TRILLIUM FLOW TECHNOLOGIES™

76 series (Stareco™)
Installation, Operation, Maintenance Manual

1 CONTENT

SAFETY SIGNS AND LABELS

Signs or labels are included throughout this document.

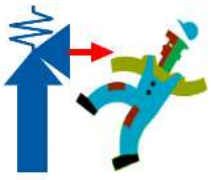
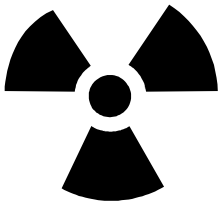
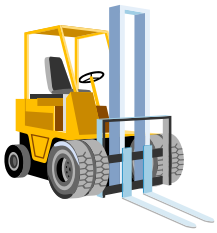
These signs or labels communicate the following messages:

- 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 c**ause 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 ~~the~~ 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 ~~injuring~~ or damage to equipment.**

2 SAFETY INSTRUCTIONS

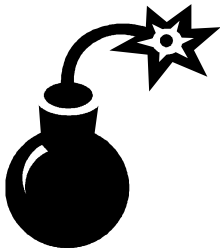
WARNING	CAUTION	ATTENTION
		
Be aware of all site safety procedures to prevent the risk of serious injury or death.	Protect yourself by wearing the necessary protective equipment to prevent possible injury	Use the proper lifting equipment to avoid personal injury or damage to equipment.

- 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 ~~on~~ 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 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 PRECAUTIONS

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 pressure relief 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 main valve, pilot exhaust 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 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 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 as quickly as possible. A return to the original plant should then be considered in order for Trillium to inspect the product.

Trillium 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 does not authorise any third parties (eg, non-Trillium service centres) to repair a product of Trillium's manufacture. Any customer allowing or sub-contracting the repair of a Trillium 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 damages 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.

RESTRICTED LIFT
The lift arrangement to attain more effective control of the rated capacity of the valve. This is strictly certified by the National Board (USA) according the ASME B&PV Code Section I.

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 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 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:

- 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

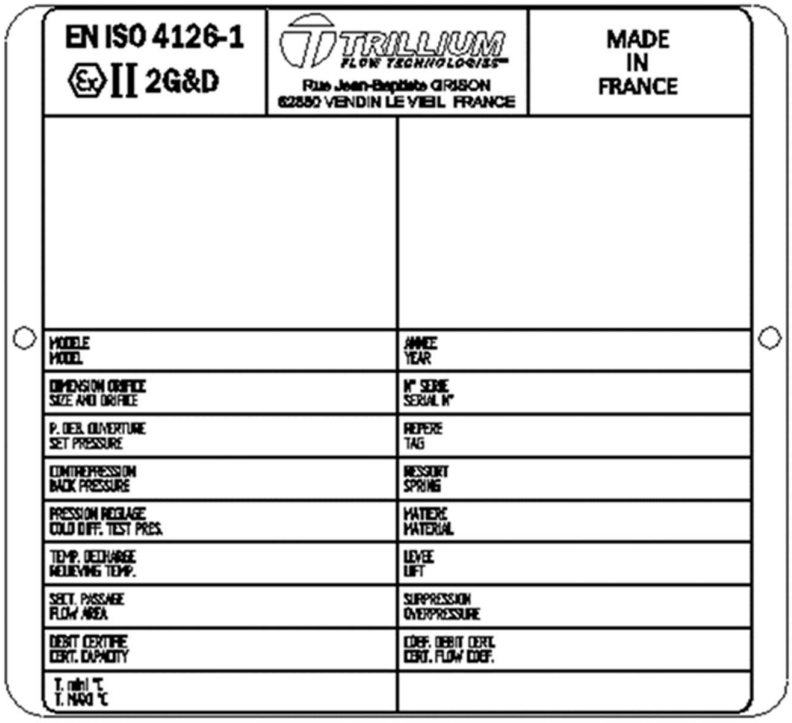


FIGURE 1 – COMMON NAMEPLATE

6.4 PILOT SPRING

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

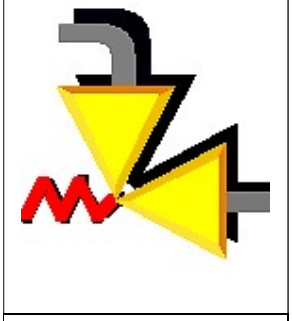
- Effective and accurate lift
- Quick closing (no damping effect when reseating)

The adjustment range of the spring must be within ± 5 % of the nominal value.

- Above than +5% adjustment can cause permanent deformation to the spring.
- Below than -5% adjustment can cause the pilot not to open fully.
- For more than +/- 5% adjustment you must contact TRILLIUM Sarasin-RSBD Aftersales Department.

Spring data should be obtained from TRILLIUM 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.

6.5 STORAGE

ATTENTION	ATTENTION
	
Never lift the valve horizontally, or hook to the lifting lever or the spring. Always lift by using the lifting eyes.	Make sure the valve is not dropped and does not receive strikes.

Pressure relief 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 pressure relief 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).

6.6 HANDLING

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 pressure relief valve by its lifting lever or its pilot.

For 76 series (Stareco™) pressure relief valves, the use of slings is recommended. The slings should be from soft material such as nylon. Slings should be attached to the lifting eyes (screwed in the main valve body) in order to provide stability during handling.

Carefully lift the valve and verify no tubing will be damaged during installation operation.

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

7 STARECO™ BASICS

7.1 DESCRIPTION

The 76 series consists of a main valve and a pilot fully dedicated to hot services, particularly the economizer applications in steam boilers. The main valve is controlled by a self acting device : the pilot.

76 series (Stareco™ style) pilot operated pressure relief valves is provided with flanged inlet and outlet end connections. Above 260°C (500°F), a buffer tank (condenser) is highly recommended to be installed.

A sectional view of the 76 series (Stareco™) pilot operated pressure relief valve is shown on next pages of this document.

The dome of the main valve is located above the main valve body to insure a good heat exchange with the air ambiance and avoid the condensate to get back to steam. The dome condensate is picked up during the discharge though a deep pick-up tube to make sure to relief the condensate immediately rather than the steam cloud possibly on the top of the dome.

The main valve and pilot are supplied with the Thermoglide™ sliding rings to minimize the frictions and allow good and fast opening and reclosing.

A sensing ring is supplied below the main valve to ease the nozzle replacement (no sensing pitot tube through the nozzle).

7.2 FEATURES AND NOMENCLATURES

Body design in accordance with ASME B16.34 and API STD 526 (spring loaded table)

- ASME B&PV Code section I design
  - 3% overpressure
  - Blowdown between 2% and 4%
  - Capacity certified steam and water (National Board)
- Full nozzle design
- Body inlet connection : Flanged
- Pressure rating : from class 150 to class 2500
- Anti-seize feature
  - Four Thermoglide™ rings on the piston and disc-holder and one in the pilot set screw.
- Buffer tank for operating temperature above 260°C (500°F).
- Pick-up tube in the dome to relief the condensate (quicker piston lift).
- Standard soft goods dimensions.
- Selection of soft goods according the temperature level (standard FKM, steam application FKM or steam application FFKM).

Color code for the tubing	
Color	Line
Green	Sensing line
Red	Feeding line
Blue	Control line

