TRILLIUM FLOW TECHNOLOGIES™

V SERIES (STARFLOW V™)

Installation, Operation, Maintenance Manual

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SAFETY SIGNS AND LABELS

Signs or labels are included throughout this document.

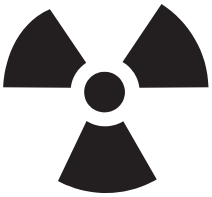
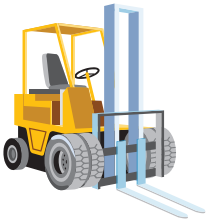
These signs or labels communicate the following messages:

- The level of hazard seriousness
- The nature of the hazard
- The consequence of human or product interaction with the hazard
- The instructions if necessary on how to avoid the hazard

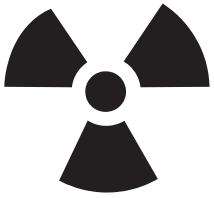
The format is characterised by vertical panels. The panels include a signal word shown below which advises the level of hazard seriousness

- **DANGER**
- **WARNING**
- **CAUTION**
- **ATTENTION**

DANGER	WARNING	CAUTION	ATTENTION
Immediate danger which **WILL** cause serious personal injury or death.	Risk or dangerous practice which **COULD** cause serious personal injury or death.	Risk or dangerous practice which **COULD** cause minor injuries.	Risk or dangerous practice which **COULD** cause damage to equipment.

DANGER	WARNING	CAUTION	ATTENTION
			
Never face the outlet of a valve when it is discharging as this may result in serious personal injury or death	Be aware of all site safety procedures to prevent the risk of serious injury or death.	Protect yourself by wearing the necessary protective equipment to prevent possible injury.	Use the proper lifting equipment to avoid personal injury or damage to equipment.

2 SAFETY INSTRUCTIONS

WARNING	CAUTION	ATTENTION
		
Be aware of all site safety procedures to prevent the risk of serious injury or death.	Protect yourself by wearing the necessary protective equipment to prevent possible injury.	Use the proper lifting equipment to avoid personal injury or damage to equipment.

- In order that the product may work as expected, ensure that it has been correctly installed, it is being correctly used and it is correctly maintained and serviced.
- This document describes the main procedures which are necessary to satisfy to the essential safety requirements in order to operate the product correctly and to comply with the International rules and regulations for the specified pressure equipment.
- This document describes each essential step from the receipt of valves through the stages of installation, operation and service. It is mandatory to ensure that anyone intervening with the product, directly or indirectly, is fully aware of these steps. Pictograms are used to clearly advise of the potential dangers associated with the use of the product.
- Whilst this document is intended to be informative, it is important to understand that the safety messages provided are not exhaustive. Trillium Flow Technologies™ cannot possibly be aware of, evaluate or advise, all of the conceivable methods by which tasks might be performed, or of the possible hazardous consequences of each of those methods.

  Consequently, anyone who uses a procedure and/or tool, which is not recommended by Trillium Flow Technologies™, or deviates from Trillium Flow Technologies™ recommendations must be thoroughly satisfied that neither personal safety nor equipment safety will be jeopardized by the method and/or tools which have been selected.

The installation, operation and maintenance of safety valves could be dangerous. During these activities personnel might be exposed to direct or indirect injury risks from fluids which are at various high pressures and/or temperatures. Therefore, every precaution should be taken to prevent injury to personnel during the performance of any procedure. Any person who uses a safety valve shall be trained in all aspects of handling, installation, operation and service.

3 SAFETY PRECAUTION

DANGER	WARNING	CAUTION
		
Never face the outlet of a valve when it is discharging as this may result in serious personal injury or death	Never dismantle a valve in line without making absolutely sure there is no remaining or residual pressure	Protect yourself by wearing the necessary protective equipment to prevent possible injury

A safety valve is a self-acting product. Always consider the potential dangers associated with the product and never minimise them. Each plant or installation has its own safety rules. Be aware of them and follow them carefully.

- Never stand in front of the discharge side of a safety valve if the valve is operating or being tested.
- Always wear personal protective equipment (PPE): PPE should consist of but not be limited to ear protection, eye protection, and the use of protective clothing (gloves, headgear, etc). Noise can be extremely high and can occur suddenly. Steam and hot water can burn. Superheated steam is NOT visible.
- Always lower the operating pressure before making any adjustment to the valve. Always gag the valve before making any ring setting adjustments.
- Before removing a valve for disassembly, ensure that there is no remaining pressure upstream the valve and that the valve is isolated from the system pressure.
- Before performing each pop test on the safety valve, ensure that no personnel are close to the valve. The steam which could escape during the operation could cause serious personal injury.
- When a lift test is performed using the lifting lever, be sure to use a rope or a chain whilst standing at a safe distance away from the valve and any potential steam escapes.
- Valves under the operating pressure may relieve at any time. Never strike the body or tamper with the valve as such practice could cause premature relief.
- Never modify or change the valves, especially when they are under pressure. It is essential that you inform Trillium Flow Technologies™ in All instances if any machining of parts is to be considered. Deviation from critical dimensions can adversely affect the performance of a safety valve.

4 WARRANTY INFORMATION

Trillium Flow Technologies™ warrants that its products (including performance) and work will meet the specifications of the customer's Purchase Order. If any issue arises whilst operating the product, the customer should inform Trillium Flow Technologies™ as quickly as possible. A return to the original plant should then be considered in order for Trillium Flow Technologies™ to inspect the product.

Trillium Flow Technologies™ cannot be held responsible for any incorrect sizing and selection of a valve if the original specification supplied by the customer was incomplete or inaccurate.

Trillium Flow Technologies™ does not authorise any third parties (eg, non-Trillium Flow Technologies™ service centres) to repair a product of Trillium Flow Technologies™'s manufacture. Any customer allowing or sub-contracting the repair of a Trillium Flow Technologies™ product which is still within its warranty period will do so entirely it at their own risk.

5 TERMINOLOGY

For the purpose of this manual, the following abbreviations, definitions and terms apply

ACCUMULATION
The pressure increase over the maximum allowable working pressure of the vessel, expressed in pressure units or as a percentage of maximum allowable working pressure (MAWP) or design pressure.

BACK PRESSURE
Back pressure is the static pressure existing at the outlet of a safety valve device due to pressure in the discharge system.

BLOWDOWN
The difference between actual popping pressure of a safety valve and actual reseating pressure expressed as a percentage of set pressure, or in pressure units.

CDTP (COLD DIFFERENTIAL TEST PRESSURE)
The pressure at which a safety valve is adjusted to open on the factory test bench. The cold differential test pressure includes corrections for the service conditions of backpressure or temperature or both.

CHATTER
Rapid and erratic motion of the disc from closed to open position. This phenomenon can create damage to the valve internals, the main effect being on the disc and the nozzle components.

CLOSING PRESSURE
The value of decreasing inlet static pressure at which the valve disc re-establishes contact with the seat or nozzle, or at which the lift becomes zero.

LIFT
The actual travel of the disc away from closed position when a valve is relieving. LEAK TEST PRESSURE Leak test pressure is the specified inlet static pressure at which a quantitative seat leakage test is performed in accordance with a standard procedure.

MAWP (maximum allowable working pressure)
The maximum gauge pressure permissible at the top of a vessel in its normal operating position at the designated coincident temperature specified for that pressure.

OPERATING PRESSURE
The pressure at which protected unit is working and at which the safety valve should be tight.

OVERPRESSURE
The pressure increase over the set pressure of a safety valve, usually expressed as a percentage of the set pressure.

POPPING PRESSURE
The value of increasing inlet static pressure at which the disc moves in the opening direction at a faster rate as compared with corresponding movement at higher or lower pressures. It applies only to valves in compressible fluid service.

SET PRESSURE
Inlet gauge pressure at which the safety valve is set to open under relief conditions

SIMMER
The audible or visible escape of fluid between the seat and disc at an inlet static pressure below the popping pressure and at no measurable capacity.

6 GENERAL ADVICE

6.1 RESPONSIBILITIES

The recommended practices indicated within this manual must be respected to prevent any potential damage to goods. It is important that all points of advice are followed closely and are implemented by suitably qualified personnel. Trillium Flow Technologies™ disclaims all responsibility for maintenance operations which may be performed by persons who are either not suitably qualified or are not considered to be an accepted part the Trillium Flow Technologies™ organisation.

6.2 IDENTIFICATION PLATE

The data shown on the identification plate (figure 1) should be referenced with all requests for work, or for the supply of spare parts.

The identification plate bears the following information fields fulfilled according code and regulation requirements:

- Serial number (also stamped on the edge of the outlet flange)
- Safety valve type (model number)
- Inlet dimension - pressure class (rating)
- Outlet dimension - pressure class (rating)
- Orifice
- Set pressure with units
- Capacities (water and steam for economizer application)
- Backpressure with units
- Identification number
- Spring identification number

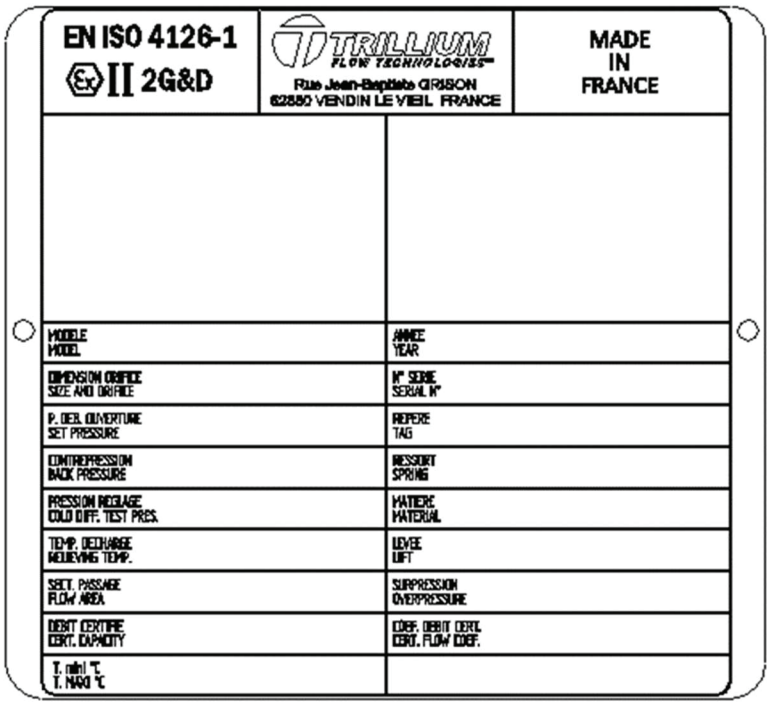


FIGURE 1 – COMMON NAMEPLATE

6.3 SPRING

The correct operation of a pressure relief valve depends upon its spring characteristics, resilience, and compression.
Good pressure relief valve operation requires:

- Effective and accurate lift
- Sufficient flow rating
- Quick closing (no damping effect when reseating)

The adjustment range of the spring must be within ± 5 % of the nominal value
Spring data should be obtained from Trillium Flow Technologies™'s Sarasin-RSBD™ Aftersales Department. When requesting information, please quote the serial number which is shown on the valve identification plate. Without this number, it may not be possible to identify the original valve

6.4 STORAGE

ATTENTION

Never lift the valve horizontally, or hook to the lifting lever or the spring. Always lift by using the lifting eyes or sling.

ATTENTION

Make sure the valve is not dropped and does not receive strikes.

Safety valves may be received several months before an actual plant start-up date. In order that the valve performance is not adversely affected, it is important to follow some clear rules concerning storage and handling prior to installation.

- It is recommended that the safety valves are stored in a clean and dry environment, protected from weather conditions, the ingress of sand, dust, or any other solid particles or foreign matter.
- Wherever possible, the valves should be stored in their original packaging.
- Blanking plugs, thread protectors and plastic covers should only be removed at the point of installation of the valve.
- Special attention should be given to flange gasket contact surfaces and machined threads. Impact on these areas should be avoided.
- The valve must remain vertical, always laying on the inlet end (never on the outlet end).

6.5 HANDLING

According to procedure 20.02, the safety valve should be handled very carefully at all times whether they are in the packed or unpacked condition. The valves should never be subjected to any impact or striking, either directly or indirectly through the packaging.

Never lift or handle a safety valve by its lifting lever.

