damaged, jeopardising the valve's performance.
- Safety valves often 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 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 must 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.

Note: Spirax Sarco recommends full vapour flow during initial testing.

8.2 Initial Adjustments of the Regulating Rings

- The positions of the upper (8) and lower (7) adjusting rings are locked by the respective locking screws (3) (4). 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 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, putting service personnel at risk.

- 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 (4) (3).

  3 Move the upper ring (8) so that the lower face is at the same level as the face of the disc holder (Figure 2).

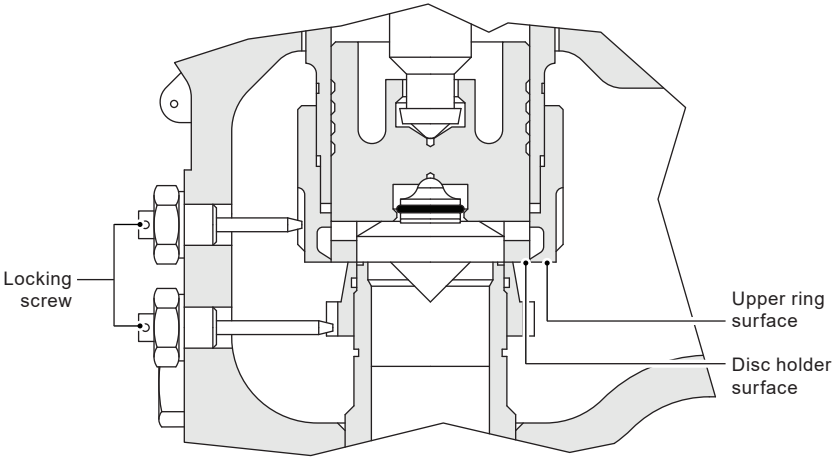

Fig. 2

4 See Table 2 for the number of notches to be lowered depending on the valve orifice (move clockwise).

5 Move the lower ring (7) upwards (anti-clockwise) until it comes into contact with the face of the disc holder (Figure 3).

Table 2

Orifice	No. of notches	
	Lower Ring	Upper Ring
F	13	13
G	12	13
H	13	19
J	14	13
K	16	14
L	20	13
M	21	14
N	20	18
P	34	25
Q	28	36

6 Lower the lower ring according to the number of notches according to the valve orifice in Table 2 (move clockwise), adding 01 notch for every 42 bar of opening pressure.

7 Lock the adjusting rings with their locking screws. The locking screws must not rest on the labelling rings.

8 Unlock the valve. The valve is ready for the steam test.

8.3 Steam tests

- Steam safety valves subjected to excessively high water levels can have very blowdown values, which cannot be corrected by positioning the adjusting rings.
- If a Safety Valve for superheated steam is fitted with low-temperature steam, it is advisable to increase the blowdown 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 set pressure to the closing pressure for every 38 ºC of steam temperature below the superheat temperature.

8.3.1 Procedures

8.3.1.1 Raise the pressure of the boiler or equipment at a rate of no more than 0.14 bar per second. If, during the pressure rise, the valve remains closed with the pressure reaching 2% or 0.13 barg (whichever is greater) above the opening pressure, open the valve via the test lever.
Reduce the pressure of the boiler or equipment and carry out step 8.3.1.5.1 to adjust the set pressure. Restart the procedure.

8.3.1.2 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.

8.3.1.3 Check that the valve fulfils the requirements of the ASME Section I code (Table 03) for opening pressure and relief differential. The nameplate specifies the valve's construction standard.

Table 3

	Set pressure (PG-72.2)		Blowdown (PG-73.4.3)	
Standard Construction ASME Sec.I	Set Pressure (bar)	Tolerance (+/-)	Set Pressure (bar)	Maximum Blowdown
	<= 4.8	0.13 bar	< 4.6	0.28 bar
	> 4.8 e <=20.6	3% **	>= 4.6 e <=17.2	6% ** ***
	>20.6 e <=68.9	0.7 bar	>17.2 and< 25.8	1.1 bar
	>68.9	1% **	>= 25.8	4% ** ***

* The ASME Section I Code no longer defines maximum blowdown limits for production valves. However, the code does specify maximum blowdown limits during certification testing.
The minimum blowdown value is 2 per cent for all the valves in this Code.