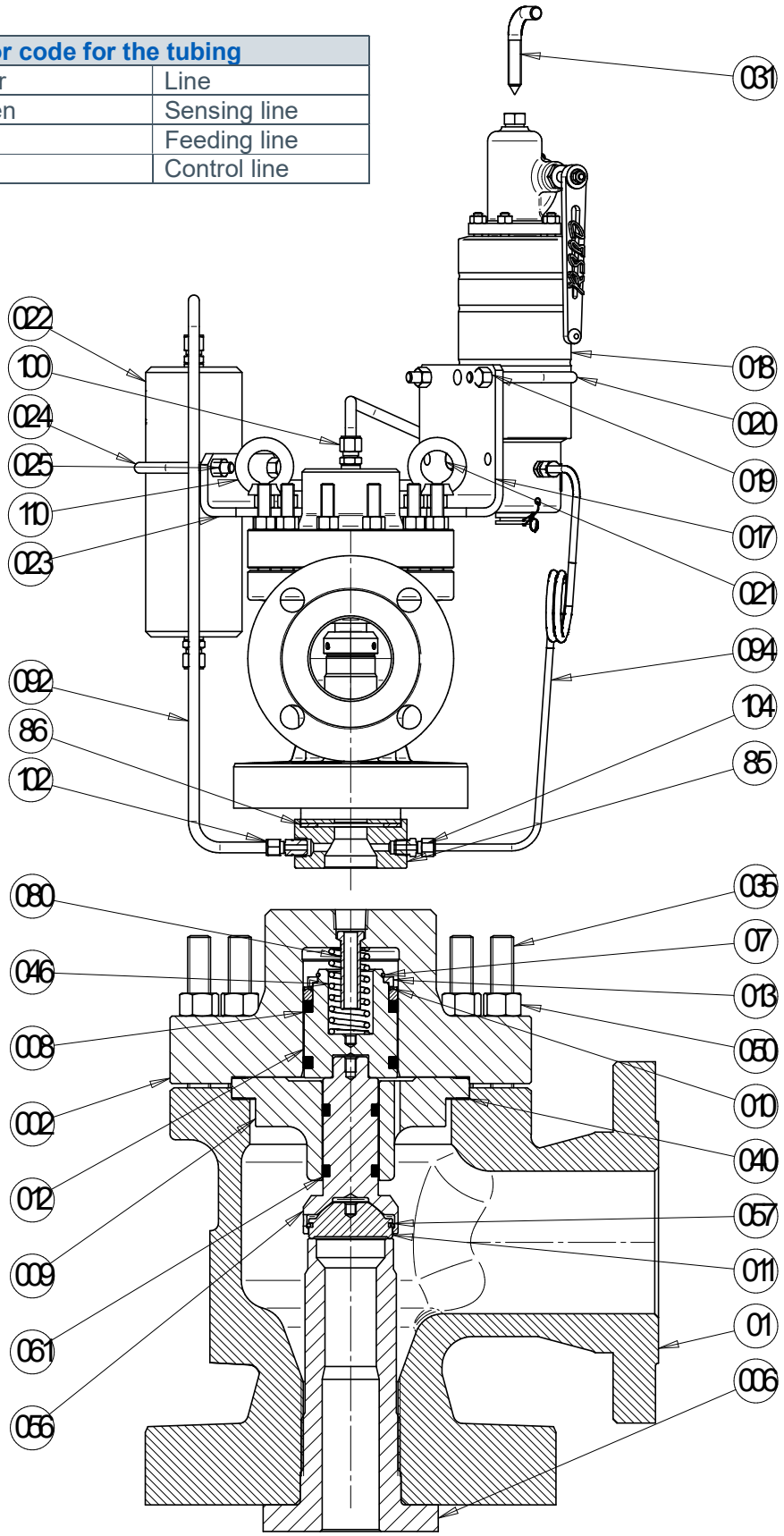


FIGURE 2 - MAIN VALVE DRAWING

E	110	2	ANNEAU DE LEVAGE	LIFTING EYE	STEEL
D	105	1	CONNECTEUR S.L. PILOTE	PILOT S.L. CONNECTOR	SS 316
D	104	1	CONNECTEUR S.L. ANNEAU	NOZZLE S.L. CONNECTOR	SS 316
D	103	1	CONNECTEUR F.L. PILOTE	PILOT F.L. CONENCTOR	SS 316
D	102	1	CONNECTEUR F.L. ANNEAU	RING F.L. CONNECTOR	SS 316
D	101	1	CONNECTEUR C.L. PILOTE	PILOT C.L. CONNECTOR	SS 316
D	100	1	CONNECTEUR C.L. DOME	DOME C.L. CONNECTEUR	SS 316
D	99	1	PLAQUE D'ESTAMPILLE	NAMEPLATE	SS 316L
D	94	1	TUBE IMPULSION (S.L.)	SENSING LINE (S.L.)	SS 316L
D	92	1	TUBE ALIMENTATION (F.L.)	FEEDING LINE (S.L.)	SS 316L
D	90	1	TUBE TETE SOUPAPE (C.L.)	CONTROL LINE (C.L.)	SS 316L
A	86	1	JOINT METALLIQUE D'ANNEAU	SENSING RING GASKET	SS 316
E	85	1	ANNEAU PRISE DE PRESSION	CONNECTION RING	SS 316L
D	80	1	TUBE PLONGEUR	PICK-UP TUBE	SS 316L
A	61	2	ANNEAU PORTEUR PORTE-CLAPET	DISC-HOLDER SLIDING RING	THERMOGLIDE
C	57	1	JONC DE CLAPET	DISC RETAINER	SS 304
D	56	1	PORTE-CLAPET	DISC-HOLDER	SA 479 Gr. 316L
D	50	N	ECROU DE COUVERCLE	COVER NUT	SA 194 Gr. 8
D	46	1	RESSORT DE RAPPEL	RETURN SPRING	SS 316L
A	40	2	JOINT METALLIQUE DE GUIDE	GUIDE GASKET	SS 316L
D	35	N	TIGE FILETEE	STUD	SA 193 Gr. B8 Cl2
D	32	2	BOUCHON DE DRAIN	DRAIN PLUG	SA 479 Gr. 316L
E	31	1	VIS D'ESSAI	TEST GAG	SS 316L
E	25	2	ECROU POT DE CONDENSATION	BUFFER TANK NUT	SS 316L
E	24	1	ETRIER POT DE CONDENSATION	BUFFER TANK STIRRUP	SS 316L
E	23	1	EQUERRE POT DE CONDENSATION	BUFFER TANK BRACKET	SS 316L
D	22	1	POT DE CONDENSATION	BUFFER TANK	SS 316L
E	21	1	VIS DE FIXATION PILOTE DCS-E	DCS-E CONNECTION SCREW	SS 316L
E	20	1	ETRIER PILOTE DCS-E	DCS-E PILOT STIRRUP	SS 316L
E	19	1	ECROU PILOTE DCS-E	DCS-E PILOTE NUT	SS 316L
E	18	1	PILOTE DCS-E	DCS-E PILOTE	SS 316L
E	17	1	EQUERRE PILOTE DCS-E	DCS-E PILOT BRACKET	SS 316L
D	13	1	BAGUE DE RETENUE	RETAINING RING	SA 479 Gr. 316L
D	12	1	PISTON	PISTON	SA 479 Gr. 316L
A	11	1	CLAPET	DISC	SA 479 Gr. 316L
B	10	1	JOINT DE PISTON	PISTON SEAL	PTFE + GRAPHITE
D	9	1	GUIDE	GUIDE	SA 479 Gr. 316L
A	8	2	ANNEAU PORTEUR DE PISTON	PISTON SLIDING RING	THERMOGLIDE
C	7	1	JONC DE PISTON	RETAINER RING	SS 304
A	6	1	BUSE	NOZZLE	SA 479 Gr. 316L
E	2	1	COUVERCLE	COVER PLATE	SA 479 Gr. 316L
E	1	1	CORPS	BODY	SA 216 Gr. WCC
CLASS.	**TAG**	**QTY**	**NOMENCLATURE (FR / EN)**		**MATERIAL**

TABLE 2 – MAIN VALVE BOM

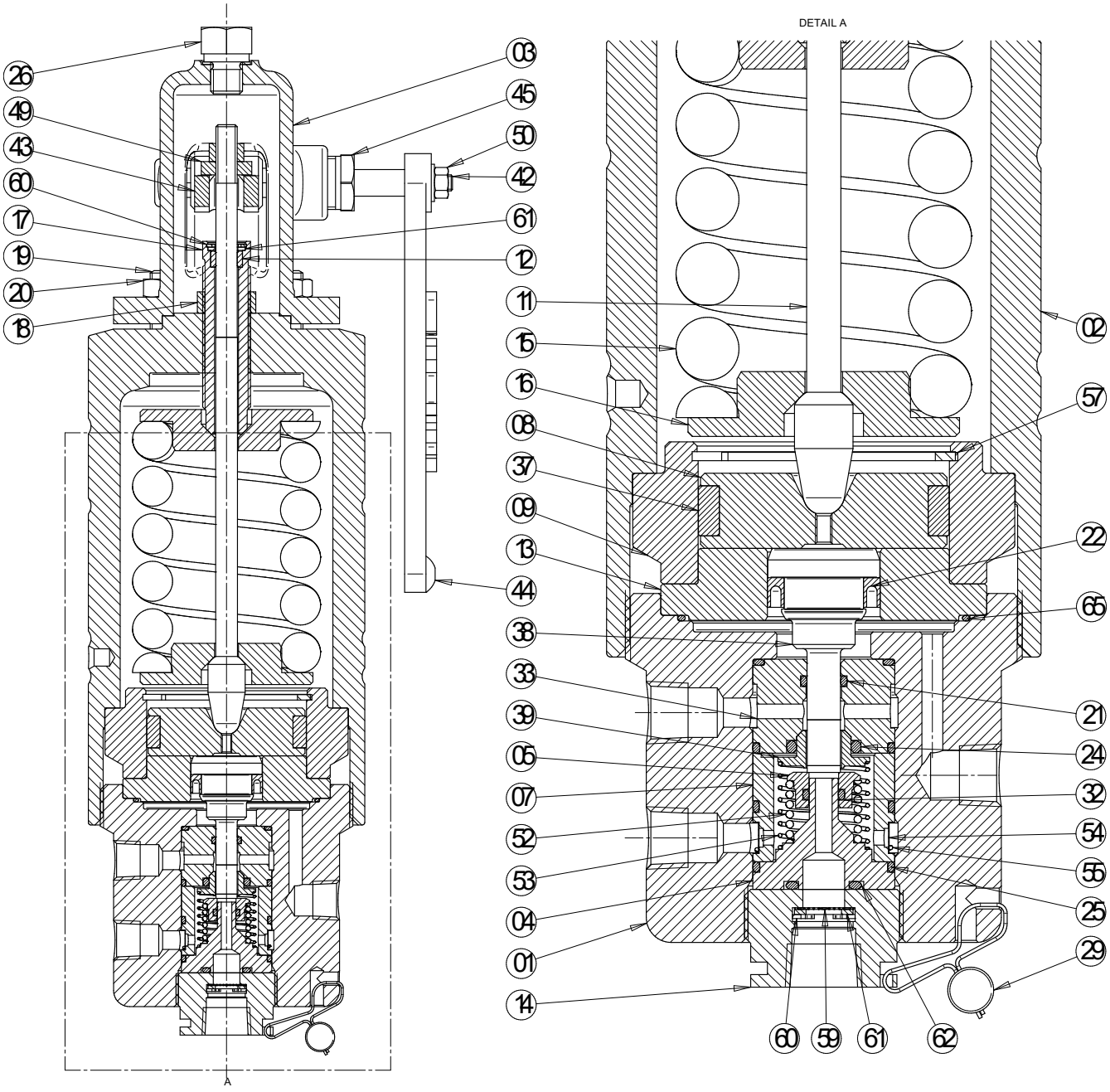


FIGURE 3 – PILOT DRAWING

B	65	1	JOINT TORIQUE SUPERIEUR	UPPER BODY O'RING	FFKM 75SH
B	62	1	JOINT TORIQUE DE BUSE	EXHAUST NOZZLE O'RING	FFKM 75SH
E	61	2	RONDELLE D'EVENT	EXHAUST WASHER	A 479 Gr. 316L
D	60	2	ANNEAU ELASTIQUE	CIRCLIPS	SS 304
C	59	2	FILTRE D'EVENT	EXHAUST STRAINER	A 479 Gr. 316L
C	57	1	JONC DE BUTEE DE LEVEE	LIFT STOP	SS 304
C	55	1	JONC DE FILTRE D'ALIMENTATION	FEEDING FILTER RETAINER	ALLOY 600
C	54	1	FILTRE D'ALIMENTATION	FEEDING STRAINER	A 276 Gr. 316L
D	53	1	RESSORT DE RAPPEL DE VIDANGE	EXHAUST RETURN SPRING	AMS 5670 (Alloy X-750)
D	52	1	RESSORT DE RAPPEL DE CLAPET	DISC RETURN SPRING	AMS 5670 (Alloy X-750)
E	51	1	RONDELLE D'AXE DE FOURCHETTE	FORK SHAFT WASHER	SS 304
E	50	1	ECROU D'AXE DE FOURCHETTE	FORK SHAFT NUT	A 276 Gr. 316L
E	49	1	ECROU DE RELEVAGE	RELIEVING NUT	A 479 Gr. 316L
D	47	1	BAGUE DE FOND (non affiché)	STUFFING BOX BUSHING (Not shown)	A 479 Gr. 316L
C	46	3	GARNITURE	PACKING	PTFE
E	45	1	VIS DE PRESSE ETOUPE	PACKING SCREW	A 479 Gr. 316L
E	44	1	LEVIER	LEVER	SA 351Gr. CF3M
E	43	1	FOURCHETTE	FORK	SA 351Gr. CF3M
E	42	1	AXE DE FOURCHETTE	FORK SHAFT	SA 351Gr. CF3M
E	39	1	SIEGE D'ALIMENTATION	FEEDING SEAT	A 479 Gr. 316L
A	38	1	TIGE DE VIDANGE	DRAIN SPINDLE	A 479 Gr. 316L
B	37	1	SEGMENT PORTEUR DE PISTON	PISTON GUIDE SEGMENT	THERMOGLIDE™
D	33	1	ENTRETOISE MODULANTE	MODULATING BRACE	A479 Gr. 316L
B	32	1	JOINT TORIQUE DE CLAPET	DISC O'RING	FFKM 75SH
E	30	1	VIS D'ESSAI	TEST GAG	SS 304
E	29	1	FIL DE PLOMBAGE	SEAL WIRE	STEEL
E	26	1	BOUCHON SUPERIEUR	UPPER PLUG	SS 304
B	25	4	JOINT TORIQUE DE CORPS	BODY O'RING	FFKM 75SH
B	24	1	JOINT TORIQUE DE SIEGE	SEAT O'RING	FFKM 75SH
B	22	1	JOINT ENERGISE TIGE VIDANGE	DRAIN SPINDLE SPRING-ENERGISED SEAL	PTFE Gr.APHITE + STEEL
B	21	1	JOINT TORIQUE TIGE VIDANGE	DRAIN SPINDLE O'RING	FFKM 75SH
E	20	4	ECROU DE CAPUCHON	CAP NUT	A 276 Gr. 316L
E	19	4	GOUJON DE CAPUCHON	CAP STUD	A 193 Gr. B8
C	18	1	CONTRE-ECROU DE VIS DE REGLAGE	ADJ. SCREW LOCKNUT	A 479 Gr. 316L
C	17	1	VIS DE REGLAGE	ADJUSTING SCREW	SA 453 Gr. 660 CL.B
D	16	2	RONDELLE DE RESSORT	SPRING WASHER	A 479 Gr. 316L
D	15	1	RESSORT	SPRING	AMS 5670 (Alloy X-750)
C	14	1	BOUCHON / BRIDE DE VIDANGE	DRAIN PLUG	A 479 Gr. 316L
C	13	1	CHEMISE DE DETECTION	DETECTION HOUSING	A 479 Gr. 316L
B	12	1	ANNEAU PORTEUR DE TIGE	SPINDLE RING	THERMOGLIDE™
C	11	1	TIGE	SPINDLE	A 479 Gr. 316L
A	9	1	GUIDE	GUIDE	A 479 Gr. 316L
C	8	1	PISTON	PISTON	A 479 Gr. 316L
C	7	1	ENTRETOISE D'ALIMENTATION	FEEDING BRACE	A 479 Gr. 316L
A	5	1	CLAPET	DISC	STELLITE Gr.6
B	4	1	BUSE DE VIDANGE	EXHAUST NOZZLE	A 479 Gr. 316L
E	3	1	CAPUCHON	CAP	SA 351Gr. CF8M
E	2	1	CHAPEAU	BONNET	A 479 Gr. 316L
E	1	1	CORPS	BODY	A 479 Gr. 316L
CLASS.	**TAG**	**QTY**	**NOMENCLATURE (FR / EN)**		**MATERIAL**