The valve should be moved and transported in the upright position at all times to maintain performance accuracy.

7 STARFLOW V™ BASICS

7.1 DESCRIPTION

Starflow V™ safety valves is provided with flanged ends connections.
Table 1 shows the critical flow path dimensions according to each orifice designation. In cases of restricted lift, values presented are the maximum allowable limitation.

A sectional view of the Starflow V™ safety valve is shown on page 13 of this document.

The valve consists of a body and inlet connection which is mounted on the pressurized system. A disc (11) is held in place against the nozzle (6) to prevent any flow under normal system operating conditions and a spring (46) is used to hold the disc firmly on to the nozzle seat. The disc (11) which is screwed on to the spindle (13) is held in place by the disc nut (26) and the dischholder (56). The disc holder is inserted into the guide (9) with two sliding rings (12). Each of these rings are made up of two segments which allow them to be mounted around the disc-holder. This arrangement is referred to as the anti-seizing function.

Three rings allow accurate adjustment of the popping and the reseating pressure: a lower adjusting ring (7), an upper adjusting ring (8) and an overlap ring (28) which is at the cover level. A lift stop (10) controls the lift characteristics.

The sub-assembly, ie, disc nut (16), lift stop (10) and overlap ring (28) are prevented from rotating by the use of cotter pins. Upper and lower adjusting ring screws (22) and (23) prevent the rotation of the lower adjusting ring (7) and upper adjusting ring (8).

The spring (46) load is adjustable by using the set screw (14) to ensure control of the pressure at which the valve opens. A thrust bearing (104) protects the valve setting avoiding any rotation of the spindle or the disc. This feature protects the seat during any adjustment.

The lifting lever (30) is connected via the cap (5) to the spindle (13) and the disc (11). This device is mandatory in accordance with the ASME code to periodically test the safety valve.

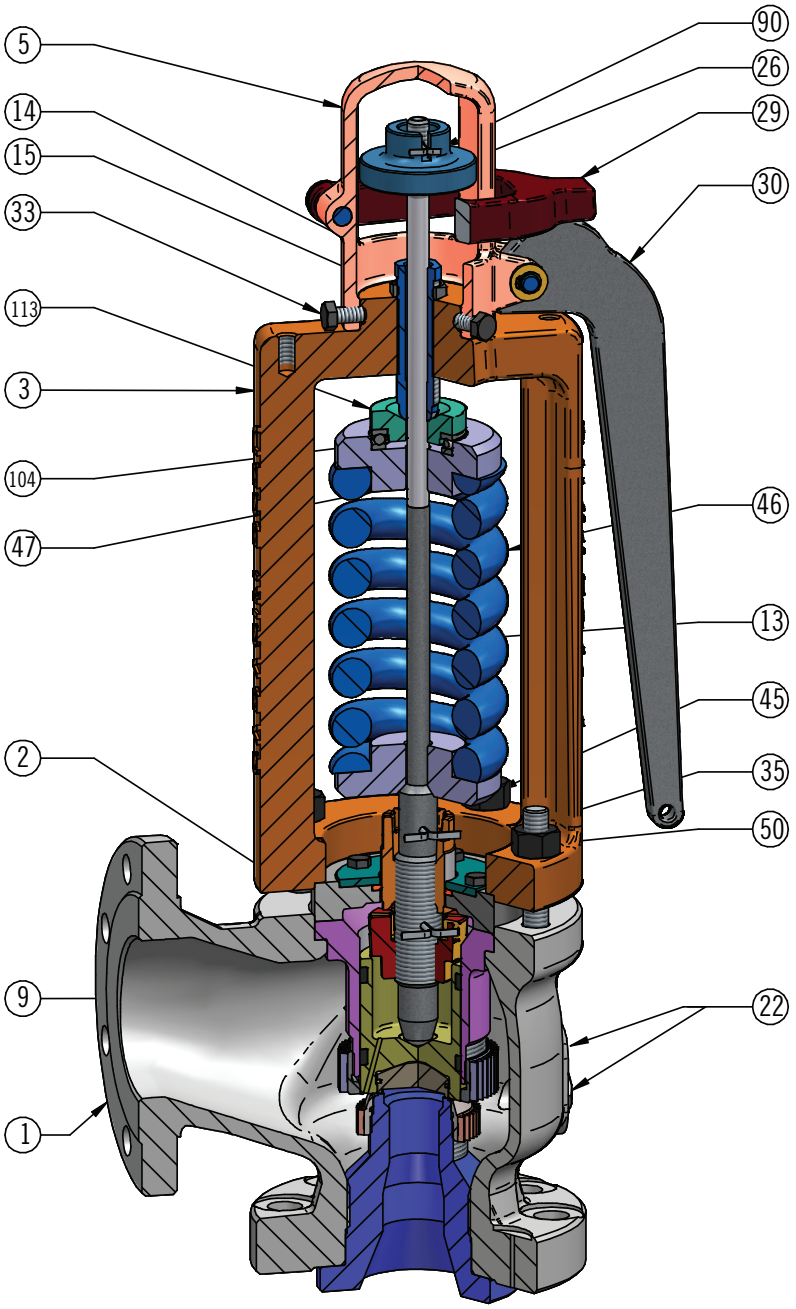
The drain plug (34) allows draining of fluid from the lowest available point of the body (1).

7.2 FEATURES AND NOMENCLATURES

Body design in accordance with ASME B16.34

- ASME B&PV Code section I design
  - o 3% overpressure
  - o Adjustable blowdown in between -2% and -4%
- Full nozzle design
- Body inlet connection : Flanged
- Pressure rating : from class 150 to class 2500
- Anti-seize feature
  - o Two Thermoglide™ rings on the piston
- Restricted lift arrangement
  - o Adjustable lift stop to attain either a full lift or a restricted lift
- Premium tightness performance
  - o A lip disc design which increases the tightness on high pressures and high temperatures applications.
  - o Disc supplied in Alloy 718.
- Blowdown chamber
  - o Allows a short blowdown adjustment
  - o Allows a fast blowdown speed to protect the seat from high steam velocity when reseating

PART	QTY	DESCRIPTION	SPARE PARTS
113	1	INTERMEDIATE WASHER	C
104	1	THRUST BEARING	C
95	1	DISC RETAINER	A
91	4	RETAINER PLATE SCREW	C
90	1	PIN	A
89	2	PIN	A
87*	4	WASHER	A
86*	4	CIRCLIP	A
56*	1	DISC HOLDER	C
50	4	NUT	D
47	1	UPPER SPRING WASHER	C
46	1	SPRING	C
45	1	LOWER SPRING WASHER	C
35	4	COVER STUD	D
34*	1	PLUG	
33	3	CAP SCREW	D
31*	1	TEST GAG	
30	1	LEVER	D
29	1	FORK	D
28	1	OVERLAP RING	B
27*	1	LEVER PIN	D
26	1	SPINDLE NUT	D
25*	1	FORK PIN	D
22	2	ADJUSTING RING SCREW	B
18	1	FLOATING WASHER	C
17	1	WASHER RETAINER PLATE	
15	1	SET SCREW NUT	D
14	1	SET SCREW	D
13	1	SPINDLE	B
12	2	SLIDING RING	A
11*	1	DISC	B
10	1	LIFT STOP	B
9	1	GUIDE	C
8	1	UPPER ADJUSTING RING	B
7	1	LOWER ADJUSTING RING	B
6	1	NOZZLE	E
5	1	CAP	E
3	1	YOKE	E
2	1	COVER	E
1	1	BODY	E