** Percentage of opening pressure.

*** The relief differential of a boiler's valves can be adjusted so that the valves close at a pressure no lower than the closing pressure of the valve with the lowest set pressure.

8.3.1.4 If the valve is operating in accordance with the requirements of the ASME Section I code, carry out step 8.3.1.5.9.

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

8.3.1.5.1 To adjust the set pressure, loosen the locking nut (25) and turn the adjusting screw (24) 1/6 turn (60º) clockwise to increase or anti- clockwise to decrease the pressure.

When retesting the valve, note the change to 1/6 of a turn. Calculate the number of turns needed to set the opening pressure to the desired value if you need to readjust the opening pressure. Tighten the locking nut after positioning the adjusting screw.

8.3.1.5.2 If the blowdown differential is excessive, move the upper ring (08) upwards (anti-clockwise).

If the relief differential is insufficient, move it downwards (clockwise). The upper adjusting ring should be moved 4-6 notches at a time.

It is possible that the upper ring is too high, preventing the valve from reaching its full stroke. 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 (7).

8.3.1.5.3 Move the lower ring downwards (clockwise) to reduce the relief differential and upwards (anti-clockwise) to increase the relief differential value.

The lower ring should be moved 2-3 notches at a time. The lower ring must be positioned as low as possible without the valve producing simmer (5.17).

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

8.3.1.5.5 When trying to adjust the blowdown differential to 4 per cent, you must 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 differentialWhen making this adjustment, lower the upper ring twice as much as the lower ring.

8.3.1.5.6 Unlock the valve and repeat step 8.3.1.1, continuing with the adjustments according to the following steps, until requirements of the ASME Seç.I code are met.

8.3.1.5.7 Repeat the test two more times to check th e repeatability of the opening pressure and blowdown differential values, observing a 10-minute interval between tests.

8.3.1.5.8 Continue testing the other valves on the boiler or equipment.

8.3.1.5.9 Once the tests have been completed, the valves must be unlocked and sealed (ASME Section I PG-73.2.9 and standard NR-13).

9. Maintenance and Testing

SV66H 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 the specific characteristics of the process and operating conditions must also be taken into account.
Before dismantling or removing the valve for maintenance work, make sure that the equipment or process line is depressurised.

9.1 Disassembly:

9.1.1 Remove the fork pin (39) and pull it out. Loosen the cap screws (30) and remove it.

9.1.2 Remove the lock nut (28) and the lever disc (27).

9.1.3 Make a note of dimension A, as shown in Figure 3. You will need this information to position the adjusting screw (24) when reassembling the valve.

9.1.4 Loosen the locking nut (25) and turn the adjusting screw (24) anti-clockwise to fully decompress the spring (21).

9.1.5 Remove the nuts (23) from the studs and remove the bonnet (22).

9.1.6 Remove the spring and support assembly (21) (20).

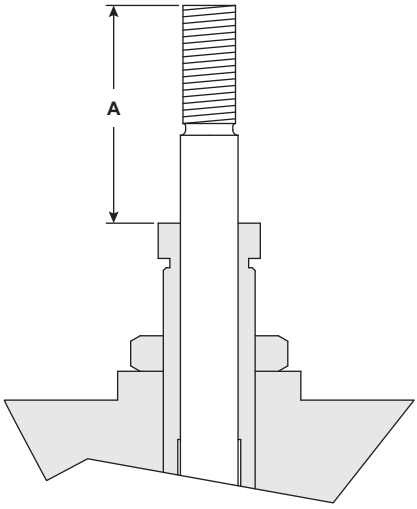

Fig. 3

9.1.7 Remove the upper locking screw (4). Remove the stem assembly (19), guide (17), upper adjusting ring (08), disc holder (12) and disc (4), pulling the stem upwards and taking care not to alter the positioning of the ring. Protect the sealing surface of the disc. Mark the position of the notches on the upper ring in relation to the guide and on the ring. Make a note of dimension B as shown in Figure 4. This will help to position the upper adjusting ring exactly in the position it was in before disassembly.