TABLE 3 – PILOT BOM

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	During discharge, small amounts of steam or hot water can be relieved from the main valve gaskets. Direct proximity shall be avoided. Anyhow be aware that the environment might be extremely hot	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 pressure relief 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 boiler will create a minimum of turbulence.
- The inlet piping must be as short as possible and direct.
- A pressure relief must not be installed on piping which has a nominal diameter of less than the nominal inlet diameter of the safety valve.
- The pressure relief 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 one size greater than 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 pressure relief valve outlet orifice.
- 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 ≥ 2.5 d.

8.4 INSTALLATION ON THE PROTECTED EQUIPMENT

The equipment nozzle on which the pilot operated pressure relief 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 pressure relief valve must always be installed in the vertical position.
- The safety valve must be subjected to no stresses whatsoever from piping, connections or drains be.
- 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 pressure relief valve to perform essential tasks.

The pressure relief valve body must be permanently drained, by connecting the drain orifice on the lower part of the body. The connection thread is 1/4” NPTF.

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:

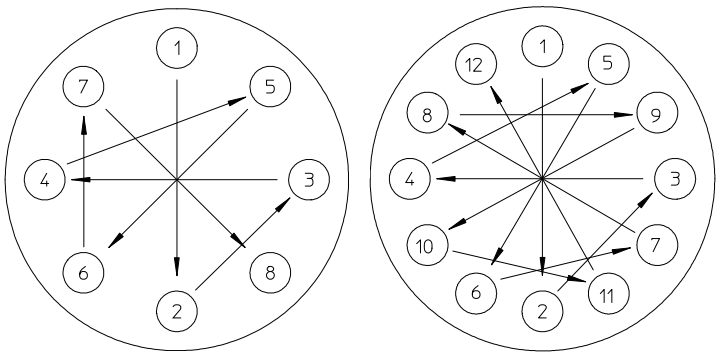


FIGURE 4 – BOLTING ORDER

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	Stainless steel	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 INSTALLATION NOT DIRECTLY ON THE EQUIPMENT (REMOTE SENSE)

The Pressure Relief valve shall be installed as written on §8.4. The ¼"NPT Sensing Line shall be directly connected from the the equipment to the pilot.

Maximum length of the remote sensing line tubing from equipment to the pilot is 20 meters. If the length is required to be longer, please refer to Trillium.

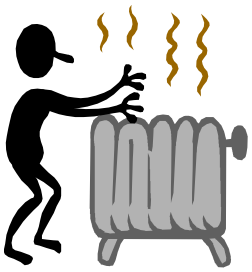
For longer distances, you must consult TRILLIUM.

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.

A mean shall be installed to prevent the tubings and the pilot from freezing. No technique is preferred but maximum continuous temperature should not overtake 100 °C. Pilot shall not be insulated.

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 working on 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 (Stareco™) 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 Sarasin-RSBD 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 76 SERIES (STARECO™ STYLE)

Always disassemble first all accessories from the main valve.

- After disassembly, check the seats condition (disc/nozzle). Eventually proceed to lapping.
- Clean, degrease and dry with appropriate solvent.
- Use the appropriate torque value particularly for special gaskets
- Before starting disassembly, ensure you have at least the following minimum spare parts :
    - 2 metallic body gaskets
    - High Temperature grease (Never use regular grade equivalent) Trillium part number # 9152G100
    - Cleaning solvent, as authorized below :
        - Isopropyl alcohol
        - Acetone
    - Soft, Lintless & Clean rags
    - Wrenches

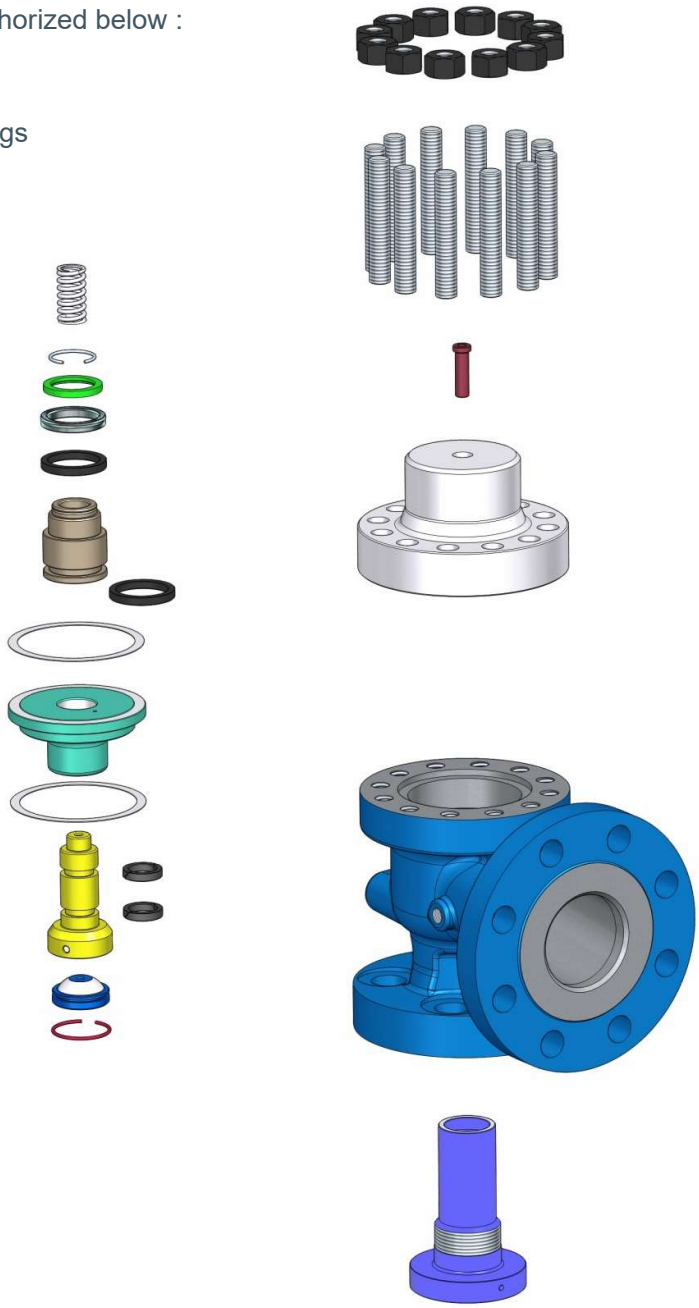


FIGURE 5 – MAIN VALVE EXPLODED VIEW

- BUFFER TANK REMOVAL (if any) from the main valve
  - Check the buffer tank temperature is not warm.
  - Verify that the feeding line has been totally bled off pressure
  - Unscrew the top and the bottom feeding line fittings of the buffer tank.
  - Do not try to uncrew the connectors main part as they are welded to the buffer tank.
  - Remove the 2 counter screws on the buffer tank bracket
  - Remove the buffer tank (with bracket and stirrup)
  - Optional (figure 6) : If you need to change the feeding line tubing you must ensure about 10 mm of tubing will run over the buffer tank inside wall. This will prevent the pilot to deal with deposits or dirt.

    Warning : When disconnected from the buffer tank (free tubing), the connectors are very fragile and could easily be broken if free piping is not totally removed from the connection ring and from the pilot.