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DETAIL A

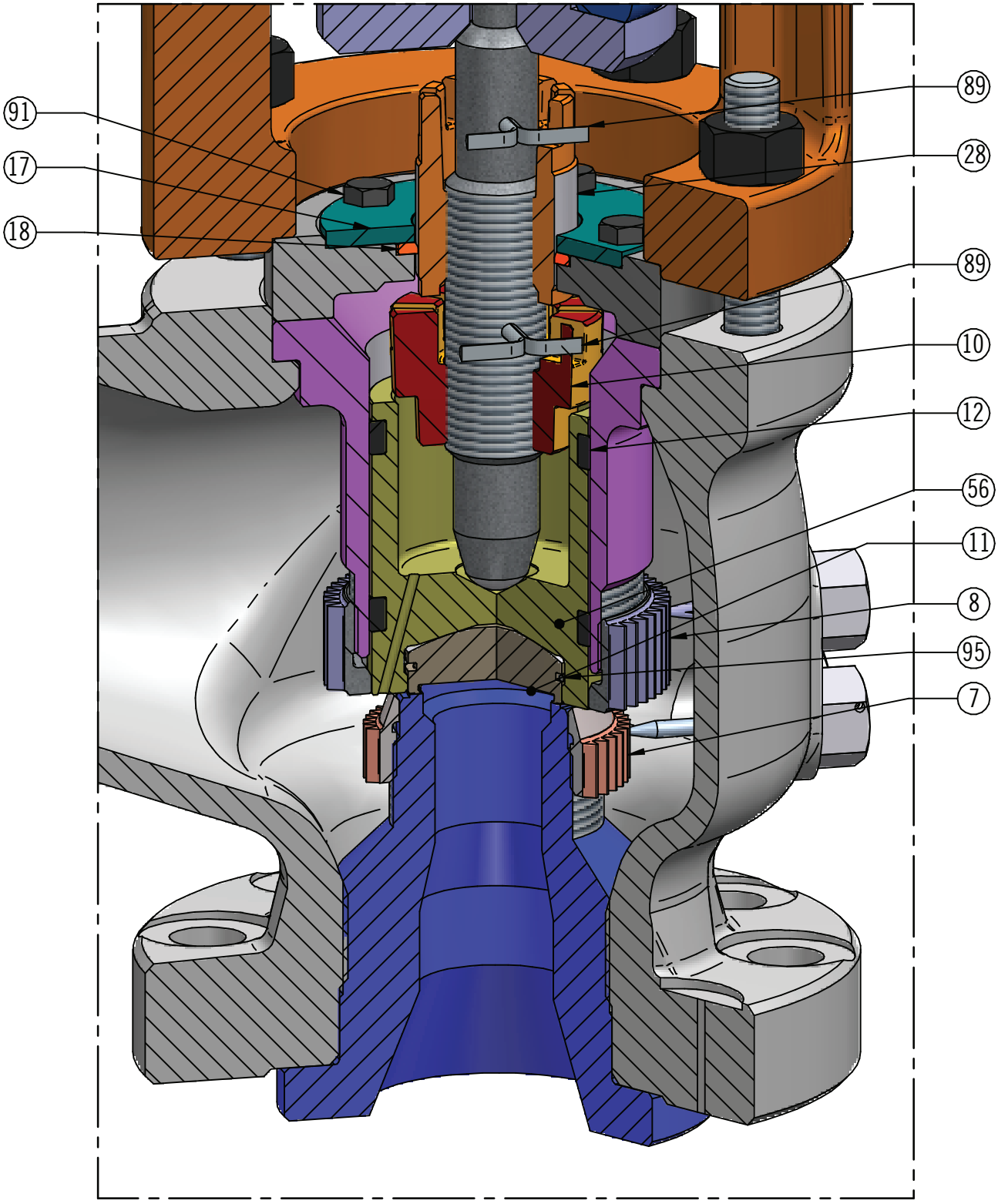


FIGURE 2 - MAIN VALVE DRAWING

Material configuration

N°	Part Name	Code 30 WCC	Code 32 WC6	Code 42 WC9	Code 52 C12A	Code 16 CF8M
1	BODY	SA216 Gr WCC	SA217 Gr WC6	SA217 Gr WC9	SA217 Gr C12A	SA351 Gr CF8M
2	BODY PLATE	SA479 Gr 316	SA479 Gr 316	SA479 Gr 316	SA479 Gr 316	SA479 Gr 316
3	YOKE	SA216 Gr WCC	SA216 Gr WCC	SA216 Gr WCC	SA216 Gr WCC	SA216 Gr WCC
5	CAP	SA216 Gr WCC	SA216 Gr WCC	SA216 Gr WCC	SA216 Gr WCC	SA216 Gr WCC
6	NOZZLE	SA479 Gr 316L	SA479 Gr 316	SA479 Gr 316	SA479 Gr 316	SA479 Gr 316
7	LOWER ADJUSTING RING	SA351 Gr CF8M	SA351 Gr CF8M	SA351 Gr CF8M	SA351 Gr CF8M	SA351 Gr CF8M
8	UPPER ADJUSTING RING	SA351 Gr CF8M	SA351 Gr CF8M	SA351 Gr CF8M	SA351 Gr CF8M	SA351 Gr CF8M
9	GUIDE	SA479 Gr 316	SA479 Gr 316	SA479 Gr 316	SA479 Gr 316	SA479 Gr 316
10	LIFT STOP	SA351 Gr CF8M	SA351 Gr CF8M	SA351 Gr CF8M	SA351 Gr CF8M	SA351 Gr CF8M
11	STARDISC	ALLOY 718	ALLOY 718	ALLOY 718	ALLOY 718	ALLOY 718
12	SLIDING RING	THERMOGLIDE	THERMOGLIDE	THERMOGLIDE	THERMOGLIDE	THERMOGLIDE
13	SPINDLE	A479 Gr 410	A479 Gr 410	A479 Gr 410	A479 Gr 410	A479 Gr 410
14	SET SCREW	A479 Gr 410	A479 Gr 410	A479 Gr 410	A479 Gr 410	A479 Gr 410
15	SET SCREW NUT	A479 Gr 410	A479 Gr 410	A479 Gr 410	A479 Gr 410	A479 Gr 410
17	WASHER RETAINER PLATE	SA479 Gr 316L	SA479 Gr 316L	SA479 Gr 316L	SA479 Gr 316L	SA479 Gr 316L
18	FLOATING WASHER	ALLOY 400	ALLOY 400	ALLOY 400	ALLOY 400	ALLOY 400
22	LOWER ADJUSTING RING SCREW	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL
23	UPPER ADJUSTING RING SCREW	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL
25	FORK PIN	A479 Gr 410	A479 Gr 410	A479 Gr 410	A479 Gr 410	A479 Gr 410
26	SPINDLE NUT	SA351 Gr CF8M	SA351 Gr CF8M	SA351 Gr CF8M	SA351 Gr CF8M	SA351 Gr CF8M
27	LEVER PIN	A479 Gr 410	A479 Gr 410	A479 Gr 410	A479 Gr 410	A479 Gr 410
28	OVERLAP RING	SA351 Gr CF8M	SA351 Gr CF8M	SA351 Gr CF8M	SA351 Gr CF8M	SA351 Gr CF8M
29	FORK	SA216 Gr WCC	SA216 Gr WCC	SA216 Gr WCC	SA216 Gr WCC	SA216 Gr WCC
30	LEVER SA216 Gr WCC	SA216 Gr WCC	SA216 Gr WCC	SA216 Gr WCC	SA216 Gr WCC	SA216 Gr WCC
31	TEST GAG	SA216 Gr WCC	SA216 Gr WCC	SA216 Gr WCC	SA216 Gr WCC	SA216 Gr WCC
33	CAP SCREW	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL
34	DRAIN PLUG	ACIER/STEEL	ACIER/STEEL	ACIER/STEEL	ACIER/STEEL	ACIER/STEEL
35	COVER STUD	SA193 Gr B7	SA193 Gr B16	SA193 Gr B16	SA193 Gr B16	SA193 Gr B16
45	LOWER SPRING WASHER	A479 Gr 410	A479 Gr 410	A479 Gr 410	A479 Gr 410	A479 Gr 410
46	SPRING	A232	A232	A232	A232	A232
47	UPPER SPRING WASHER	A479 Gr 410	A479 Gr 410	A479 Gr 410	A479 Gr 410	A479 Gr 410
50	YOKE NUT	SA194 Gr 2H	SA194 Gr 2H	SA194 Gr 7	SA194 Gr 7	SA194 Gr 7
56	DISC HOLDER	SA479 Gr 316L	SA479 Gr 316L	SA479 Gr 316L	SA479 Gr 316L	SA479 Gr 316L
70	SPINDLE NUT COTTER PIN	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL
86	CIRCLIPS	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL
87	COTTER PIN WASHER	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL
89	LIFT STOP COTTER PIN	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL
90	OVERLAP RING COTTER PIN	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL
91	RETAINER PLATE SCREW	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL	INOX/ST.STEEL
104	THRUST BEARING	ACIER/STEEL	ACIER/STEEL	ACIER/STEEL	ACIER/STEEL	ACIER/STEEL
105	LIFTING EYE BOLT	ACIER/STEEL	ACIER/STEEL	ACIER/STEEL	ACIER/STEEL	ACIER/STEEL
113	INTERMEDIATE WASHER	A479 Gr 410	A479 Gr 410	A479 Gr 410	A479 Gr 410	A479 Gr 410

8 INSTALLATION

8.1 GENERAL

DANGER	WARNING	CAUTION	CAUTION
			
Never face the outlet of a valve when it is discharging as this may result in serious personal injury or death	Be aware that the environment might be extremely hot. Care should be taken if there is any potential steam leakage. Superheated steam is invisible	Protect against high noise levels which occur during popping tests. Keep a safe distance when the test is being performed.	Helmets and gloves must be worn to prevent any injures while operating or working on the valve.

Piping systems and equipment through which the fluid flows must be thoroughly cleaned. Dust, deposits and metal particles must be removed using controlled blasts of compressed air or steam.

The presence of any solid particles between the safety valve and its seat faces will have damaging effects. Any leak will lead to improper functioning and erosion of the seating surfaces. Such erosion develops quickly, due to the high pressure. The system should always be purged before safety valve is installed.

Prior to installation of the safety valves, all protective covers must be removed. It is recommended that any surfaces in contact with gaskets are checked. Dimensions of gaskets should be checked: gaskets must not obstruct inlet or outlet orifices.

A pressure relief valve will only operate correctly if all installation procedures are observed.

8.2 INLET PIPING

If the inlet pressure drop is excessive, it may generate chattering effect during operation of the valve. Chattering may in turn be the cause of seat damage, or spindle deformation.

In order to avoid chattering, the following recommendations should be followed to reduce pressure drop:

- A rounded concentric reducer from the installation will create a minimum of turbulence.
- The inlet piping must be as short as possible and direct.
- A safety valve must not be installed on piping which has a nominal diameter of less than the nominal inlet diameter of the safety valve.
- The safety valve must not be subjected to excessive vibration which might be transmitted by the installation.

8.3 OUTLET PIPING

The safety valve must not support either the weight or the installation stresses of the outlet piping.
The backpressure should be reduced by using outlet piping with a nominal diameter of at least equal to the nominal diameter of the safety valve outlet flange, together with large radius elbow.

Recommendations

- The inside diameter of the exhausting piping must not be less than that of the safety valve outlet orifice.
- Release should be in the upwards direction and, a means of draining must be available in the lower angle to prevent any accumulation in the body.
- The connection curve to the vertical piping must be as close as possible to the safety valve outlet flange. The easiest solution is for the elbow to be bolted directly to the safety valve flange.
- The radius of the elbow must be as great as possible, ie, at least $R \geq 2.5$ d.

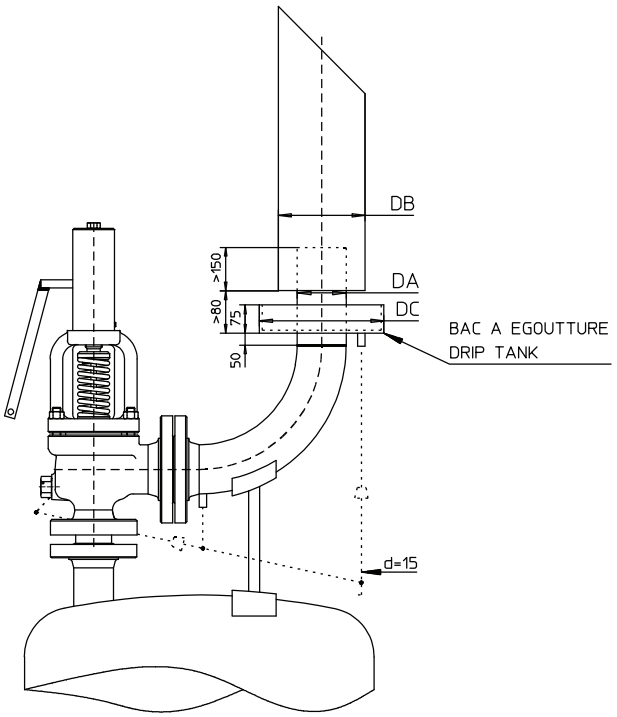
8.4 INSTALLATION ON THE PROTECTED EQUIPMENT

The equipment nozzle on which the safety valve is to be connected must be designed to give direct flow. There must be no obstruction between the equipment and the safety valve.
The pressure relief valve must be mounted on the upper part of the equipment which it is to protect.

Recommendations

- The safety valve must always be installed in the vertical position.
- The safety valve must be subjected to no stresses whatsoever from piping, connections or drains.
- The use of reinforcement should be considered for the inlet piping connections, to support dynamic loading which might be caused by reaction forces at the outlet connection.
- For maintenance operations, it is necessary to have sufficient space around and above the safety valve to perform essential tasks.

In the case of long outlet piping, and in order to achieve full safety requirements, the piping should be designed to accommodate a drip pan or drip tank - see figure 4. Such an arrangement will considerably reduce stresses between the piping and its support. The safety valve body must be permanently drained, by connecting the drain orifice on the lower part of the body, to that on the drip tank or drip pan. The connection thread is ½" NPTF



DA (mm)	DB (mm)	DC (mm)
25	50	150
40	80	200
30	80	200
66	100	220
80	150	270
100	150	270
150	200	320
200	250	370
250	300	420

It is necessary to use a torque wrench to tighten the inlet and outlet flange bolting.

1. A check should be made that the gasket is centered on the flange
2. Tighten to 30% of the nominal torque according to the following figures:

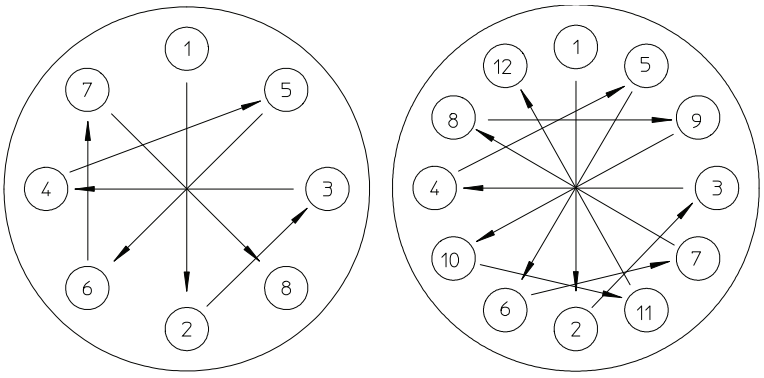


FIGURE 4 – BOLTING ORDER

Continue to tighten alternatively until the required torque is reached. This should be done in 3 or 4 steps.

NOTE: Due to the relaxation of the gasket, it should be checked 24 to 48 hours after the first installation.

Nominal diameter (mm)	Core section (mm²)	Allowable stress (M.Pa)		Tightening torque (m.daN)	
		Carbon steel [1]	Stainless Steel[2]	Carbon steel	Stainless steel
10	52.3	172	152	1.7	1.5
12	76.2	172	152	3.0	2.6
14	105	172	152	4.7	4.2
16	144	172	152	7.2	6.4
18	175	172	152	10.0	8.8
20	225	172	152	14.1	12.5
22	281	172	138	19.1	15.3
24	324	172	138	24.4	19.6
27	427	172	113	36.0	23.7
30	519	172	113	49.0	32.2
33	647	172	113	66.5	43.7
36	759	172	88	85.6	43.8
39	913	172	88	111.2	56.9

TABLE 4 – NOMINAL TIGHTENING TORQUES

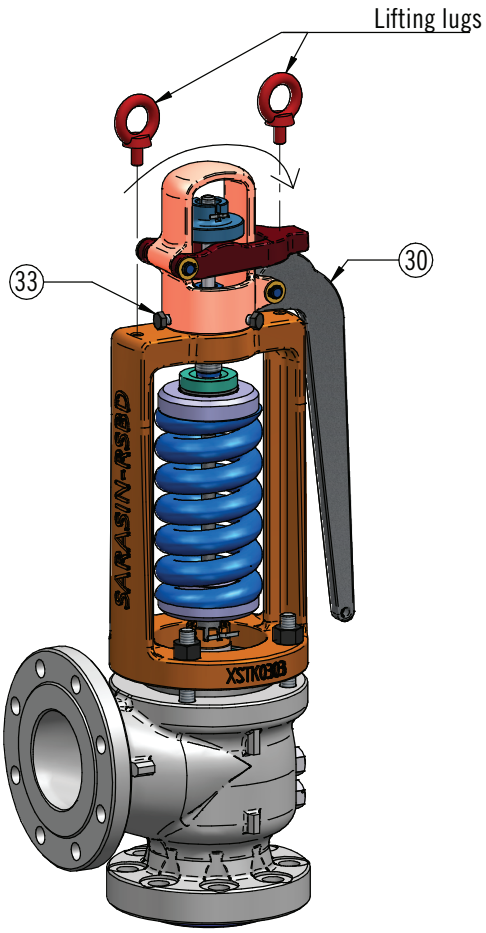
Note :
1 - Such as B7/L7 or 42CD4
2 - Such as B8 or Z6CN18.9

8.5 LEVER ORIENTATION

Remove the 2 lifting lugs
Unset the 3 cap screws [33]
Rotate the lifting [30] to the suited position
Set the 3 cap screws [33]

NOTE: lifting lugs shall not be replaced on the safety valve.