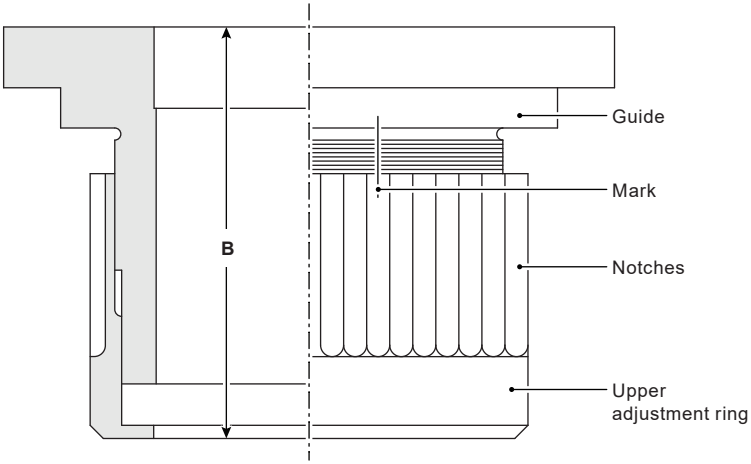

Fig. 4

9.1.8 Remove the guide and the upper adjusting ring from the assembly remove the upper adjusting ring.

9.1.9 To remove the stem from the disc holder, support the holder, lift and turn the stem anti- clockwise to engage the threads, continue to unscrew, releasing the stem.

9.1.10 To remove the disc from disc holder, rest the holder on a bench with the disc upwards and insert two spanners into the holes in the disc holder (Figure 5), forcing the disc out of the holder.

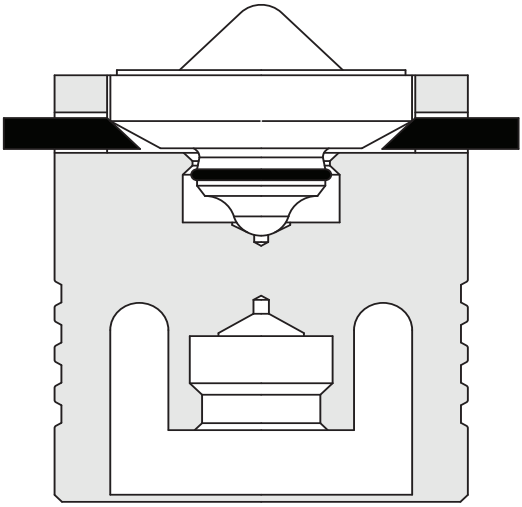

Fig. 5

9.1.11 Loosen the lower locking screw (3), moving it slightly away from the lower adjusting ring (7). Place a lapping ring on the sealing surface of the nozzle (6), taking care not to change 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 lapping ring (Figure 6). Make a note of this information, as it will help you position the lower ring in the same position as before disassembly.

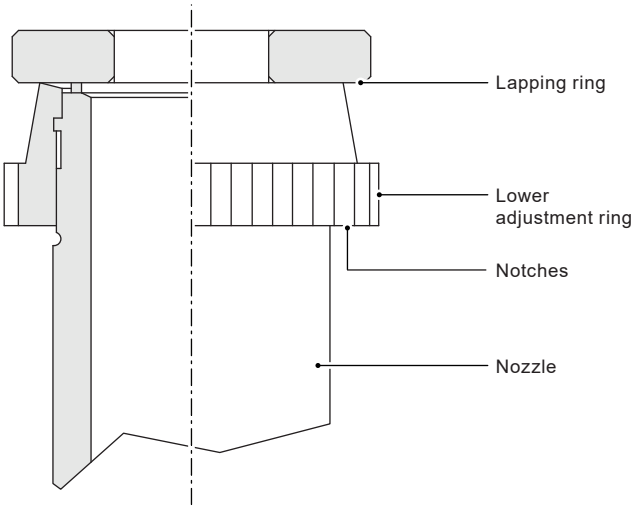

Fig. 6

9.1.12 Remove the lower regulating ring from the nozzle.

9.1.13 Remove the nozzle (06) from the body (01). The nozzle is mounted to the body by right-hand threads. Using a 3 or 4 clamps mandrel, hold the nozzle in the mandrel and loosen it from the body using a bar or pipe (Figure 07) and rotating the body in an counterclockwise direction. Be careful when using the bar or pipe in the outlet connection to ensure that the nozzle is not damaged during operation. Where the nozzle is stuck in the body, removal may be facilitated by heating the body externally in the threaded area while a cooling agent is applied to the inside of the nozzle. Remove the nozzle.