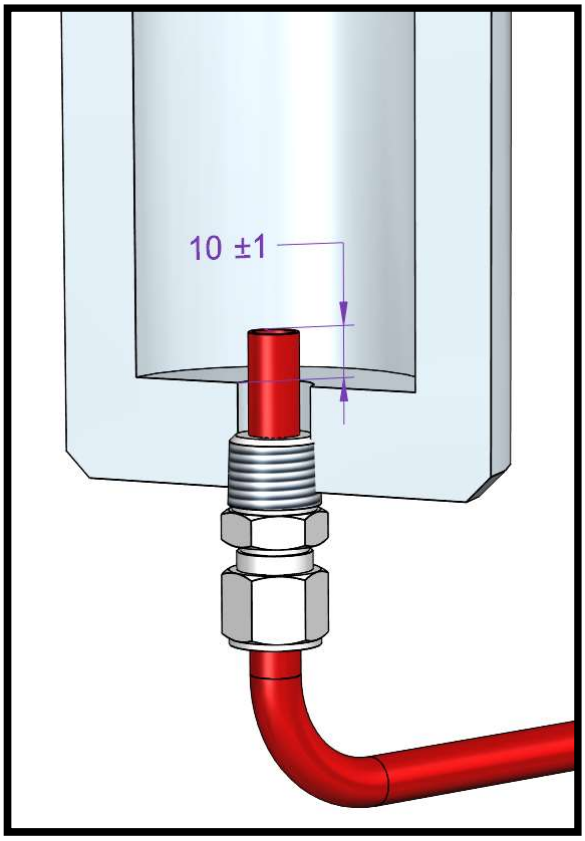
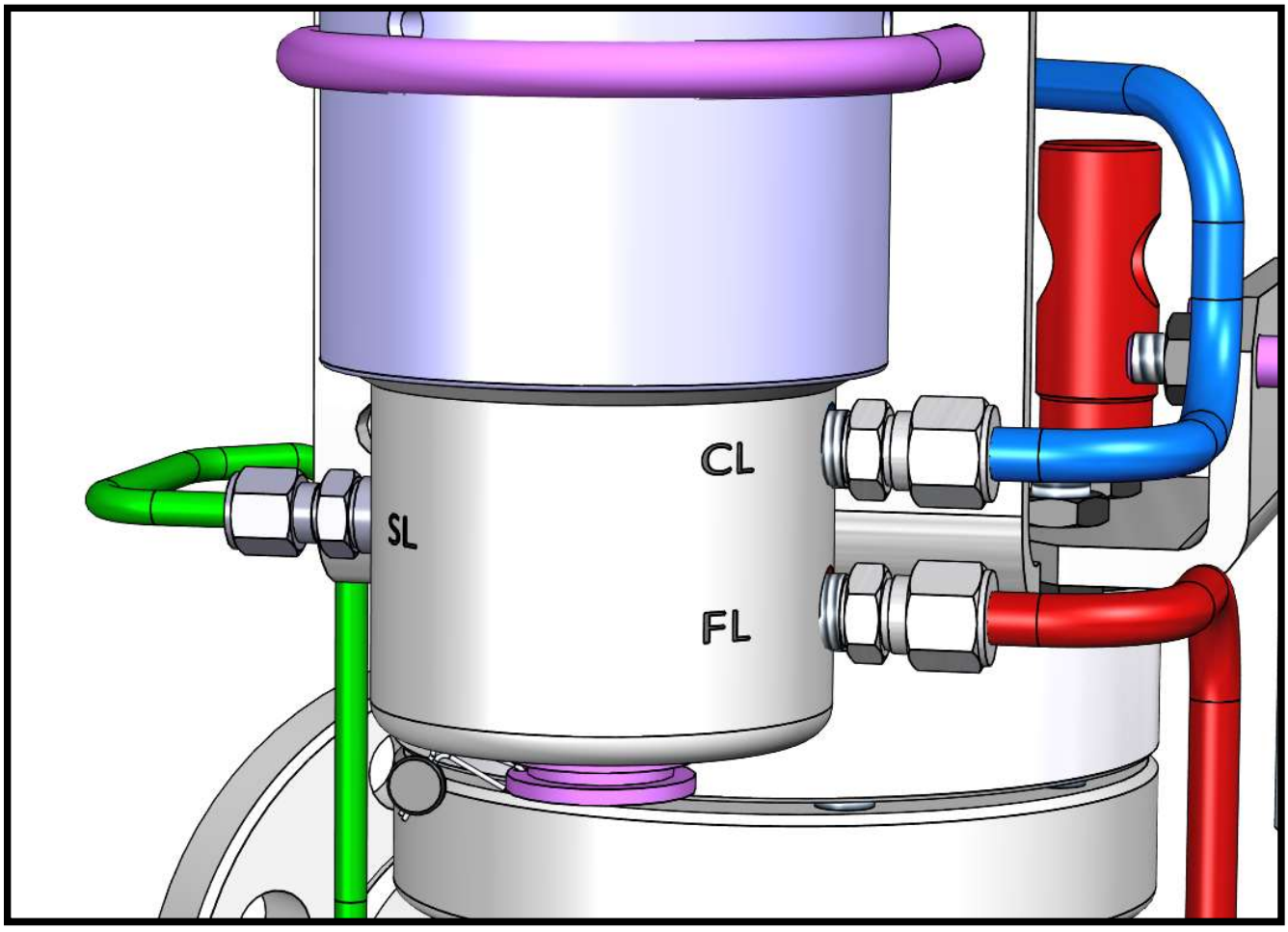


FIGURE 6 – FEEDING LINE RUN OVER INSIDE BUFFER TANK

- PILOT REMOVAL from the main valve.
  - Check the pilot temperature is not warm
  - Verify that the control and sensing lines have been totally bled off pressure
  - Unscrew the 3 pilot fittings.
  - Remove the 2 counter screws on the pilot bracket
  - Remove the pilot (with bracket and stirrup)
  - Optional :
    - If you need to change the sensing line tubing you must realise 2 pig tails between the ring and the pilot to cool down the steam that will enter the pilot. After a while this will create a water plug.
    - If you need to change the feeding line piping (when no buffer tank is required) you must realize 2 pig tails between the ring and the pilot to cool down the steam that will enter the pilot.

  Warning : When disconnected from the pilot (free tubing), the fittings are fragile and can easily be broken if freetubing is not totally removed from the connection ring, from the pilot and from the main valve.



LEGEND	
SL	SENSING LINE (Green)
FL	FEEDING LINE (Red)
CL	CONTROL LINE (Blue)

FIGURE 7 - DCS-E PILOT CONNECTIONS

- OTHER ACCESSORIES removal from the main valve.
  - Field test connector / Field test indicator

    Unscrew the NPT ports on the Indicator (in blue) /connector (in red)

    Warning : Take pictures of the connections or ensure general assembly drawing is available for the reassembly.

FIGURE 8 - ACCESSORIES

- MAIN VALVE DISASSEMBLY
  - Remove the pick-up tube from the cover in order to avoid to damage it while removing the cover.
  - Use a threaded rod, washers (in red) and a nut to maintain the spring compressed while you unscrew the bonnet. Hand tighten only, the spring force is low, this step is only to prevent parts from falling on the ground or being lost.

    Below are the sizes of the threaded rods to use :

Orifices	Thread
D – E	M4
F – G – H – J	M6
K – L – M – N – P – Q – R	M8

TABLE 5

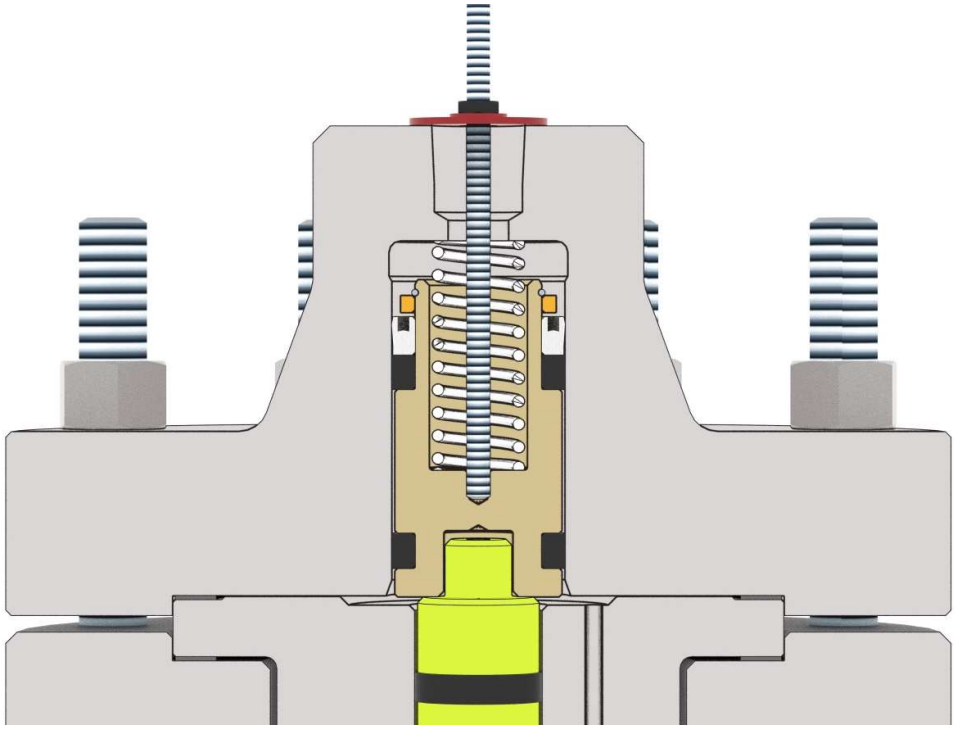


FIGURE 9 – BONNET DISASSEMBLY

  - Unscrew the cover bolting
  - Take the cover off with the piston inside
  - Remove the piston from the cover taking off the sliding rings. **Keep the sliding segments by pair as you disassemble them** (important for inspection and reassembly).

    Warning : Sliding rings are made from Thermoglide and each segment is made from 2 parts. When disassembling the sliding rings can detach from the piston. If the sliding rings fall down they may be broken or cracked which may alter further assembly / operation.
  - Control the quality of these sliding rings (segments). Any scratched, worn or incomplete segment shall be changed
  - Remove the guide from the body, together with the disc-holder. For handling purpose, the thread on top of the disc-holder may be used.
  - Remove the disc-holder from the guide. The 2 metallic gaskets shall only be used once only and thus shall be changed.

- Remove the disc from the disc-holder. The disc is held in place with a retainer ring. Place a flat screw driver one of the 3 service holes in the disc holder and lift the disc outside its disc-holder

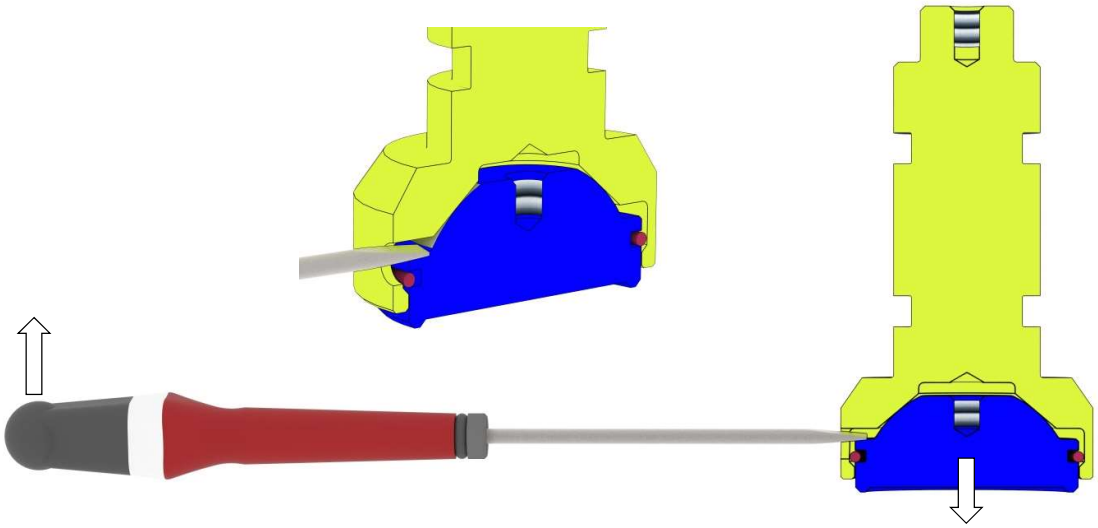


FIGURE 10 – DISC DISASSEMBLY

Warning : Take care not to damage the seating surface and the sphere of the disc during disassembly

- Remove the nozzle from the body

  For small orifices (D to K), 2 holes are located on the nozzle base to enable the use of a pin wrench.
  For bigger orifices (starting at L), a pattern is made inside the nozzle. Use the following tools :

Nozzle disassembly tools	
Orifice	**Tool number**
D – L	STANDARD PIN WRENCH
M – P	Consult factory
Q – R	Consult factory

TABLE 6 – NOZZLE DISASSEMBLY TOOLS

- PARTS CLEANING
  - Clean parts carefuly from rust, burrs, scale, grease and dirt. Use appropriate solvent. Deeply clean the threads to remove all grease and dirt.
  - Dry the parts using Soft, Lintless and clean rags or dry and filtered air.