ITEM	QTY	DESRIPTION
33*	3	CAP SCREW
30*	1	LEVER



8.6 OUTDOOR INSTALLATION

A pressure relief valve which is installed outdoors must be protected against any inclement environmental conditions to ensure that it will provide the highest level of safety and will operate in the most effective & responsive manner.

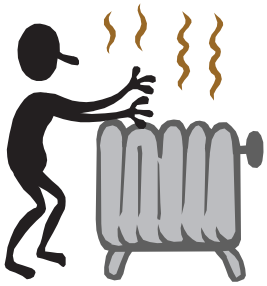
If the safety valve is exposed to hazardous weather conditions, ingress of dirt or other foreign matter or any extremes of temperature conditions, please ensure that:

- The body is insulated from the inlet neck to the cover. Excessive variations in temperature may affect the set pressure or the body structure (thermal stress).
- A weathershield is fitted to prevent ice or snow accumulation or any foreign particles being trapped between the spring coils. A weathershield may also be used to protect the spring against sea or ocean spray.

8.7 INDOOR INSTALLATION

The outlet of the safety valve should not be connected to any equipment which might allow steam to be ejected though the top cover and might in turn add risk of injury to personnel working close to the valve.

9 MAINTENANCE

DANGER	CAUTION	CAUTION
		
Never face the outlet of a valve when it is discharging as this may result in serious personal injury or death. There should be zero pressure at the valve inlet prior to commencement of any work which is to be performed.	Any person who is workingon the valve should be aware of any potential dangers such as retained heat)	Helmets and gloves must be worn to prevent any injures while operating or working on the valve.

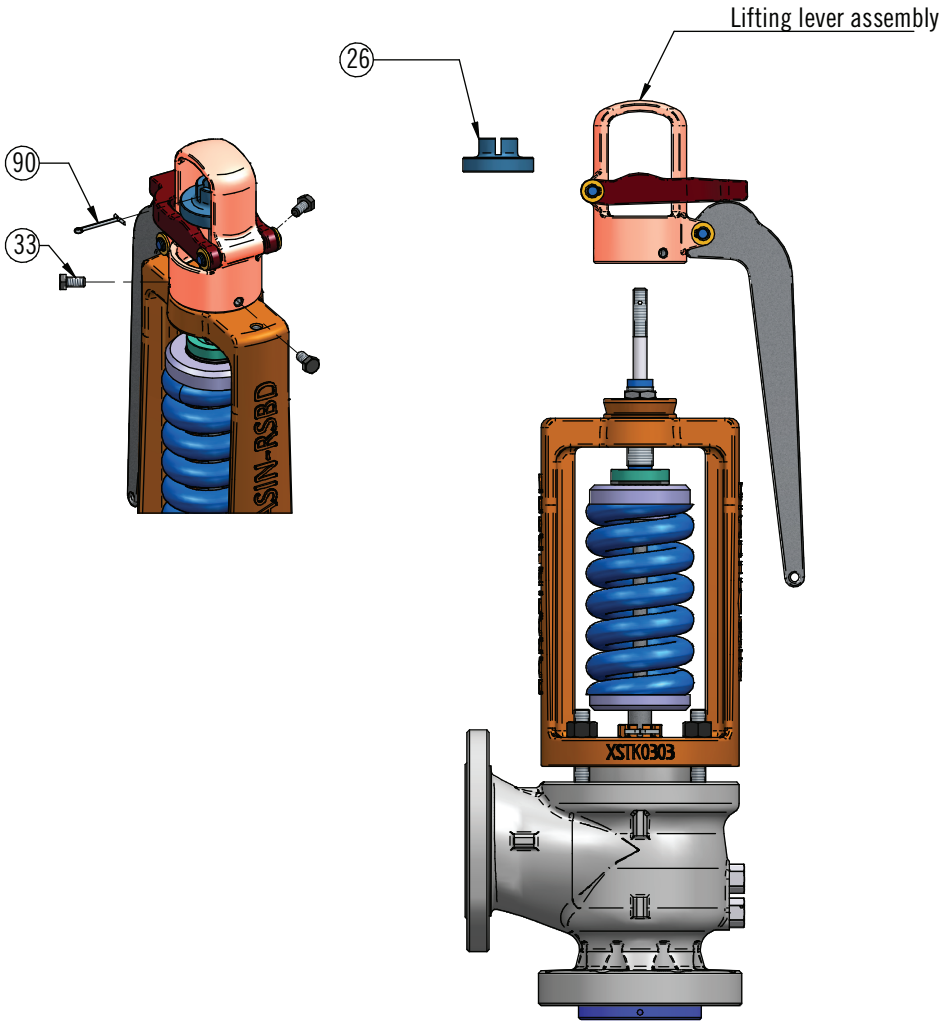
No particular tool is required for the maintenance operations on the main valve of the 76 series valve. Regarding the pilot, a tool kit is recommended to ease the lapping and the re-assembly of disc in the pilot body. Maintenance may be performed without taking the valve off line. Please contact Trillium Flow Technologies™ SarasinRSBD™ aftersales team in the event of any uncertainty.

Prior to performing any maintenance operation, the system upon which the pressure relief valve is installed must not be pressurised.

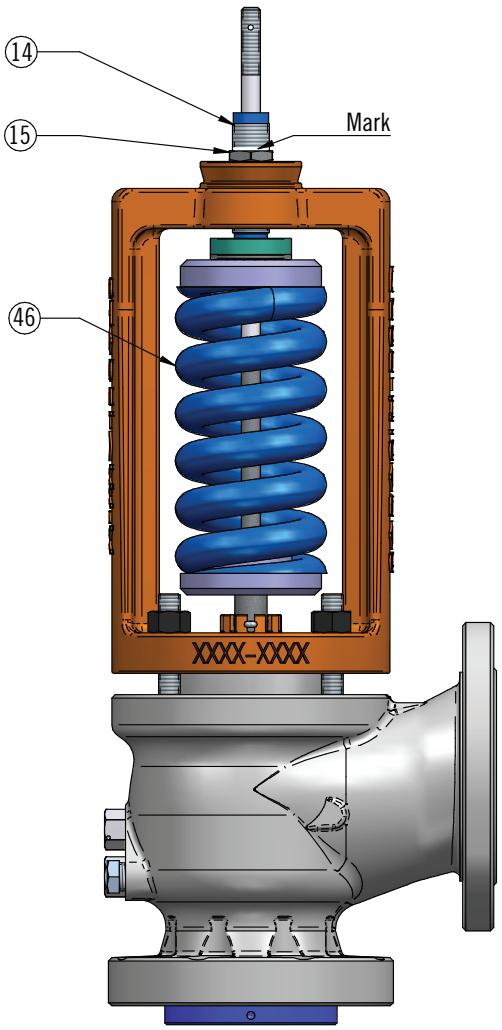
9.1 DISASSEMBLY OF THE STARFLOW V™

Remove the 3 cap screws [33]
Remove the pin [90]
Remove the spindle nut [26] whilst lifting lever assembly

90	1	PIN
33	3	CAP SCREW
26	1	SPINDLE NUT
ITEM	QTY	DESCRIPTION



Mark the position of the set screw nut [15] on set screw [14], this will speed up the resetting progress.
Unscrew the set screw nut [15] of about ¼ turn.
Loosen the set screw [14] until the spring [46] thrust has been completely released
The set screw [14] shall rotate freely.

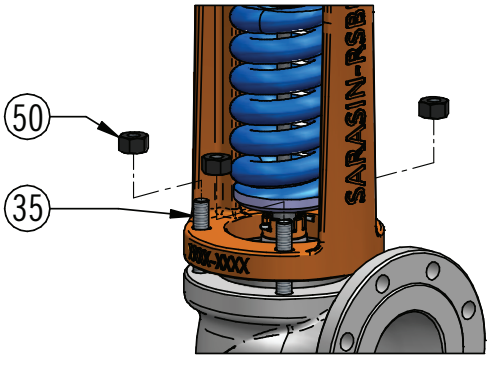


ITEM	QTY	DESCRIPTION
46	1	SPRING
15	1	SET SCREW NUT
14	1	SET SCREW

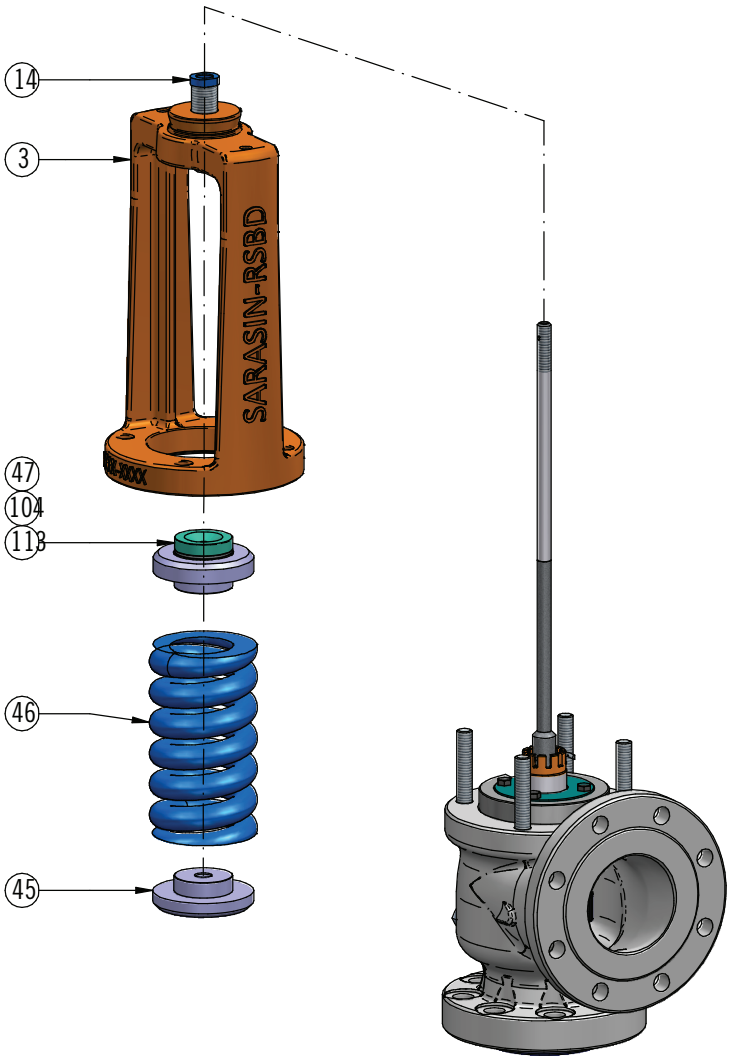
Unscrew the 4 nuts [50] from the cover studs [35]

Lift the yoke [3] + set screw [14], you can use lifting lugs if needed

Then remove the upper spring washer assembly [47+103+113], the spring [46] and the lower spring washer [45].