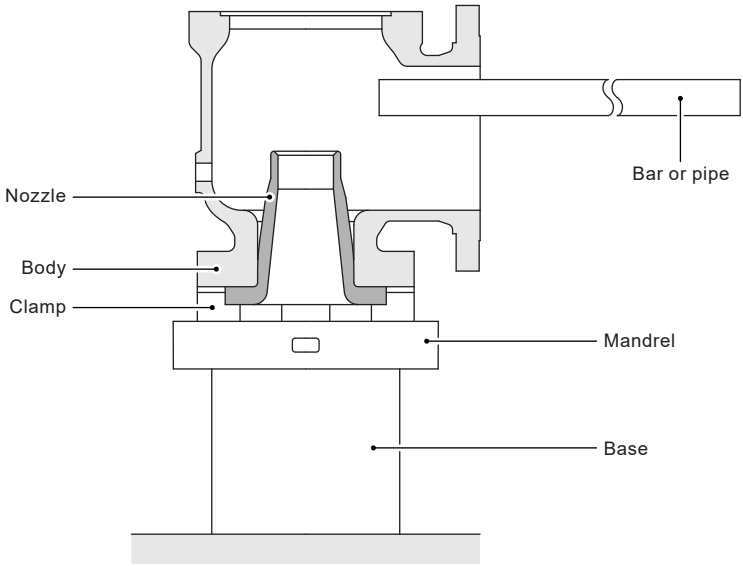

Fig. 7

9.1.14 The nozzle may also be removed from the body using a large plumber wrench (Figure 08).

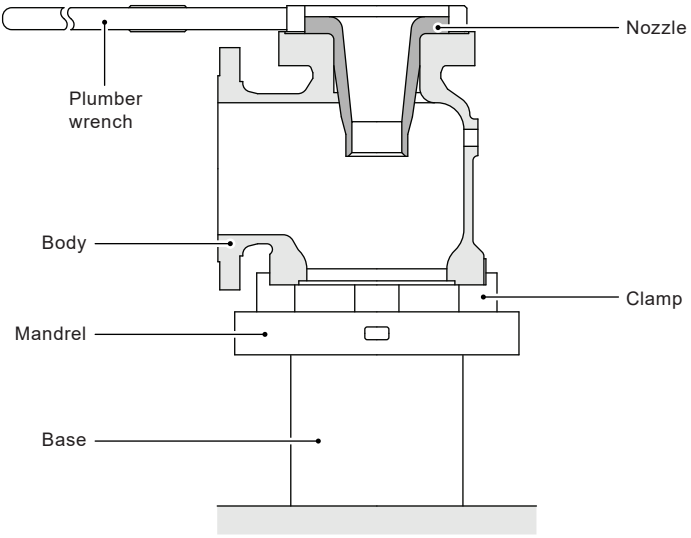

Fig. 8

9.1.15 The valve is ready for cleaning and inspection.

9.2 Cleaning

The parts should be cleaned using sandpaper and suitable solvents. During the cleaning process, special attention should be paid to sealing surfaces, guided surfaces and threads.
Remove all scale from the body (1) and bonnet (22) by scraping, wire brushing or, if necessary, abrasive blasting.
It is not recommended to use an abrasive jet to clean the valve's internal parts.

9.3 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.

9.3.1 Nozzle (2)

Check the sealing surface for cuts, marks or other damage. 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 nozzle for defects such as cracks (for liquid penetrant) or severe corrosion. After re-machining, if necessary, and lapping, check the G dimension (Figure 10). If it is badly damaged, or the G dimension is less than the minimum indicated in Table 04, the nozzle should be replaced.