Warning : Do not sand blast the parts. Sliding or sealing surfaces will be damaged.

9.2 MAIN VALVE PARTS INSPECTION & MAINTENANCE

- 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 soft good materials, sliding surfaces and sealing ones.

- PART INSPECTION
- Main valve 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.
  The upper body gasket seating surface roughness shall be of about Ra 1.6µm (64 RMS). Scratches can be removed with abrasive paper grade 1000 or higher.

- Main valve boltings (1)

  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.

- Main valve cover (2)

  Inspect the Cover for any cracks, erosion, pitting. If the cover has such defects it shall be replaced.
  The lower cover gasket seating surface roughness shall be of about Ra 1.6µm (64 RMS). Scratches can be removed with abrasive paper grade 1000 or higher.
  Check the dome internal diameter and inlet chamfer where the piston slides. If surface is galled, scratched, corroded or pitted the cover shall be replaced.

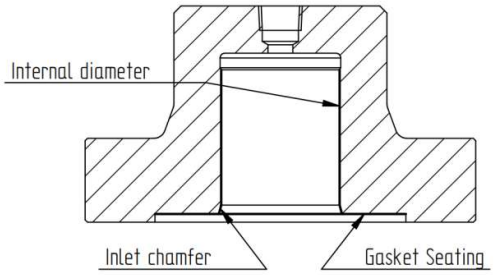


FIGURE 11 - BONNET

- Main valve guide (9)

  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 be replaced.

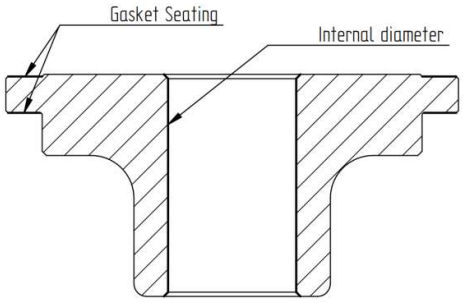


FIGURE 12 - GUIDE

- Main valve 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.

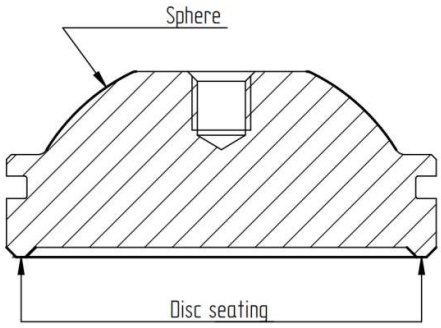


FIGURE 13 - DISC

  - Nozzle 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 (figure 14 & table 7)
    - Final roughness of the seating surface of the disc shall be Ra 0.4µm (16 RMS).
    - 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.

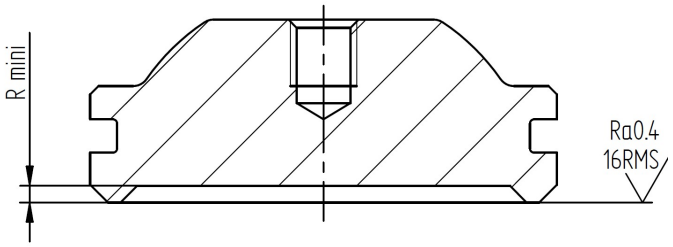


FIGURE 14 – DISC LAPPING

Orifice	R mini (mm)
D-E-F-G-H-J-K-L-M-N-P	0.6
Q-R	1

TABLE 7 – MAX. LAPPING

- Main valve 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.

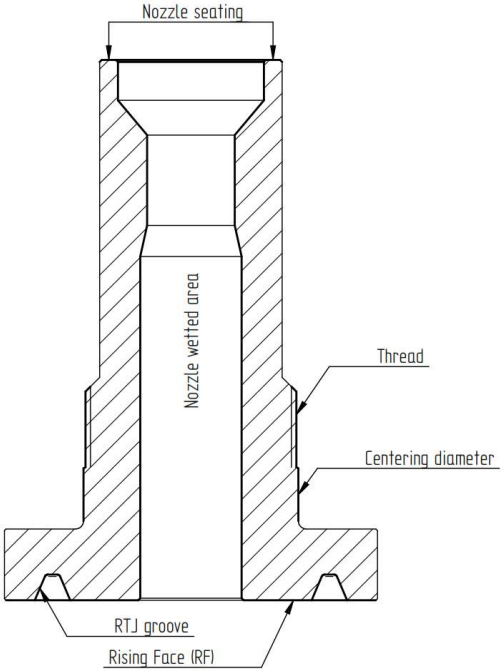


FIGURE 15 - NOZZLE

    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).
      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).

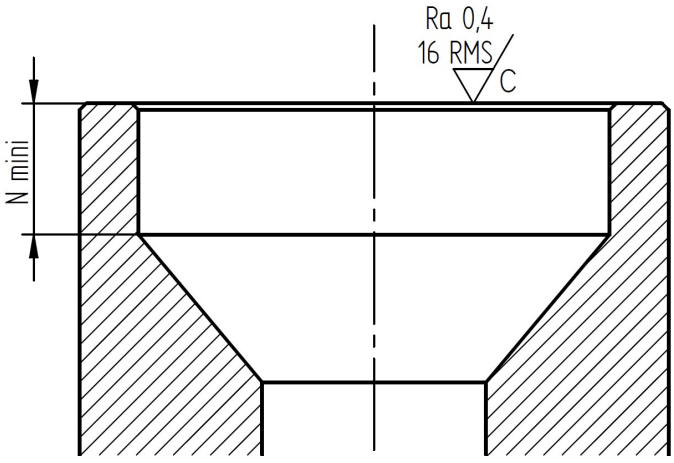


FIGURE 16 – NOZZLE LAPPING

Orifices	N mini (mm)
D-E	3
F-G-H	9
J-K-L	11
M-N-P	39
Q-R	14

TABLE 8 – MAX. LAPPING

- Main valve 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.

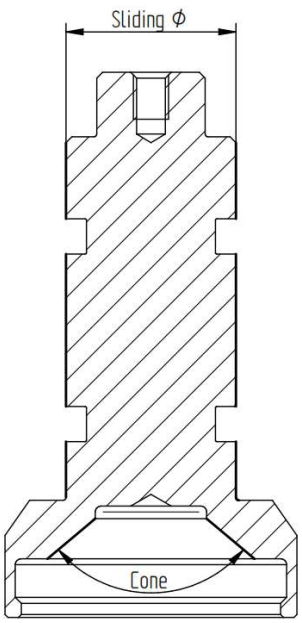


FIGURE 17 – DISC-HOLDER

- Main valve piston (12)

Inspect the external diameter of the piston 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 dynamic seal seating surface. 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. If the surface is scratched, pitted or corroded, the piston shall be changed.

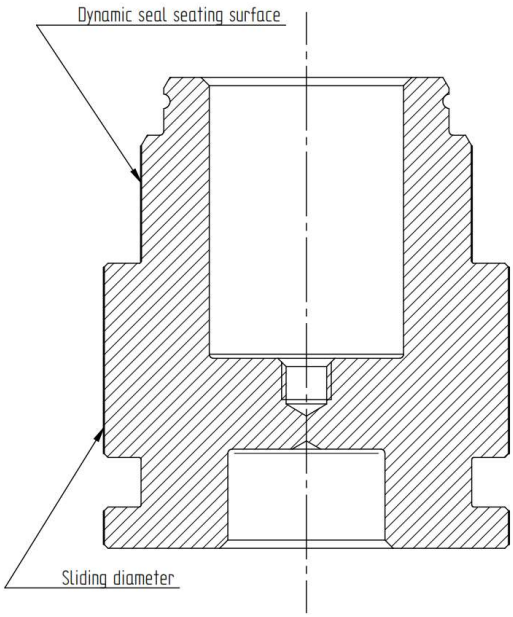


FIGURE 18 - PISTON

- 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.

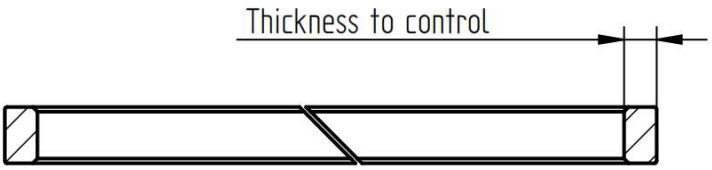


FIGURE 19 – SLIDING RING

FIGURE 20 – SLIDING RING

Sliding ring thickness (mm)	D-E	F-G-H-J	J-K-L	M-N-P-Q-R
Tolerancy (mm)	-0.02 / -0.08	-0.02 / -0.08	-0.02 / -0.08	-0.02 / -0.1
Piston	4	5	7	7
Disc Holder	3	4	5	7

TABLE 9 – SLIDING RING THICKNESS

- Main valve piston seal (10)

Inspect the piston seal for any scratches or impact marks on its lips. Ensure the internal spring is present and in good state. Any abnormal deformation of the spring, due to improper disassembly or reassembly, will cause the piston to leak.
In case of any of these damages, the piston seal shall be replaced.

9.3 MAIN VALVE RE-ASSEMBLY

- Nozzle (6)
  - Grease (high temperature grease) the nozzle thread. Screw the nozzle (6) in the body (1).
  - Tighten the nozzle to rated torque and remove the grease excess.

Orifice	Couple de serrage (daN.m)
D – E	10
F – G	12
H	15
J – K	25
L – M – N – P	45
Q	48
R	45

TABLE 10 – NOZZLE ASSEMBLY TORQUES

- Sliding ring (8)
  - If you replace the sliding rings (8), you may need to make the 45° angle cuts. Trillium prefers not to supply the rings in two segments to prevent the risk to damage during the shipment.
  - Handle the sliding ring in a vise. Take care to cover the steel vise claws with soft material such as rubber or PTFE to prevent sliding rings from being broken. There is no need to tighten hard the vise.
  - Make 2 angle cuts with a steel saw (1mm thick max.). They shall be in opposition as shown in the picture below.

FIGURE 21 – SLIDING RING CUTTING

FIGURE 22 – SLIDING RING

- Disc (11)
  - Slightly grease (high temperature grease) the disc hinge surface (sphere).
  - Clip the retainer ring (57) on the disc (11).
  - Insert the disc (11) in the disc-holder (56).
- Assemble the 2 sliding rings (2 segments per ring) (61) to the disc-holder (56) and insert the disc-holder (56) in the guide (9).
- Grease one guide gasket (40). Place it on the body (1)

Warning : Never use a twice a metallic gasket once tightened once. Change it at each service.

- Use the threaded hole on top of the disc-holder to lift the assembly and insert it onto the body. Release lifting force progressively until the disc come in contact with the nozzle. Ensure you correctly position the guide hole on the outlet flange side.