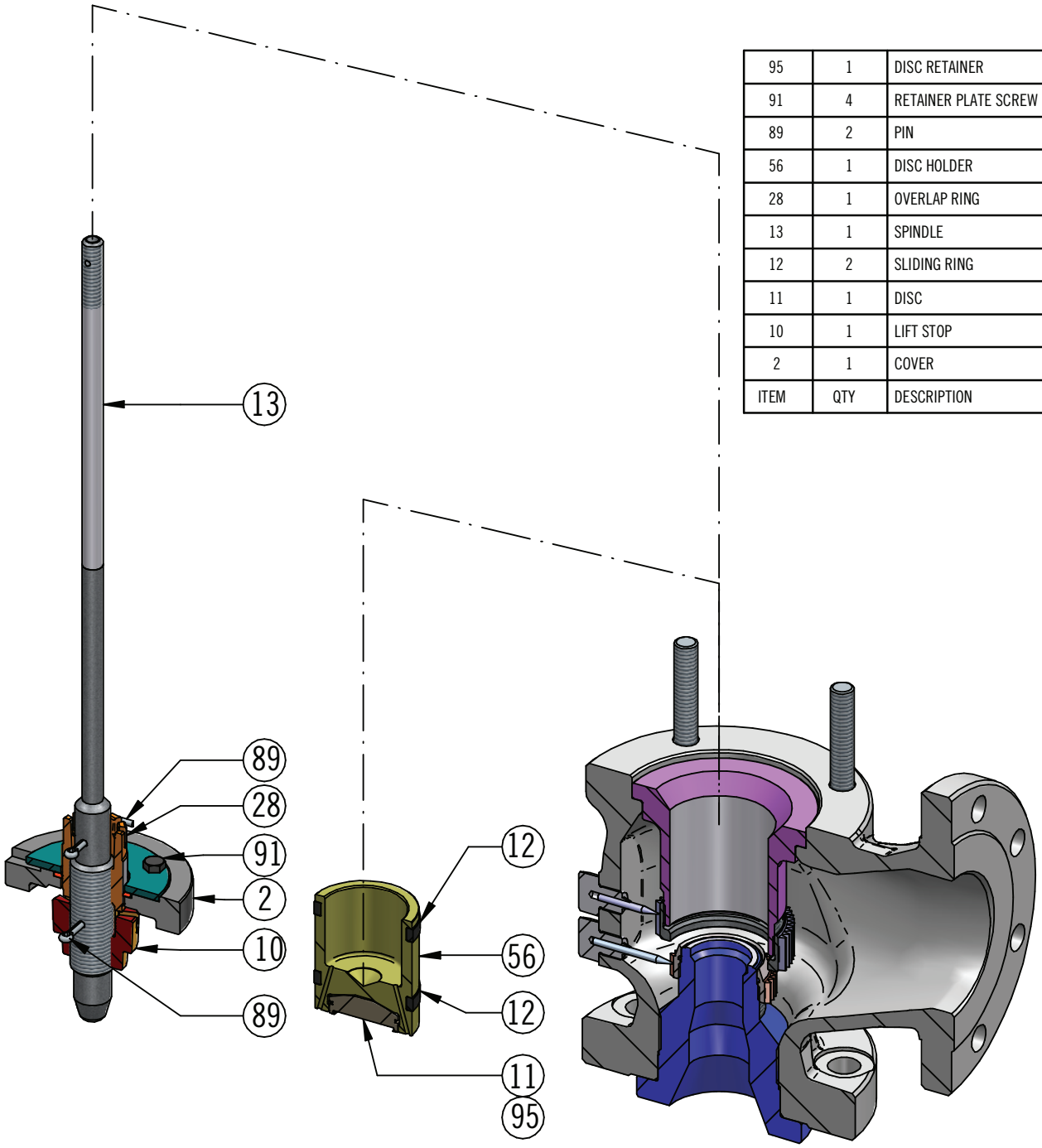


ITEM	QTY	DESCRIPTION
113	1	INTERMEDIATE WASHER
104	1	THRUST BEARING
50	4	NUT
47	1	UPPER SPRING WASHER
46	1	SPRING
45	1	LOWER SPRING WASHER
35	4	COVER STUD
14	1	SET SCREW
3	1	YOKE



Lift the spindle assembly [13+89+28+91+2+10]. Keep it vertical as far as practicle.

Lift the disc holder assembly [12+56+11+95]. Take care to maintain the disc holder assembly vertical to prevent the sliding rings [12] to fall and break up.



ITEM	QTY	DESCRIPTION
95	1	DISC RETAINER
91	4	RETAINER PLATE SCREW
89	2	PIN
56	1	DISC HOLDER
28	1	OVERLAP RING
13	1	SPINDLE
12	2	SLIDING RING
11	1	DISC
10	1	LIFT STOP
2	1	COVER

Mark the position of each adjusting ring.

Upper adjusting ring [8] position marked on the guide [9].

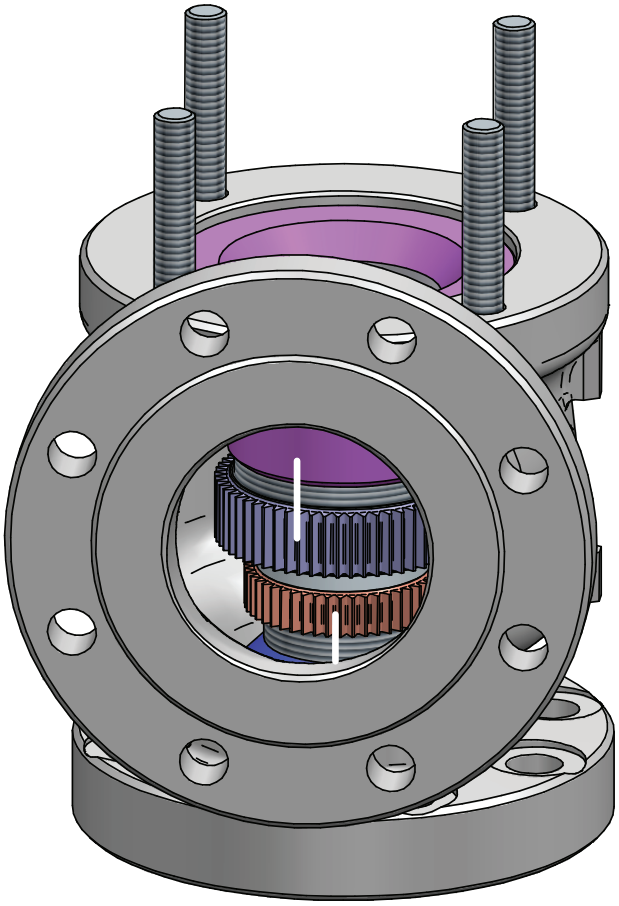
Lower adjusting ring [7] position marked on the nozzle [6].

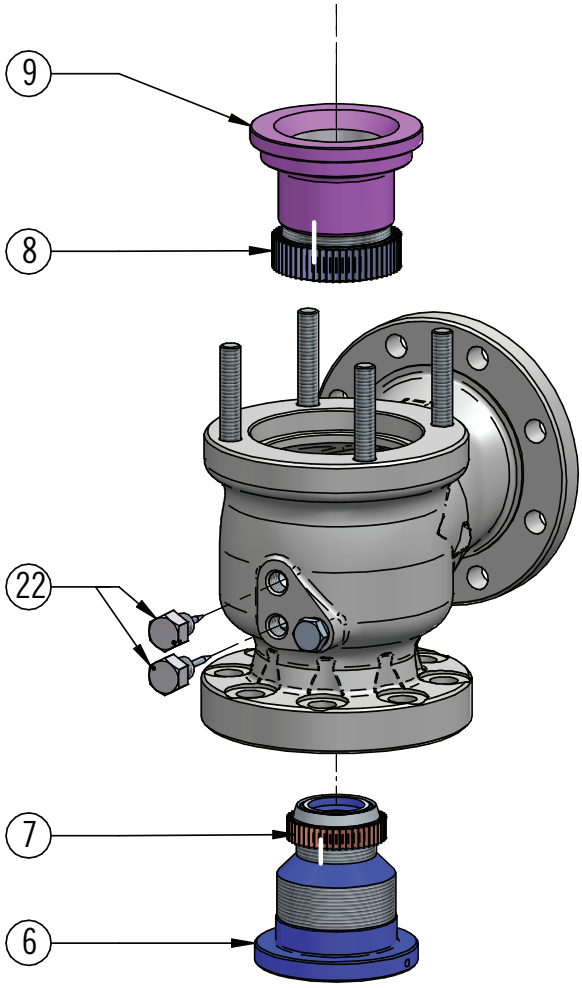
Unscrew the 2 adjusting ring screws [22].

Remove the guide assembly [9+8].

Unscrew the nozzle assembly [6+7].

ITEM	QTY	DESCRIPTION
22	2	ADJUSTING RING SCREW
9	1	GUIDE
8	1	UPPER ADJUSTING RING
7	1	LOWER ADJUSTING RING
6	1	NOZZLE



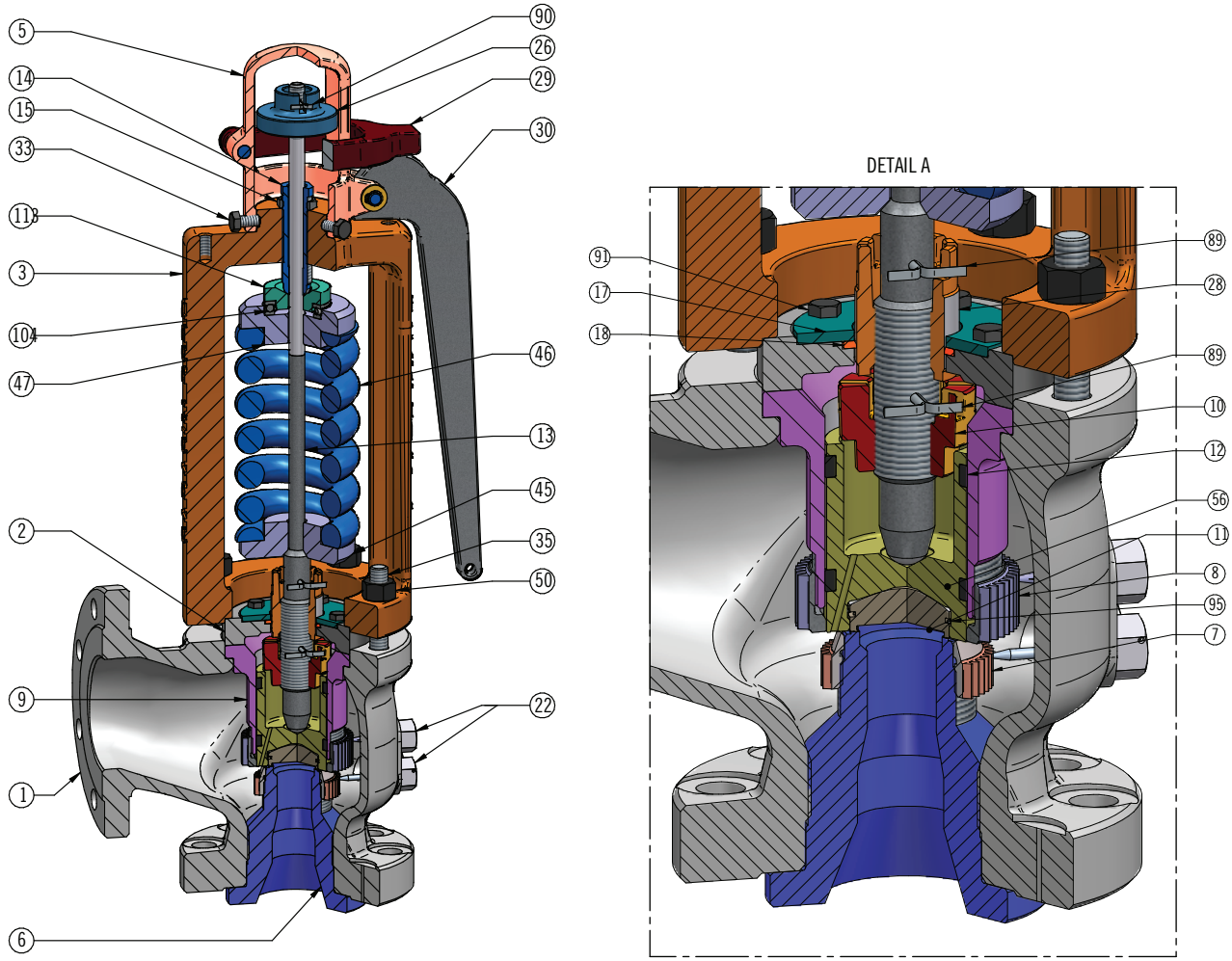


9.2 INSPECTION OF THE STARFLOW V™

9.2.1 GENERAL RECOMMENDATIONS

We recommend to carefuly stock the disassembled valves per serial number not to mixup parts during inspection and maintenance. Changes from one valve part to another can be invisible to the eye and may compromit perfect valve operation during its whole life cycle.