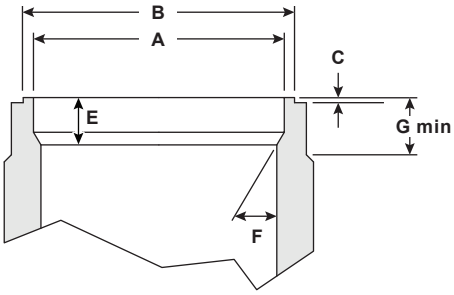

Fig. 9

Table 4

Metric units, mm						
Orifice	G Min.	A	B	C	E	F
		+ 0.10 - 0.00	+ 0.00 - 0.10	+ 0.10 - 0.00	+ 0.10 - 0.00	± 1/2º
F	5.8	20.7	23.3	0.7	3.0	30º
G	5.8	23.7	26.3	0.7	3.5	30º
H	8.1	28.5	31.5	0.7	4.0	30º
J	8.5	36.5	39.6	0.7	5.0	30º
K	14.2	43.6	46.8	0.7	6.0	30º
L	14.4	54.3	57.8	0.7	7.4	30º
M	14.2	61.1	64.6	0.7	8.0	30º
N	18.0	67.0	71.0	0.7	9.0	30º
P	20.3	81.2	85.2	0.9	11.0	30º
Q	27.0	108.3	111.3	0.9	15.3	30º

9.3.2 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. The disc can be re-machined, if necessary, up to the dimension A minimum (Figure 10) shown in Table 03. Dimension C should be redone when the disc is re-machined. 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 and disc holder assembly and will result in a significant increase in simmer (2:17) before the valve opening.

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.

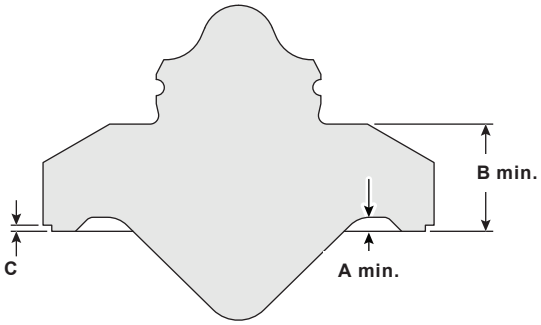

Fig. 10

Table 5

Disc (Millimetres)			
Orifice	A	B	C
	Min.	Min.	+ 0.1 - 0,0
F	0.2	7.6	-
G	1.1	8.9	-
H	0.4	8.9	0.7
J	1.1	11.1	0.7
K	1.1	12.1	0.7
L	1.1	15.4	0.7
M	1.1	17.7	0.7
N	1.1	15.4	0.7
P	1.1	15.4	0.9
Q	1.1	20.5	0.9

9.3.3 Disc holder (12)

Make sure the outside diameter is not galling and the surface is smooth. If any small indication of galling is present, polish the high spots with an emery cloth. If serious or large scale galling is present, the disc holder should be replaced.

If there are any imperfections, these surfaces can be polished with appropriate sandpaper. The stem thread must be in good condition, no abrasions, tears or other damage. If it is badly damaged, the disc holder should be replaced.

9.3.4 Guide (17)

Inspect the guide inside diameter for galling, and make sure the inside surface is smooth and there is no corrosion on the gasket sealing areas. If some imperfection is found, the surfaces can be polished with emery cloth. If it is badly damaged, the guide should be replaced. In cases where the clearance between the inside diameter of the guide and the guided outside diameter of the disc holder is larger than value shown in Table 06, both the guide and the disc holder must be replaced.

If the guide is badly damaged, it should be replaced.

In cases where the gap between the inner diameter of the guide and the guided outer diameter of the disc holder is greater than the dimension given in Table 06, both the guide and the disc holder must be replaced.

Table 6

Allowable Clearance (mm) / Guide and Disc Holder (mm) Support / Guide		
Orifice	**Guided Nominal Diameter Disc Holder (mm)**	**Max.**
F	33	0,28
G	40	0,28
H	50	0,29
J	58	0,40
K	72	0,43
L	90	0,46
M	101	0,50
N	111	0,50
P	135	0,52
Q	177	0,67

9.3.5 Body(1)

Make sure the body has no defects like cracks (w/ dye penetrant) and severe corrosion on the gasket sealing area. Inspect the condition of the outlet flange grooves for corrosion, tears, scratches or other damage. If necessary, the grooves can be remade, observing the minimum flange thickness, defined by the valve connection standard.

Inspect the condition of the 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.