FIGURE 23 – DISC-HOLDER ASSEMBLY

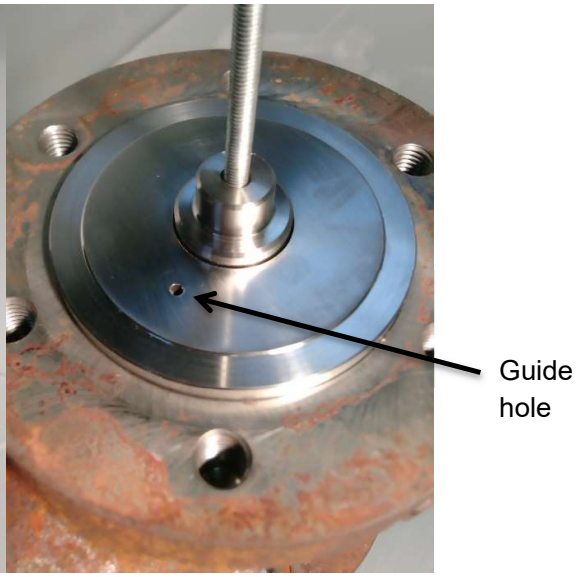


FIGURE 24 – GUIDE HOLE ORIENTATION

Warning : relieving the lifting force suddenly will make impact marks on the nozzle and the disc seating surfaces. The Main Valve cannot remain tight with such marks on those surfaces.

- Piston (12)
  - Reassemble the piston (12), by fitting on it the two sliding rings (8), the piston seal (10), the backup ring, the retaining ring (13) and the return spring (46). Take care not to damage the spring seal during assembly.
  - Insert the piston assembly on the cover. Ensure you are perfectly centered on the cover not to damage the spring seal (10).
  - Use a threaded rod and a nut (as described in chapter 8.1) to maintain the piston (12) inside the cover (2).
  - Grease (high temperature grease) the second guide gasket (40) and place it on top of the guide (9).
  - Slide the cover (2) on its studs (35) until it reaches the guide (9). It is necessary to use a torque wrench to tighten the cover bolting. Tighten to 30% of the nominal torque (figures 25 + 26 & table 11)

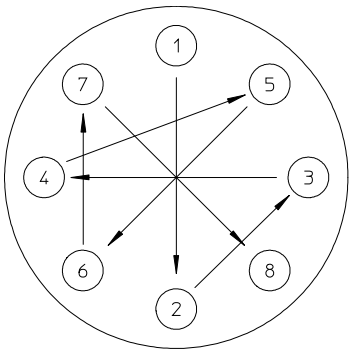


FIGURE 25

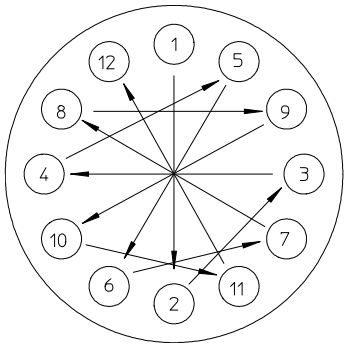


FIGURE 26

Continue to tighten alternatively until the required torque is reached (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 (mm^2)	Allowable stress (M.Pa)		Tightening torque (m.daN)	
		Carbon steel	*Stainless steel*	*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 11 – NOMINAL TIGHTENING TORQUE

Note :

1 - Such as B7/L7 or 42CD4

2 - Such as B8 or Z6CN18.9

- Place the pickup tube (80) inside the cover.
- Reassemble the pilot with its bracket and nuts.
- Reassemble other options (buffer tank / field test indicator / connector), the connection ring and the tubing. Use the General Assembly drawing.

Note : If the Valve is about to be reinstalled on a hot installation (no heating period), we recommend you to fill the valve dome and the buffer tank with water before reassembly on the equipment to protect.

9.4 DISSASSEMBLY OF THE DCS-E PILOT

- DISSASSEMBLY

  For every regular maintenance on a valve, all the gaskets of the shall be changed.

  - Precautions before any operation :
    - Be sure to respect any safety instruction of your company and the site to avoid accident.
    - Mark the setting of the set spring (you will save time of the resetting operation)
    - Release completely the set spring by unscrewing the set screw (item 17).
  - Disassembly order
    - Unscrew the bonnet (item 2).
    - Separate the guide (item 9).
    - Separate and disassemble the "drain spindle" set (item 38). If the Drain spindle gasket is in good state, it can stay on the drain spindle. (The disassembly of the drain spindle gasket is only recommended when you change it. Any attempt to remove it will damage it or the drain spindle sealing diameter)
    - Unscrew the drain plug (item 14).
    - Disassemble the body.

    Warning : When the drain plug (14) will be unscrewed, all the pilot internals are free to move and can fall off the pilot.

- CLEANING
  - Clean parts carefuly from rust, burrs, scale, grease and dirt. Use appropriate solvent. Deeply clean the threads to remove all grease and dirt.
  - Dry the parts using Soft, Lintless and clean rags or dry and filtered air.

  Warning : Do not sand blast the parts. Sliding or sealing surfaces will be damaged;

9.5 PILOT VALVE PARTS INSPECTION & MAINTENANCE

- GENERAL RECOMMENDATIONS

  Ensure all parts have been degreased and cleaned properly. The workbench is free from any dust, dirt or any other contaminant. The whole environment of the workspace shall be free of potential contamination.

- PART INSPECTION AND MAINTENANCE

- Spindle (11)

  Inspect Spindle sliding diameter. 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 sphere and the spring washer seating surface of the spindle. If surfaces are galled, scratched, corroded or pitted the spindle shall be replaced.

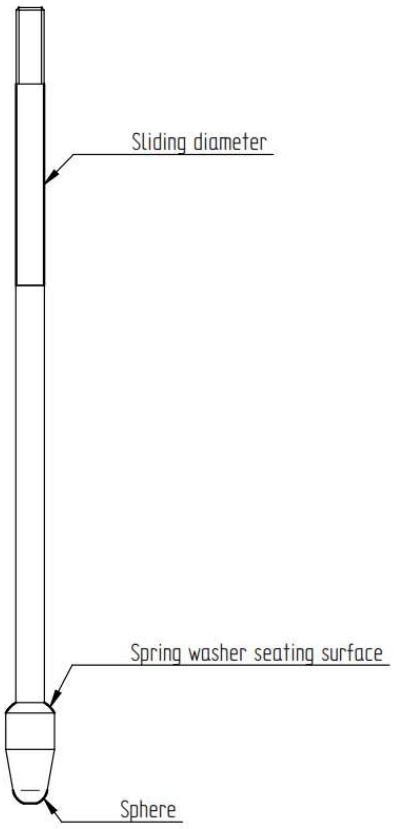


FIGURE 27 - SPINDLE

- Drain spindle (38)
  - Inspect sliding diameter. Any scratches, impact marks shall be removed with high grade (1000 or higher) sandpaper.

    If you removed the drain spindle gasket (22), inspect the sealing diameter for any scratches or impact marks. If the sealing diameter is damaged, replace the drain spindle (38).
  - Inspect O'ring diameter. Any scratches, impact marks shall be removed with high grade (1200 or higher) sandpaper.
  - Inspect the disc/nozzle seating surface. The outer edge shall be sharp (no chamfer, no fillet) and the surface shall be Ra 0.4µm (16RMS) or less.
  - Inspect the drain spindle seating surface.

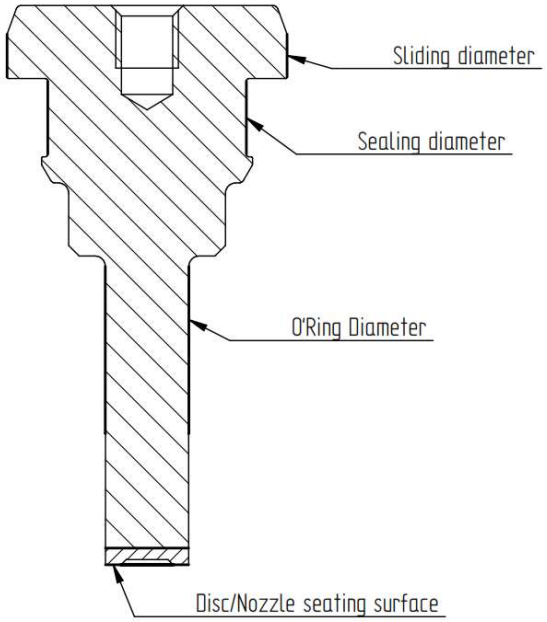


FIGURE 28 – DRAIN SPINDLE

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 not recommended.

- Lap the seating surface as deemed necessary.

  Ensure that the drain spindle is perfectly perpendiculary to the lapping workbench. It is critical for tightness. Outer edge shall remain sharp. The Trillium pilot tool kit include one drain spindle support for hand lapping. Use a diamond paste such as the Lamplan (6.213, 3.213, 1.213).
  Final roughness of the seating surface of the disc shall be Ra 0.4µm (16 RMS).
  Planeity of the lapping machine shall have been checked.
- Inspect nozzle seating surface after lapping / machining operations.

  Touch check the roughness of lapped seating surfaces according to ISO 2632 (or equivalent) test specimen.

  Note : Final roughness of the seating surface of the drain spindle shall be Ra 0.4µm (16 RMS).

- Piston (8)
  - Inspect Piston housing diameter. 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 sphere and the sliding ring diameter of the piston (8). If surfaces are galled, scratched, corroded or pitted the piston shall be replaced.

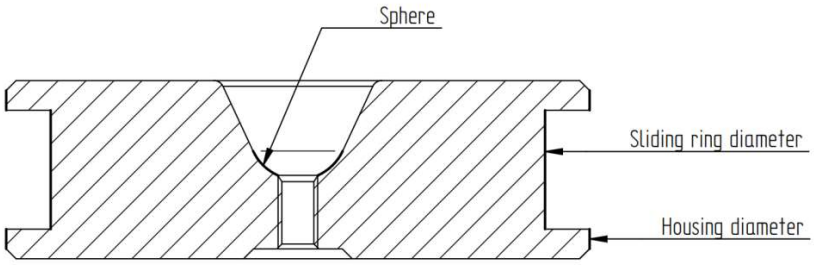


FIGURE 27 - PISTON

- Detection housing (13)
  - Inspect internal diameter of the detection housing. It shall be Ra 0.4 µm (16RMS). If the internal diameter is scratched or galled or pitted, theh shall be replaced.

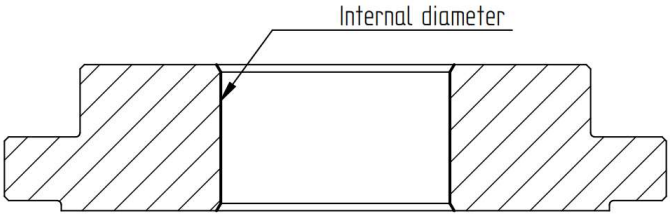


FIGURE 28 – DETECTION HOUSING

- Feeding seat (39)
  - Inspect the sphere of the feeding seat. If surfaces are galled, scratched, corroded or pitted the feeding seat shall be replaced.
  - Inspect the seating surface. The outer edge shall be sharp (no chamfer, no fillet) and the surface shall be Ra 0.4µm (16RMS) or less.
  - Inspect the feeding seat seating surface.

    Any scratch or impact mark less than 0.5mm deep on the seating surface shall be removed by lapping.
    The remachining of the seating surface is not recommended.