The tools to use must be adequate in order to prevent the part damage. It is particularly true with sliding surfaces and sealing ones.



9.2.2 PART INSPECTION

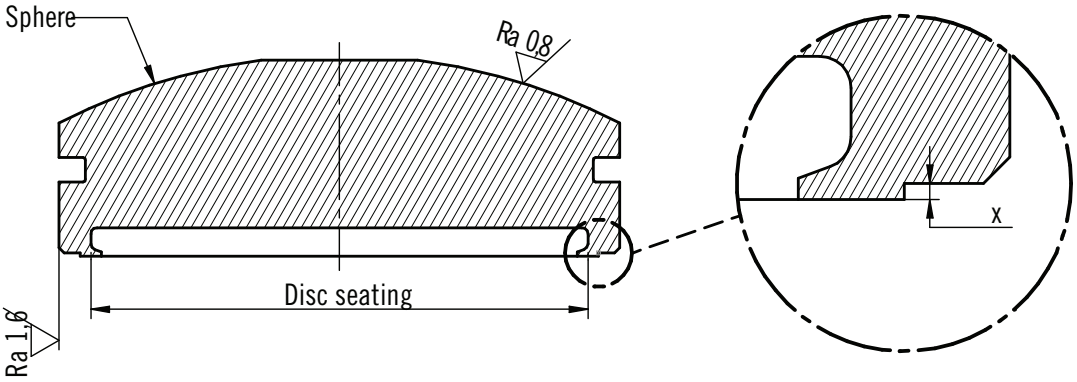
- Body (1)

Inspect the body for any cracks, erosion, pitting. Outlet flange gasket seating area shall be in proper condition without any impact marks. If the body has such defects it shall be replaced.

- Boltings (35+50)

Studs and nut shall be free of rust, and threads free of deformation and impact marks. If studs and nuts are not in perfect shape the defected ones shall be replaced.

- Disc (11)
  - General
    - Inspect the hinge surface (sphere) of the disc. If it is galled, scratched, corroded or pitted the disc shall be replaced.
    - Inspect the disc seating surface (figure 13). Roughness of the seating surface of the nozzle shall be Ra 0.4µm (16 RMS). Touch check the roughness of lapped seating surfaces according to ISO 2632 (or equivalent) test specimen.
  - Disc seat
    - Inspect the disc seat.
    - Any scratch or impact mark less than 0.5mm deep on the seating surface shall be removed by lapping only according to 8.2.4.2. (Preffered operation).
    - The remachining of the nozzle seating surface is recommended if there is any impact mark deeper than 0.5mm.
    - Lap the disc seat as deemed necessary
    - Final roughness of the seating surface of the disc shall be Ra 0.4µm (16 RMS or finer).
    - Planeity of the lapping machine shall have been checked.Inspect the nozzle seat. Any scratch or impact mark less than 0.5mm deep on the seating surface shall be removed by lapping. The remachining of the nozzle seating surface is recommended if there is any impact mark deeper than 0.5mm.

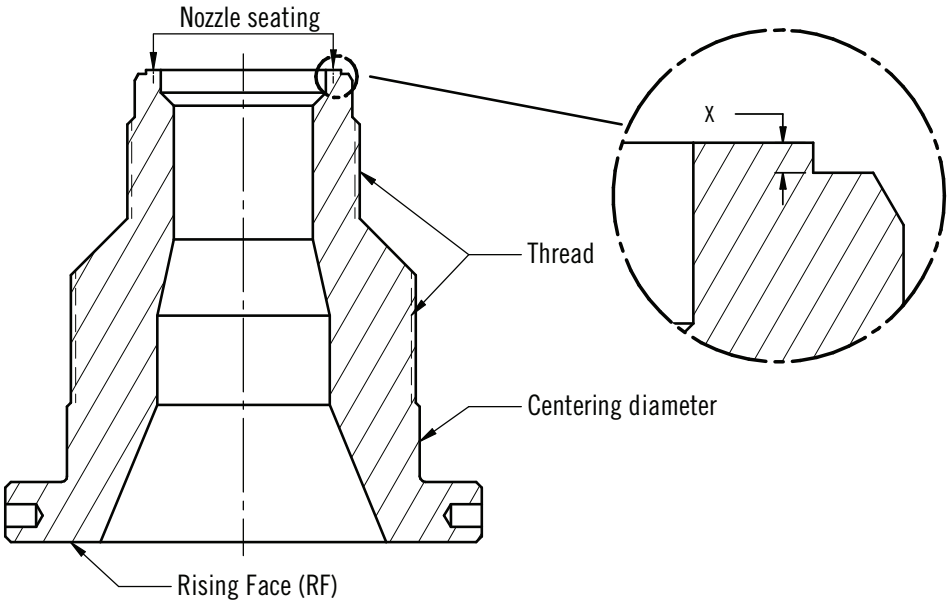


The disc seat maximum repair (figure 15): X dimension must not go below 0.1 mm for all orifices. If the repair dimension is out of the tolerance, the disc must be replaced.

- Nozzle (6)
  - General
    - Inspect the nozzle wetted area. There shall be no trace of erosion, pitting.
    - Inspect the thread. There shall be no impact marks on it. Damaged can lead to seizing.
    - Inspect the centering diameter. It shall be free of any burrs to prevent seizing on reassembly.
    - Inspect the nozzle base surface/groove.

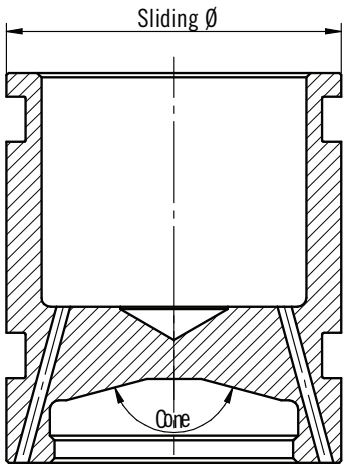
    If the surfaces are galled, scratched, the nozzle base surface shall be lapped according to the flange finition chosen (written on GA drawing). RTJ groove may be reworked with very high grade sandpaper (1200 mini) or lapping paste to Ra 0.4 to 1.6 (16-64 RMS).
    If the surfaces are corroded or pitted, the nozzle shall be changed.
    The nozzle seating surface inspection and rework are critical to ensure the tightness of the main valve after reassembly.
  - Nozzle seat

- Inspect the nozzle seat. Any scratch or impact mark less than 0.5mm deep on the seating surface shall be removed by lapping. The remachining of the nozzle seating surface is recommended if there is any impact mark deeper than 0.5mm.
- Lap the nozzle seat as deemed necessary.
- Final roughness of the seating surface of the disc shall be Ra 0.4µm (16 RMS or finer). Planeity of the lapping machine shall have been checked.
  See table below for critical nozzle dimensions. If any of the critical dimension is to be passed, the nozzle shall be changed.
- Inspect nozzle seating surface after lapping / machining operations.
  Touch check the roughness of lapped seating surfaces according to ISO 2632 (or equivalent) test specimen.
  Final roughness of the seating surface of the nozzle shall be Ra 0.4µm (16 RMS or finer).



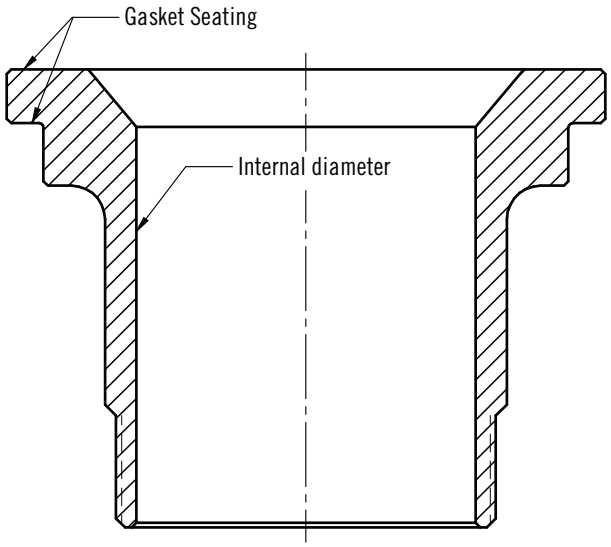
- Disc holder (56)

Inspect the external diameter of the stem part. It shall not have any scratches or be galled. If this diameter is damaged carefuly check the sliding rings. They might be damaged.
Inspect the cone of the disc-holder. If surface is galled, scratched, corroded or pitted the disc-holder shall be replaced.



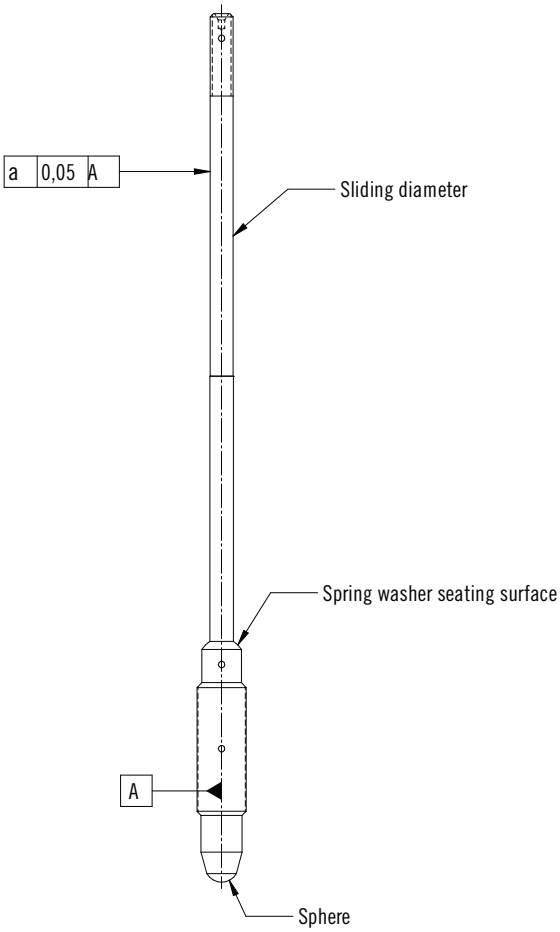
- Guide (09)

The gasket seating surfaces (in green) roughness shall be of about Ra 1.6µm (64 RMS). Scratches can be removed with abrasive paper grade 1000 or higher.
Check the internal diameter (in green) where the disc-holder slides. If surface is galled, scratched, corroded or pitted the guide shall b



- Spindle (13)

Strenghtness of the spindle



- Main valve sliding rings (8) (61)

Inspect the pairs of sliding rings for any missing splinter, broken part, desintegrating area. If the sliding rings are in proper state, proceed with thickness verification. If not replace them.
The sliding rings thicknesses shall be reviewed (figure 19). If any sliding ring thickness falls below the tolerancy given in table below, the sliding ring pair shall be replaced.