The threads must be in good condition, with no abrasions, tears or other damage. If it is badly damaged, the body should be replaced.

9.3.6 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 I PG-73.2.3.

Spring and its washer should be kept as a single assembly. Replace the spring if it presents excessive wear.

9.3.7 Stem (19)

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

9.4 Lapping

SV66H 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 11).
We recommend using the following diamond compounds for cutting:

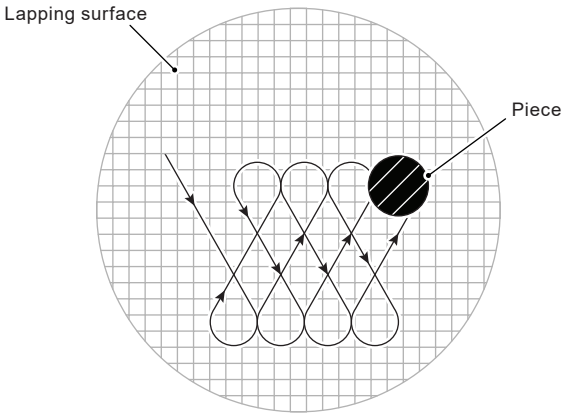

Fig. 11

Table 7

Micron Size	Lapping phase	
20 - 40	Micra	Initial thinning
10 - 20	Micra	Quick thinning and pre-polishing
6 - 12	Micra	Fine polishing
3 - 6	Micra	Extra fine polish

9.5 Assembly

SV66H Valves can be reassembled easily, without the need special tools. Make sure that the internal parts are clean, especially sealing surfaces and guided parts. Use a lubricant with anti- seize properties on all threads and bearing surfaces.

9.5.1 Fit the nozzle (6) to the body (1). The final tightening must be done using the same device used for removal (see Figure 7) and turning the body clockwise. Take care when using the bar or pipe for the valve outlet connection to ensure that the nozzle is not damaged during operation.

9.5.2 Fit the lower adjusting ring (7) to the nipple and the lower locking screw (3) to the body. The lower ring must be positioned using the same procedure and number of notches noted when dismantling the valve (See 9.1.11). If there is any doubt about the position of the lower ring, the factory position can be restored in accordance with item 7.2.

Once the ring is in place, lock it with the lower locking screw. Check that the ring accepts a small movement. If it doesn'tthe screw is too long. Remove it and grind the tip a little, keeping the original profile, then reinstall it.

9.5.3 Install the disc (9) in the disc holder (12). The disc should fit into the holder with moderate force from your finger or hand. Do not use excessive force to mount the disc. Check that the disc moves freely when supported by the holder.

9.5.4 Screw the stem (19) into the disc holder (12). Check that the disc holder moves freely, resting on the spherical surface of the rod.

9.5.5 Screw the upper regulating ring (8) onto the guide (17), adjust the position of the ring according to the dimension noted on the disassembly (see 9.1.7). Fit the guide and upper adjustment ring to the disc holder.

9.5.6 Install the assembly in the valve body by resting the disc on the nozzle, taking care not to damage the sealing surfaces. Take care not to alter the positioning of the ring and to ensure that the marking made during disassembly faces the valve outlet. If there is any doubt about the position of the upper ring, the factory position can be restored in accordance with item 7.2. Once the ring has been positioned, lock it with the upper locking screw. Check that the ring accepts a slight movement. If it doesn't, the screw is too long. Remove it, grind the tip a little, keeping the original profile, and then reinstall it.

9.5.7 Install the spring (21) and spring washers (20) assembly

9.5.8 Install the bonnet (22) and nuts (23). Tighten the nuts in the recommended sequence for the number of studs (Table 01), and using the torque values recommended in Table 08. Use this same table to determine the torque required for each turn of the tightening sequence.

Table 8

Bolts	Required torque Nm +10% -0%	Torque required for each round of pathern (Nm)				
		1º	2°	3º	4°	5º
7/16"	50	Key grip	12	30	50	50
½"	60	Key grip	15	40	60	60
5/8"	70	Key grip	20	45	70	70
¾"	70	Key grip	20	45	70	70
7/8"	120	Key grip	30	75	120	120

9.5.9 Thread the locknut (25) on the adjusting screw (24) and install the assembly in the bonnet. Compress the spring by turning the adjustment screw clockwise until the original distance between the spindle end and the top adjusting screw (see 9.1.3) is reached. This procedure will restore approximately the original pressure setting. The valve should be further regulated the pressure required. When compressing the spring, hold the spindle with locking pliers to prevent it from rotating in the disc holder.