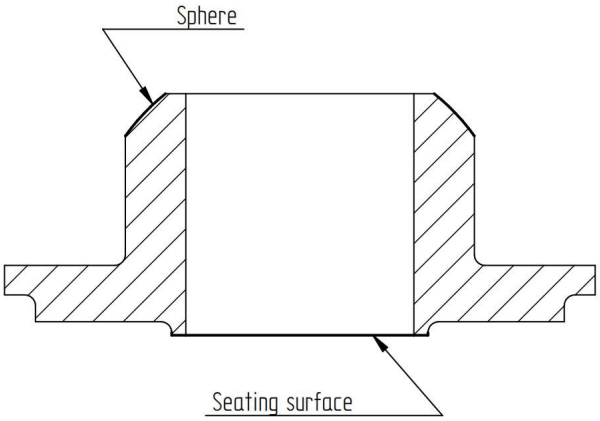


FIGURE 29 – FEEDING SEAT

  - Lap the seating surface as deemed necessary.

    Edges shall remain sharp. Final height of the lip shall be 0.3mm mini.
    Final roughness of the seating surface of the seat shall be Ra 0.25µm (10 RMS).
    Planeity of the lapping machine shall have been checked.
  - Inspect feeding seat seating surface after lapping / machining operations.
  - Touch check the roughness of lapped seating surfaces according to ISO 2632 (or equivalent) test specimen.

    Note : Final roughness of the seating surface of the feeding seat shall be Ra 0.25µm (10 RMS).

- Disc (5)
  - Inspect sliding diameter. Any scratches, impact marks shall be removed with high grade (1000 or higher) sandpaper.
  - Inspect the seating surface. The inside edge shall be sharp (no chamfer, no fillet) and the surface shall be Ra 0.4µm (16RMS) or less.
  - Inspect the disc seating surface.

    Any scratch or impact mark less than 0.5mm deep on the seating surface shall be removed by lapping.
    The remachining of the seating surface is not recommended.

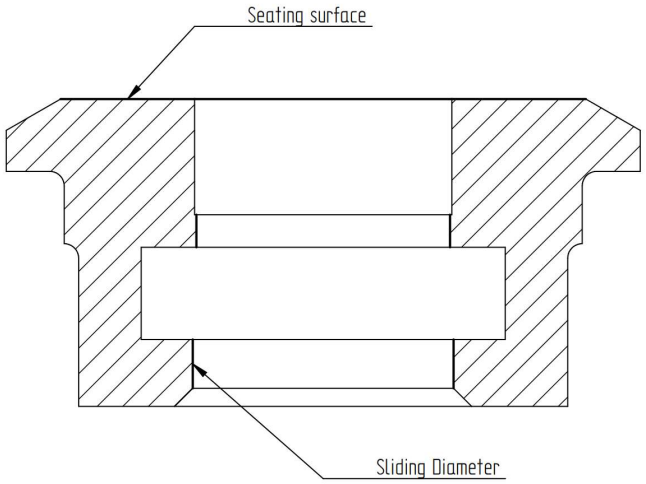


FIGURE 30 - DISC

  - Lap the seating surface as deemed necessary.

    Inner edge shall remain sharp.
    Use a diamond paste such as the Lamplan brand (6.213, 3.213, 1.213).
    Final roughness of the seating surface of the disc shall be Ra 0.25µm (10 RMS).
    Planeity of the lapping machine shall have been checked.
  - Inspect disc seating surface after lapping / machining operations.

    Touch check the roughness of lapped seating surfaces according to ISO 2632 (or equivalent) test specimen.

    Note : Final roughness of the seating surface of the feeding seat shall be Ra 0.25µm (10 RMS).

- Exhaust nozzle (4)
  - Inspect O'ring surface and grooves. Any scratches, impact marks shall be removed with high grade (1200 or higher) sandpaper.
  - Inspect centering diameter. Any scratches, impact marks shall be removed with high grade (1000 or higher) sandpaper.

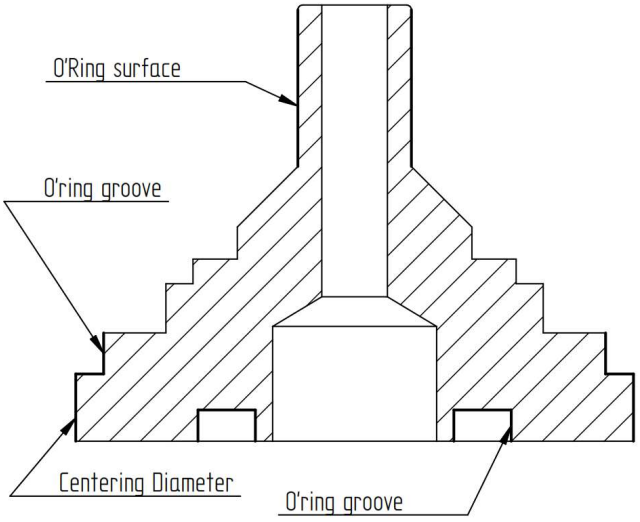


FIGURE 31 – EXHAUST NOZZLE

- Feeding strainer (54)

  Carefuly wash and clean the feeding strainer. If it was very dirty, you may consider to install an external filter on the feeding line tubing (contact the Trillium aftersales department) which will allow to reduce downtime of equipment due to frequent filter cleaning. No pilot disassembly to clean the filter will be required. ***A dual filter option will allow you to keep the valve operating during filter cleaning.***

  Reminder : a dirty filter may increase the valve operating times (opening and closing).

  If the feeding strainer is damaged you shall replace it.

  - Material : 316L stainless steel
  - Dimensions 110 x 7.5 mm
  - Wire diameter between 0.065 and 0.071 mm
  - Flitering 100µm particles and over

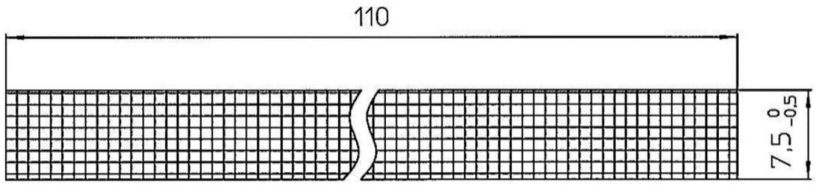


FIGURE 32 - STRAINER

- Piston guide segments (37)
  - Inspect the piston guide segments for any missing splinter, broken part, desintegrating area. If they are in clean condition, proceed with thickness verification. If not replace them.
  - The segment thicknesses shall be inspected. If any thickness falls below the tolerancy (table 35), the segments shall be replaced (by pair).

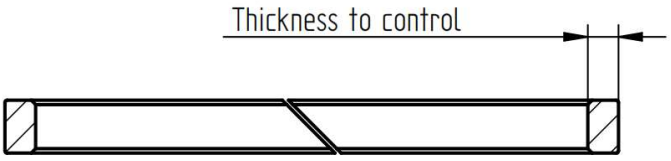


FIGURE 33 – SLIDING RINGTHICKNESS

FIGURE 34 – SLIDING RING

Sliding ring thickness (mm)	DCS-E Set screw (12)	DCS-E Piston (37)
Tolerancy (mm)	+0.01 / -0.01	-0.01 / -0.05
Thickness	2	5

TABLE 12 : SIDING RING THICKNESS

9.6 PILOT VALVE RE-ASSEMBLY

- TOOLING

  See chapter 10 (maintenance tools).

- SYMBOL LEGEND

  I Take care, particular point

  I

  T Take care of the way of assembly

   Adapted greasing

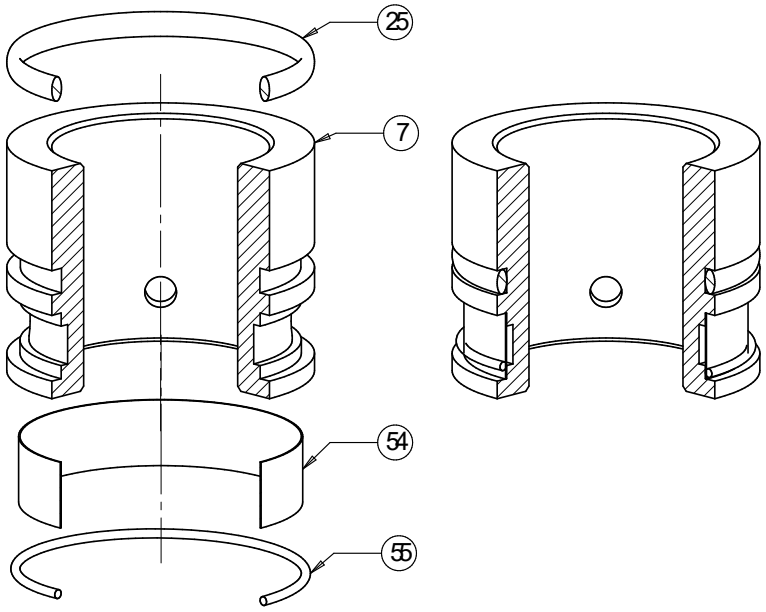
   Greasing forbidden

  Tidy cleaning

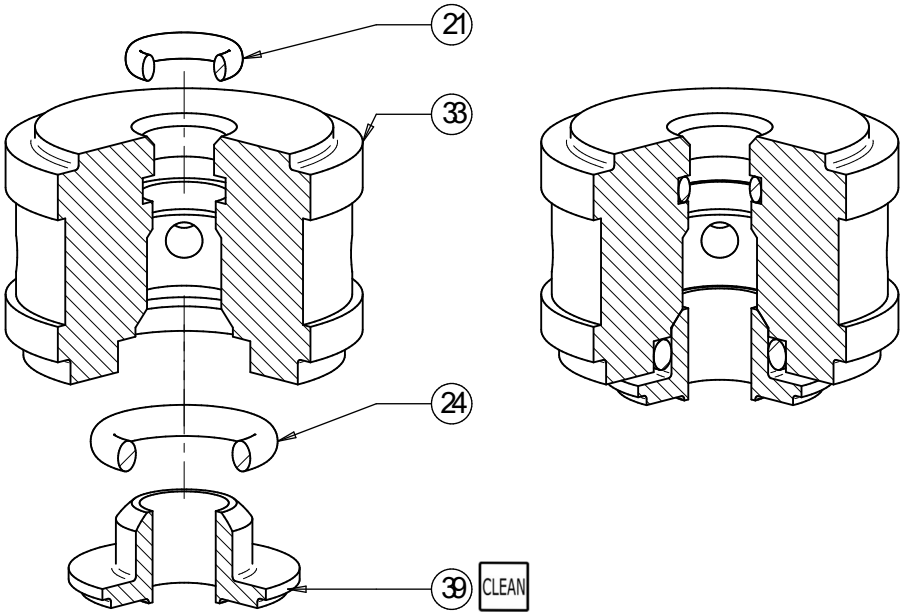
  NOTE : Do not grease every part of the pilot, only slightly grease area marked on this procedure according the dedicated symbol :  **.**