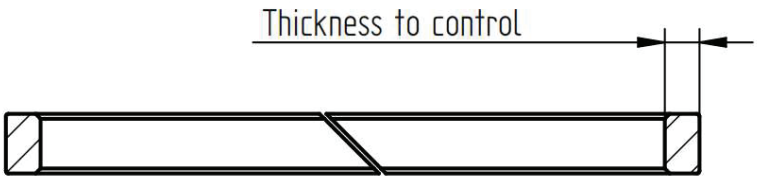


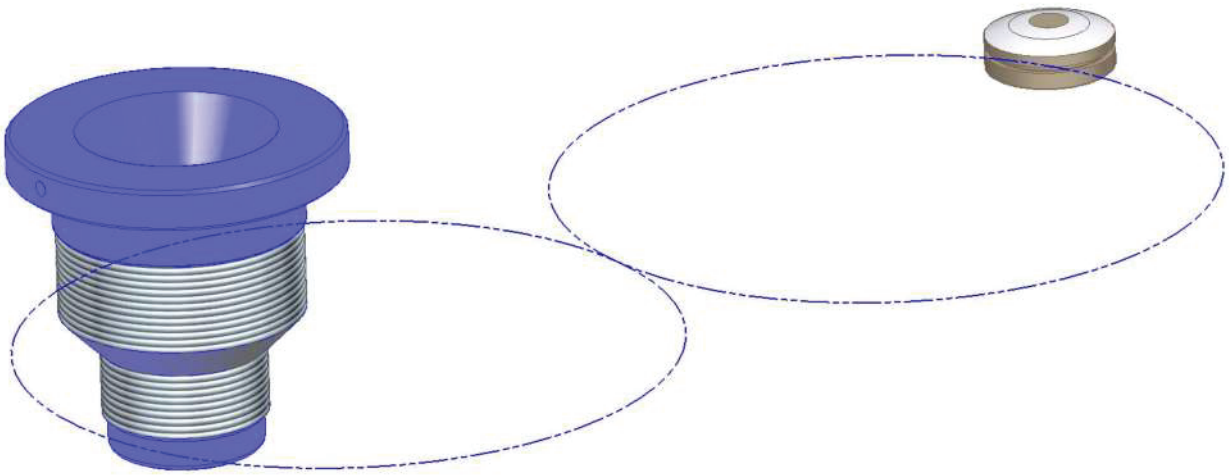
FIGURE 19 – SLIDING RING

FIGURE 20 – SLIDING RING

Sliding ring thickness (mm)	F-G	H	J-K	L	M-N	P	Q	R	T
Tolerancy (mm)	-0.02 / -0.05	-0.025 / -0.061	-0.025 / -0.061	-0.032 / -0.075	-0.032 / -0.075	-0.032 / -0.075	-0.032 / -0.075	-0.032 / -0.075	-0.032 / -0.075
Disc Holder	7	8	10	12	14	14	14	14	17

TABLE 9 – SLIDING RING THICKNESS

LAPPING



9.3 RE-ASSEMBLY

9.3.1 NOZZLE/GUIDE ASSEMBLY

1. Insert the body (1), upside down in the vise.
2. Smooth the nozzle threads (6) if there are rough patches. And clean it.
3. Grease the nozzle threads (6) and the nozzle seat (6).
4. Assemble the nozzle (6) on the body (1).
5. Clean off the excess grease and tighten the nozzle (6).
6. Loosen the vise and turn the body (1) over.
7. Screw the lower adjusting ring (7) on the nozzle (6).
   !Pay attention to the nozzle seat.
8. Grease the guide threads (9) and screw the upper adjusting ring (8) on it.

9.3.2 DISC/DISC HOLDER ASSEMBLY

1. Clip the disc retainer (95) on the disc (11). To clip the disc retainer (95) either use the Disc retainer tool or do it manually.
2. Grease the disc (11).
3. Insert it inside the disc holder (56).

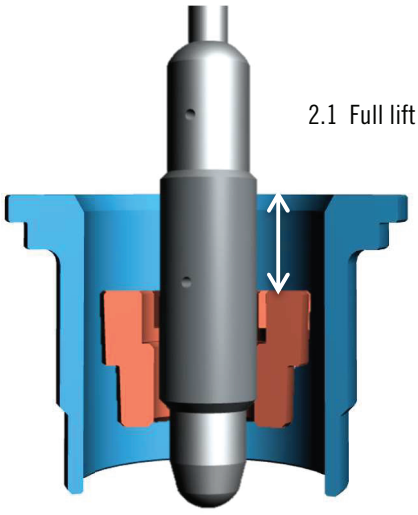
! The disc (11) must be able to flap inside the disc holder (56).

4. Clean the disc (11) seat.
   Put some rubber on the vise in order to cut the sliding rings (12) at (45) degrees. The cutting width must be lower than 0.04 in and the cuts must be opposed (cf. picture).
5. Put the sliding rings (8) around the disc holder (56).
6. Insert the disc holder (56) into the guide (9). Align the disc holder holes (56) up in parallel with the outlet flanged.

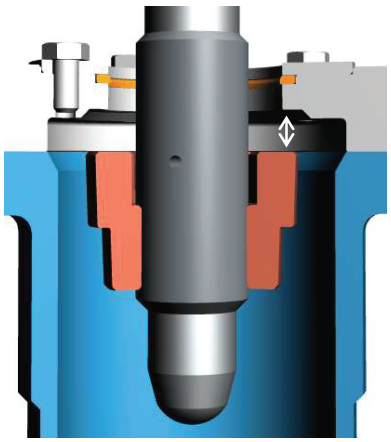
!Pay attention to the nozzle seat.

9.3.3 ADJUSTMENT OF THE LIFT

- For F, G and H orifices set the full lift distance between the guide (9) and the lift stop (10).
- For J to W set the lift stop (10) at guide (9) level. The full lift distance is already designed between the cover (2) and the guide (9).



2.1 Full lift



2.2 Full lift

The full lift settings are given in the following table 13:

Orifice designation	Orifice diameter (mm)	ASME certified		Non ASME certified	Tolerance on full lift (mm)
		Full lift (mm)	Min restricted lift (mm)		
F	17,5	4,4	2,4	2,0	+0,2/-0
G	22	5,5	3,0	2,0	+0,3/-0
H	28,6	7,2	4,0	2,2	+0,4/-0
J	34,6	8,7	4,8	2,6	+0,4/-0
K	37	9,3	5,1	2,8	+0,5/-0
L	47,6	11,9	6,5	3,6	+0,6/-0
M	57,2	14,3	7,9	4,3	+0,7/-0
N	66	16,5	9,1	5,0	+0,8/-0
P	76,2	19,1	10,5	5,7	+1/-0
Q	91,3	22,8	12,5	6,8	+1,1/-0
R	107,9	27	14,9	8,1	+1,4/-0
T	140,4	35,1	19,3	10,5	+1,8/-0
V	177,8	44,5	24,5	13,4	+2,2/-0
W	213,4	53,4	29,4	16,0	+2,7/-0

TABLE 13

IMPORTANT: The lift dimension is measured between the upper surface of the lift stop (10) and the guide upper surface using a depth gauge. For valves with restricted lifts, the actual lift will be the value which is stamped on the nameplate and in the computerized sizing report.

- Adjust the lift stop (10) with one hand whilst with the other hand prevent the spindle from turning thus stopping the disc (11) from turning on the seat.
- To lock, screw down the lift stop in order the first notch faces the pin hole.
- Insert and open the cotter pin (89). The cotter pin "head" must be in the horizontal position to ensure that the end of the pin will not touch the cover whilst the spindle being subjected to lift.
- Screw down the overlap ring (28) so that the external grooves are slightly below the level of the pin hole.
- Take off the yoke assembly (3)
- Screw down the four cover studs (35) using nominal torque
- Assemble the cover (2) on the body (1) by inserting from the top of the spindle (13).
- Tighten the cover nuts (60) using nominal torque on to the cover studs.

9.3.4 BODY PLATE AND SPINDLE ASSEMBLY

1. Insert the floating washer (18) in the body plate (2), the chamfer must be turned up (see zooming picture).
2. Then, put the washer retainer plate (17) on it.
3. Finally, screw the washer retainer plate (17) by using the retainer plate screws (91).
4. Tighten the screws (91).
5. Insert the spindle (13) with the lift stop (10) inside the disc holder (56). Put the body plate (2) subassembly on the guide (9).
6. Screw the overlap ring (28) on the spindle (13).
7. Set the overlap ring (28).

9.3.5 ADJUSTEMENT OF OVERLAP RING

- Screw down the overlap ring (28) until contact is made with the lift stop (10).
- Screw up the overlap ring by the number of turns shown in the following table (14):

Orifice	Pitch on the stem (mm)	Recommended number of turns after contact with the lift stop
F	1	5
G	1	5
H	1	7
J (150#/300# inlet)	1	7
J (>300# inlet)	1	5
K	1	5,5
L	1,5	5
M	1,5	5
N	2	5
P	2	3,5
Q	2	6,5
R	2	6,5
T	2	6,5
V	2	10
W	2	12,5

TABLE 14

- Once the overlap ring (28) has been adjusted, adjusted, screw the overlap ring (28) it should be moved up by 1/8 turn maximum until the pin hole is facing a slot.
- Use the cotter pin in the unopened position (90) to block the overlap ring. The end of the cotter pin will be opened at a later stage when sealing the valve.
- For any technical informations refer to paragraph 10.2.2.

9.3.6 ADJUSTMENT OF THE LOWER ADJUSTING RING

- Take off the lower adjusting ring screw (22).
- Raise the lower adjusting ring until it is in contact with the disc holder (56). Do not apply any effort so that compressing compression of the spring may be avoided.
- Then, lower the ring by the number of notches shown in the table below:

Lower adjusting ring (number of notches)	
F	2
G	3
H	3
J	5
K	5
L	8
M	12
N	14
P	16
Q	18
R	22
T	19
V	24
W	24

- Move the lower adjusting ring screw (22) again checking that the pin is between 2 notches. It must prevent the lower adjusting ring (7) from turning but it must not rest on it. The ring must be able to move slightly in between the two notches in a hinged motion. The fitting and the motion should be checked manually.
- For any technical informations refer to paragraph 10.2.2.

9.3.7 ADJUSTMENT OF THE UPPER ADJUSTING RING

The lower face of the adjusting ring should be aligned with the face of the disc holder (56) as first initial adjustment if no mark has been taken.

Should any 'fine' adjustment of the upper adjusting ring be necessary whereby the blowdown setting should need more accuracy. The additional procedures which are shown below should be observed. The upper adjusting ring may be adjusted only if the adjustments of the overlap ring and the lower adjusting ring prove to be unsatisfactory. Our experience shows that the only necessary adjustment of the upper adjusting ring is on low pressure applications. Its position should not be changed before the correct blowdown has been attempted by changing the position of the overlap ring and the lower adjusting ring.

If 'fine' adjustment is to be considered then proceed as follows:

- To reduce blowdown the upper adjusting ring shall be raised.
- To increase blowdown the upper adjusting ring shall be lowered.

The upper adjusting ring shall be turned by a quarter turn at each adjustment depending on the existing blowdown.

9.3.8 SPRING ASSEMBLY

1. Grease and mount the lower spring washer (45) on the spindle (13).
2. Put the spring (46) on it.
3. Grease and mount the upper spring washer (47) on the spindle (13).
4. Re-cover these parts with the yoke (3).
5. Grease and fit the bonnet studs (35).
   Screw the nut (15) on the adjusting screw (14).
6. Grease the adjusting screw thread (14). Then screw it on the bonnet (2).
7. Screw the bonnet nuts (50).
8. Tighten progressively the bonnet nuts (50), using a cross pattern.
9. Adjust the adjusting screw (14) and its nut (15).
   Put the spindle inside the set screw (22), adjust it and crimp it by using the Crimping tool.
10. Grease the set screws threads (22) & (23) and their gaskets (42) (both sides), screw them on the body (1).
11. Adjust the set screws (22) & (23).
    !Position the set screws (22) & (23) between two notches. They must prevent the rings (7) & (8) from turning without blocking them.
12. Screw the spindle nut (26) on the spindle (13).
13. Fit the cap (5) on the valve.

9.3.9 CAP ASSEMBLY

1. Fit the spindle nut (26) on the spindle (13).
2. Mount the cap (5) on the yoke (3). Tighten it by using the cap screws (33). The lever (30) must be at the opposite of the outlet flange.
3. Mount the lever (30) on the cap by using the lever pin (27); tighten it with (2) circlips (86) and (2) cotter pin washers (87).
4. Mount the fork (29) on the cap by using the fork pin (25); tighten it with (2) circlips (86) and (2) cotter pin washers (87).
5. Fit the cap assembly on the main assembly. Adjust the spindle nut and fix it by using the spindle nut cotter pin (70).
6. Screw the lifting eye bolts (105) on the yoke (3).