9.5.10 The valve is ready for final adjustment.

9.6 Bench Test

Although the valve can be adjusted in the service facility, it is recommended that the setting of the valve, and checking of the seat tightness, to be done on a test bench.

9.6.1 The test bench must have an accumulator (buffer).

9.6.2 The valve must be set to open at the cold set pressure (AJ/F) (4.07) indicated on the valve nameplate (Figure 12).

9.6.3 The bench test procedure for safety valves must be in accordance with ASME Section I (PG-73.5.2) and API STD 527.

9.6.4 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 starts (simmer) (4.17).

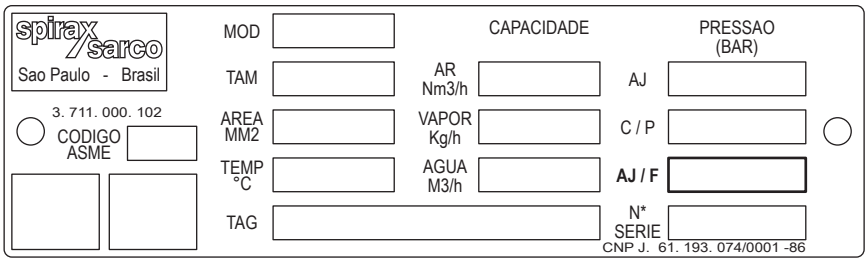

Fig. 12

9.6.5 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 set pressure, between 25% to 75% of the scale. Make sure that the pressure gauge is calibrated and within the period of validity.

9.6.6 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 holder 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.

9.6.7 If there is difficulty in presenting pop the valve (see 4.1), due to low volume available on the bench, the blowdown ring (08) can be lifted (turn anti-clockwise), until it touches the disc holder, and then lowered 2 to 3 notches. Depressurize the bench to make this adjustment. Reposition the ring after testing.

9.6.8 Check that the valve meets the requirements of the ASME code for opening pressure (Table 3).

9.6.9 Lock the locking nut (25) 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.

9.6.10 Check the valve for leaks in accordance with ASME Section I PG-7.5.3 and API STD 527.

9.6.11 Install the lever disc (27) and lock it with the lock nut (28), install the hood (29) and fork (34).

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

9.6.13 Once the adjustments and checks have been completed, the valve must be sealed (ASME Section I code PG-73.2.9 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 according to item 8.2.
- Incorrect positioning of the adjusting rings will affect the correct performance of the valve.

9.7 Testing at the Service Facility

9.7.1 Install the valve according to item 6 of this manual.

9.7.2 Adjust the valve according to the procedures described in item 7 of this manual.

9.8 Manual Valve Opening (Under Flow Condition)

- Every safety valve that operates with steam, compressed air and water with a temperature greater than 60ºC must have a manual override device (test lever), in accordance with ASME Section I PG-73.2.4 and ASME Section VIII UG-136(a)(3). For test lever actuation, the system pressure must be at least 75% of the opening pressure (4.06) of the valve. Under flow conditions, the disc(09) must be lifted completely from its seat so dirt, sediment and solid particles are not trapped on the sealing surfaces. To allow the valve to close, release the lever completely.

9.9 Hydrostatic test

- When hydrostatic tests are 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) should be used (Figure 13).
  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 sufficient to prevent the valve from opening during hydrostatic testing.

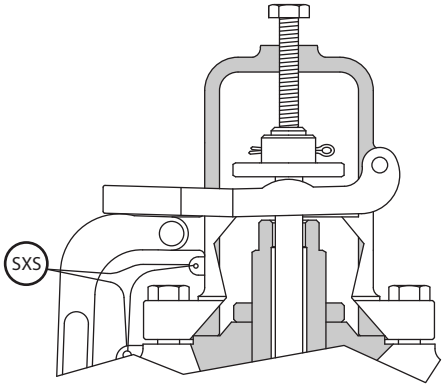

Fig. 13

General notes