10 TESTING

10.1 TEST GAG

The gag for hydrostatic testing may be used for both: flange and butt-weld inlet connections.
To assemble the test gag, the cap needs to be removed from the valve. Please refer to section 9.1 for cap removal instructions. Position the test gag caliper and the gag screw as per the following drawing:

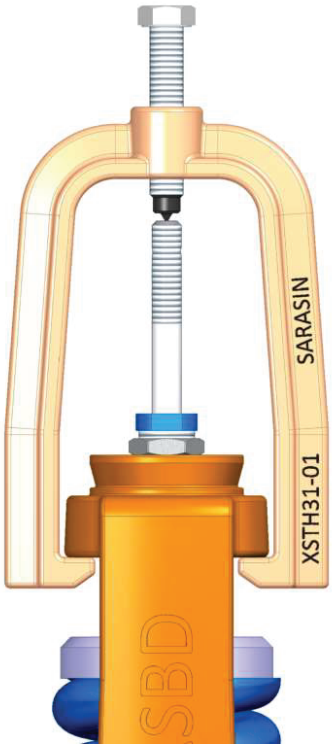


FIGURE 22

- Make sure that both legs of the caliper are vertical and in line with the spindle axis.
- When the caliper is correctly positioned, screw the gag so that it is in contact with the spindle.

Before tightening the test gag, the system pressure should be increased to 80% of the set pressure (use the lower set pressure of all safety valves which might be installed on the system). Then, apply a light torque to lock the gag into place (a high torque could result in damage to the disc and nozzle seats).

If any leakage occurs, the system pressure needs to be lowered so that the gag may be lightly retightened. The gag should not be retightened without the system pressure being lowered, as damage to the seating surfaces could occur.

After completing the hydrostatic tests (max 1,5 time the set pressure), the pressure shall be decreased to 90% of the lowest set pressure before the test gag is removed from the valve. At 90%, the disc lip will not be subject to damage during test gag removal. The cap may then be mounted back on the valve. At this point, the test pressure may be turned off.

10..2 SET PRESSURE AND ADJUSTMENT OF RINGS

DANGER	WARNING	CAUTION	CAUTION
			
Never face the outlet of a valve when it is discharging as this may result in serious personal injury or death.	Always take off the test gag before performing the pop test. Replace the gag before adjusting the screw and the rings to prevent any unexpected valve opening.	Protect against high noise levels which occur during popping tests. Keep a safe distance when the test is being performed.	Helmets and gloves must be worn to prevent any injures while operating or working on the valve.

All the safety valve are tested at the Trillium Flow Technologies™ factory. Nevertheless, a calibration on the actual equipment with a full capacity is recommended. This will ensure a proper opening and the perfect rings adjustment.

The factory adjusments are initial ones only. Final ajustments on the operating system shall be always preferred, especially if particular blowdown are required.

The safety valve set pressure may be checked by using either of the following procedures –

1 The system pressure increase
2 An online testing device.

- Using the first method, the system pressure is increased until the popping point of the safety valves is reached. This method allows both verification of the set pressure and clarification of the blowdown.
- For the second method, the Trillium Flow Technologies™ online testing device is used to determine the valve's opening pressure at the normal system operating pressure. The difference between set pressure and operating pressure which is necessary to test the valve is compensated by the online testing device. This online testing device is made up of a hydraulic cylinder and pressure, temperature and force transducers which are able to open the valve and to give precise values of the force needed to perform this procedure (see also section 9.3)

Before the set pressure test is performed, the following procedures must be followed:

- Please follow the recommendations for installation which are provided in section 7,
- The pressure gauge which is used to check the opening pressure shall be as close as possible of the valve inlet;
- The test gag must have been removed prior to performing the test. Should any adjustment be necessary, the valve should be gagged to make sure it remains closed.

10.2.1 SET PRESSURE ADJUSTMENT

NOTE : For insitu intervention, make sure the operating pressure is decreased as such to prevent the valve top open during the adjusments.

In order to change or adjust the set pressure, cap assembly should be removed as per the instructions which are provided within section 9.1.

To adjust the set pressure, note number of complete turns and mark on the screw to quickly locate the correct zone of spring compression.

To change or adjust the set pressure, unscrew the set screw locknut (15).

- To increase the set pressure, screw the set screw downwards.
- To decrease the set pressure, unscrew the set screw upwards.

The set pressure adjustment must not be above ± 5 % of the original nameplate set pressure. Any adjustment beyond this limit, please consult Trillium Flow Technologies™ so that we may check the possibility.

Once the adjustment is acceptable, screw the locknut (15) into place.

10.2.2 BLOWDOWN

NOTE : For insitu intervention, make sure to gag the valve to prevent the disc to relief during the rings adjustment. Otherwise the tools used for the adjustments could make the disc to open by accident. This does not prevent the system pressure to rise and expose all the intervening personal near the valve.

To obtain a short blowdown (high closing pressure), the overlap ring (28) shall be lowered. For this purpose, remove the overlap ring pin (90) and screw down the overlap ring by one notch. If the valve starts to chatter, cease moving the overlap ring. Leave the overlap ring at the most recent position where the valve was free from chatter. Start to move the lower adjusting ring down. If this still does not provide satisfactory results, move the upper adjusting ring up.

To obtain a long blowdown, the steps should be the same but following the opposite direction for the rings: Move the overlap ring upwards. If this does not provide satisfactory results, move the lower adjusting ring upwards. If it is found to be essential, move the upper adjusting ring downwards.

The blowdown should always be as long as possible based upon the operating conditions. Short blowdown ranges may lead to chattering.

10.2.3 UPPER AND LOWER RINGS ADJUSTMENT

Initial adjustments should be kept unless required as the above description..

In case of any issues with set pressure adjustment, please contact Trillium Flow Technologies™ aftersales department.

10.3 CALIBRATION CHECK WITH ONLINE TESTING DEVICE

It is sometimes required to check for the calibration of the valve at the commissioning stage or periodically. Such activity can be achieved using a specific online testing electronic device. Trillium Flow Technologies™ can arrange to perform such activity.

The use of such a method instead of the lifting of the disc under operating pressure allows to prevent certain risks such a valve seat damages, superheater tube damages. It allows to eliminate high costs from feed water, fuel, and minimise the personal costs.

Only the opening pressure can be verified with this method. If required the blowdown adjustments are achieve on live steam flow.

10.4 VALVE SEALING

WARNING

Always seal the valve once all the adjustments are done.

Once the valve is correctly adjusted and all the tests have passed succesfully, it is necessary to seal the valve in compliance with most of the international regulations. This prevents changing the adjustments. It allows also to identify the last intervening organisation (manufacturer, service centre or end-user) that will be responsible for the last adjustments.

The V series (Starsteam™) safety valve includes means to allow the seal of all the adjustments.

In case a seal is broken, please make sure to inform your inspection department and arrange a valve inspection as quick as possible.

Also, once the seal is broken, the valve will not be covered anymore by the warranty.

11 MAINTENANCE TOOLS

Note : the tool kit includes the lapping tool, the Lamplan diamond paste 6.213(10g), 1 liter fluid MM712, 1 red spray vessel 0.5L (empty)

- LAMPLAN diamond paste 6.213 (syringue) – 10g – Trillium Flow Technologies™ ref 9195D011
- 1 liter fluid MM712 – Trillium Flow Technologies™ ref 9195D017
- 1 red spray vessel 0.5L (empty) - Trillium Flow Technologies™ ref 9195D018
- Lifting eyes
- Synthtic slings

12 TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
The disc does not move (no lift)	Test gag still in place	Remove the test gag
	Foreign material trapped in between a moving part and fixed one.	Carry out maintenance to remove the part and to overhaul the potential damaged parts.
The disc does not go to the full rated lift	Upper adjusting ring too high.	Adjust the position of the ring.
	Overlap ring too low.	Adjust the position of the ring.
Simmer	Lower adjusting ring too low.	Adjust the position of the ring.
	Steam line / equipment vibrations	Investigate the source of the vibration and strengthen the support.
Seat leakage	Damaged seat	Carry out maintenance to lap or to change the disc and to lap or to machine the nozzle.
	Part misalignment	Inspect the contact surfaces of each component from the set screw to the disc. Check also the spindle alignment and concentricity.
	Disc hinge is not has insufficient articulation	Inspect the disc and spindle hinge surface.
	Incorrect discharge piping support allowances or its weight supported by the valve outlet flange.	A Rearrange the support hardware. Install if drip pan if necessary. Review the outlet piping installation.
The disc does not reseat	Lower adjusting ring too high.	Adjust the position of the ring.
	Foreign material	Carry out maintenance to remove the component and overhaul any damaged parts.
Long blowdown	Upper adjusting ring too low.	Adjust the position of the ring.
	Built-up back pressure too high.	Identify the source of the high back pressure. Decide by a process of elimination the source and extent of the problem – reassess, review and reconstruct the outlet piping accordingly.
	Overlap ring too high.	Adjust the position of the ring.
Chatter or short blowdown	Upper adjusting ring far too high.	Adjust the position of the ring.
	Overlap ring far too high.	Adjust the position of the ring.
	Upstream pressure drop too high.	Redesign the inlet piping to reduce the pressure drop to less than the ½ blowdown value

13 SPART PARTS

After prolonged and intensive use or in exceptional working conditions, a safety valve will need to be serviced or overhauled.

Such work must be carried out by a skilled technician. The Trillium Flow Technologies™ Group offers trainings and education programmes to cover all areas of maintenance and repair. Please consult your nearest Trillium Flow Technologies™ representative for more details.

To perform basic maintenance tasks within the shortest possible timeframe, it is recommended that class "A" spare parts are purchased at the same time as new valves.

Spare parts predictability	
Parts classification	**Replacement frequency**
A	Most frequent
B	Less frequent but critical
C	Seldom
D	Hardware
E	Practically never replaced

TABLE 17

Parts classification can be found in section 6.2 (table 2).

It is necessary to indicate the serial number which is stamped on the valve nameplate in order to guarantee the authenticity and the interchangeability of spare parts.

14 DISMANTLING

The user must make sure that the product is disposed of in an appropriate manner, according to the regulations in force in the country where the machine is installed, thus avoiding a negative impact on the environment and human health.

15 GENUINE PARTS

The use of spare parts which are not obtained from a genuine Trillium Flow Technologies™ source or a Trillium Flow Technologies™ accredited company exposes product, plant and personnel to high risk.

- Sarasin-RSBD™ parts only are designed and produced to be used in Sarasin-RSBD™ valve designs.
- Sarasin-RSBD™ parts carry warranties.
- Trillium Flow Technologies™ has an global aftersales network (sales offices, distributors and agents) to respond immediately to requests
- For any products which may be considered obsolete, Sarasin-RSBD™ parts may still be produced on demand. If you are not aware of your nearest representative, please contact the manufacturing operation at the address shown below:

If you are not aware of your nearest representative, please contact the manufacturing operation at the address shown below:

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Aftersales department:	spareparts.sarasinrsbd@trilliumflow.com
Service :	aftermarket.sarasinrsbd@trilliumflow.com
Sales :	sales.sarasinrsbd@trilliumflow.com

16 CODIFICATION

1	2	3	4	-	5	-	6	-	7	/	8	-	9
PV	23	F	2		32		A		M		TV		1

1 PV: Starsflow V ™

2 Inlet x Outlet

- 2 : 2” (DN50)
- 3 : 3” (DN80)
- 4 : 4” (DN100)
- 5 : 2.5” (DN65)
- 6 : 6” (DN150)
- 7 : 1.5” (DN40)
- 8 : 8” (DN200)
- 9 : 10” (DN250)

3 Orifice Designation

- F-G-H-J-K-L-M-N-P-Q-R-T-V-W

4 Valve Rating (ASME)

- 1 :150#
- 2 : 300#
- 3 : 600#
- 4 : 900#
- 5 : 1500#
- 6 : 2500#

5 Material of construction (body)

- 30 : SA 216 Grade WCC
- 32 : SA 217 Grade WC6
- 42 : SA 217 Grade WC9
- 52 : SA 217 Grade C12A
- 16 : SA 351 Grade CF8M
- Z : other material

6 Flange Type

- A : ASME B16.5 and EN 1759-1
- P : EN 1092.1 (whatever possible size to drill)
- Z : Other

7 Flange Finish Type (inlet)

M	RF Smooth finish	C2	Small tongue face
J	Ring Tool Joint	C1	Large tongue face
E2	Small male face	C	Tongue face
E1	Large male face	D2	Small groove face
E	Male face	D1	Large groove face
F2	Small female face	D	Groove face
F1	Large female face	Z	Other flange finish (including outlet)
F	Female face		

8 Option

A	No option	S	Wheathershield	V1	Spring compression nut
		T	V stamp	W	Outlet flange 300#
Q	Non-copper content	U	UV stamp	Z	Special
R	Restricted Lift	V	Test gag	Z1	Government Ring

9 Interchangeability

- 1