- PILOT RE-ASSEMBLY
- Filter inserting on the feeding bracket



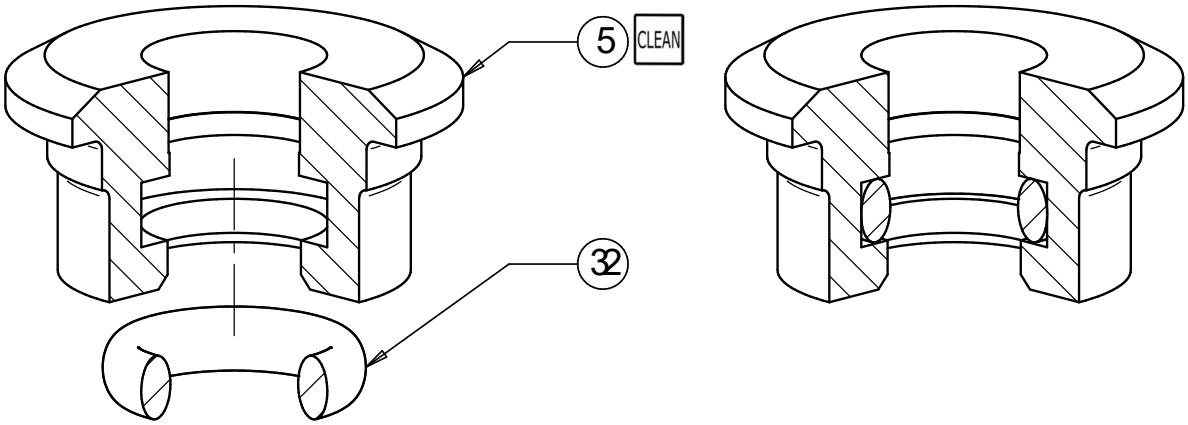
Tag	Qty	Nomenclature
7	1	Feeding brace
25	4	O'ring
54	1	Feeding strainer
55	1	Retainer

- Mounting of the pop action spacer



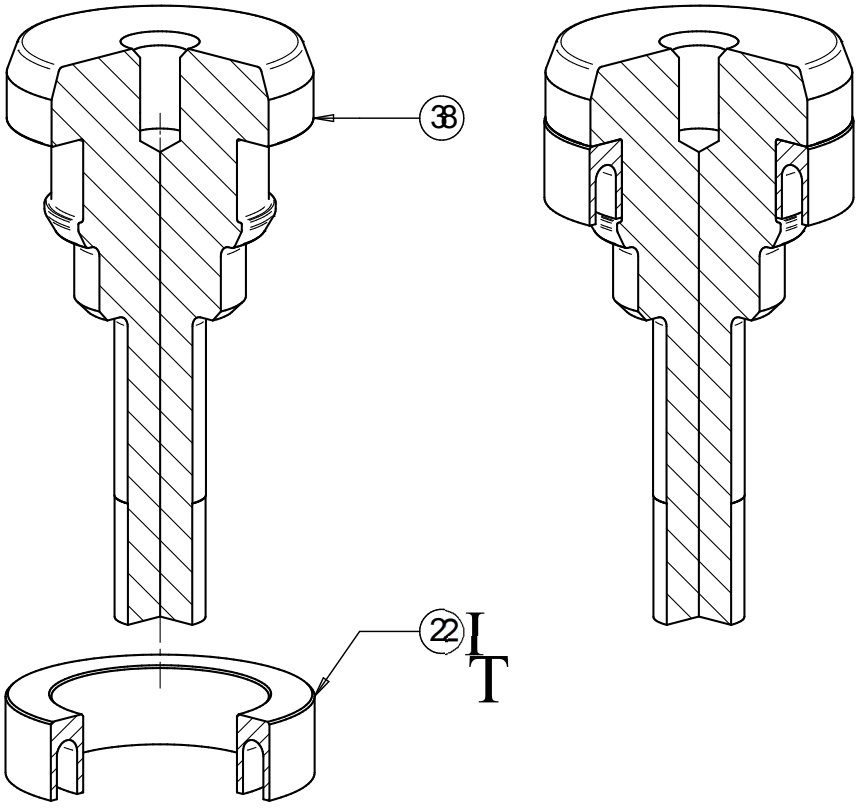
Tag	Qty	Nomenclature
21	1	O'ring
24	2	O'ring
33	1	Pop action brace
39	1	Feeding seat

- Mounting of the disc



5	1	Pilot disc
32	1	O'ring
Tag	**Qty**	**Nomenclature**

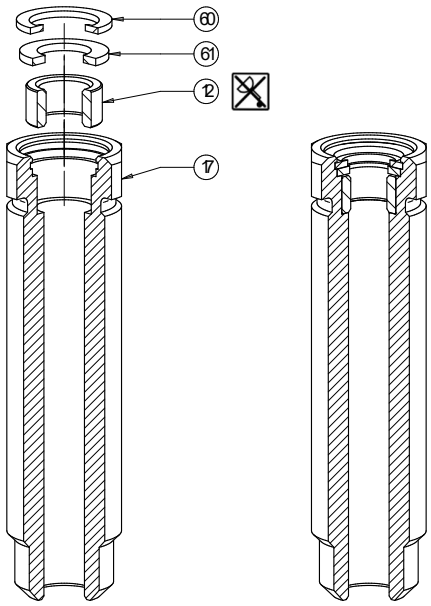
- Mounting of the drain spindle



22	1	Energised seal
38	1	Drain spindle
Tag	**Qty**	**Nomenclature**

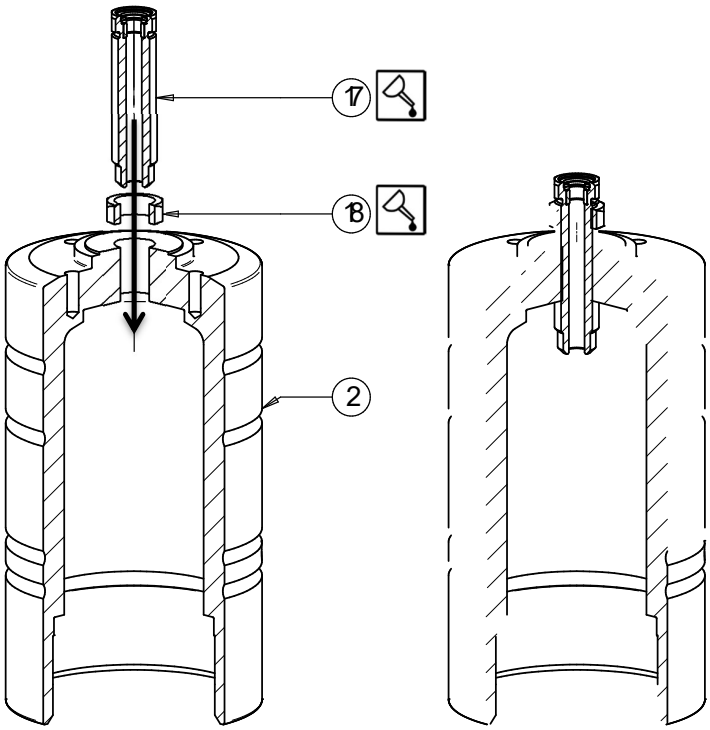
The spring seal shall be snapped on the drain spindle. Lip downwards as shown on the picture.

- Mounting of the set screw



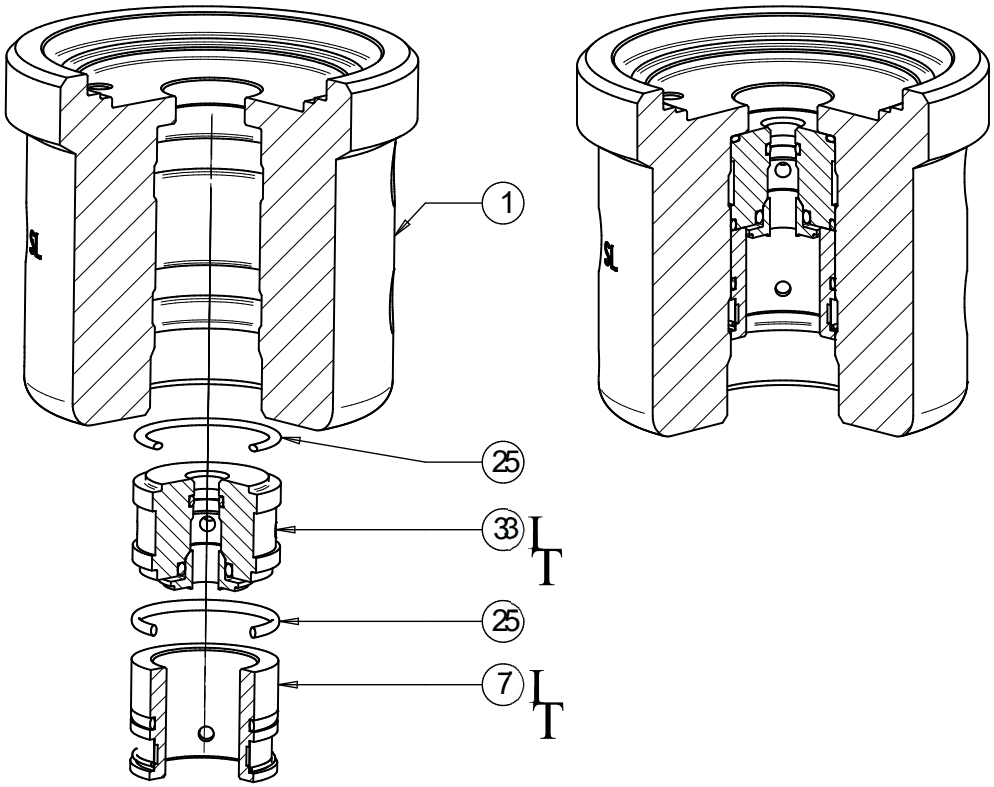
Tag	Qty	Nomenclature
12	1	Spindle ring
17	1	Set screw
60	2	Circlips
61	2	Washer

- Mounting of the bonnet



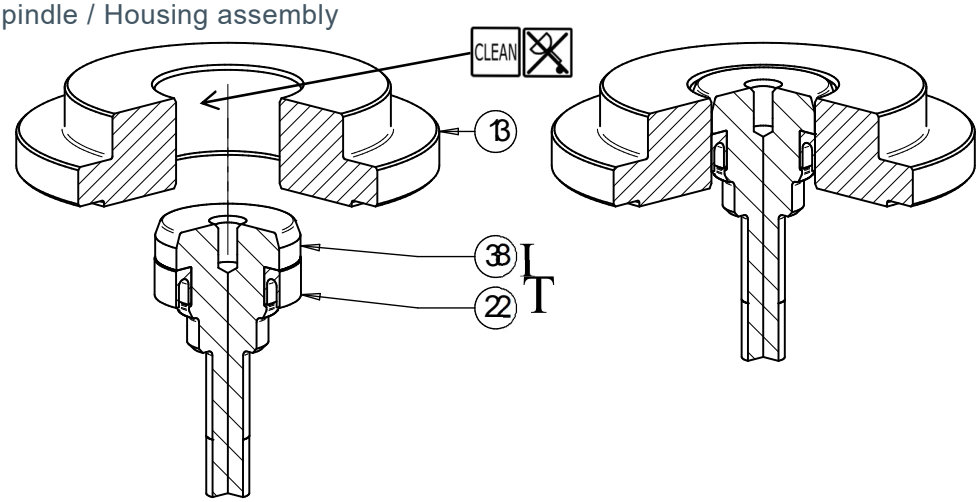
Tag	Qty	Nomenclature
2	1	Bonnet
17	1	Set screw
18	1	Locknut

- Body assembly



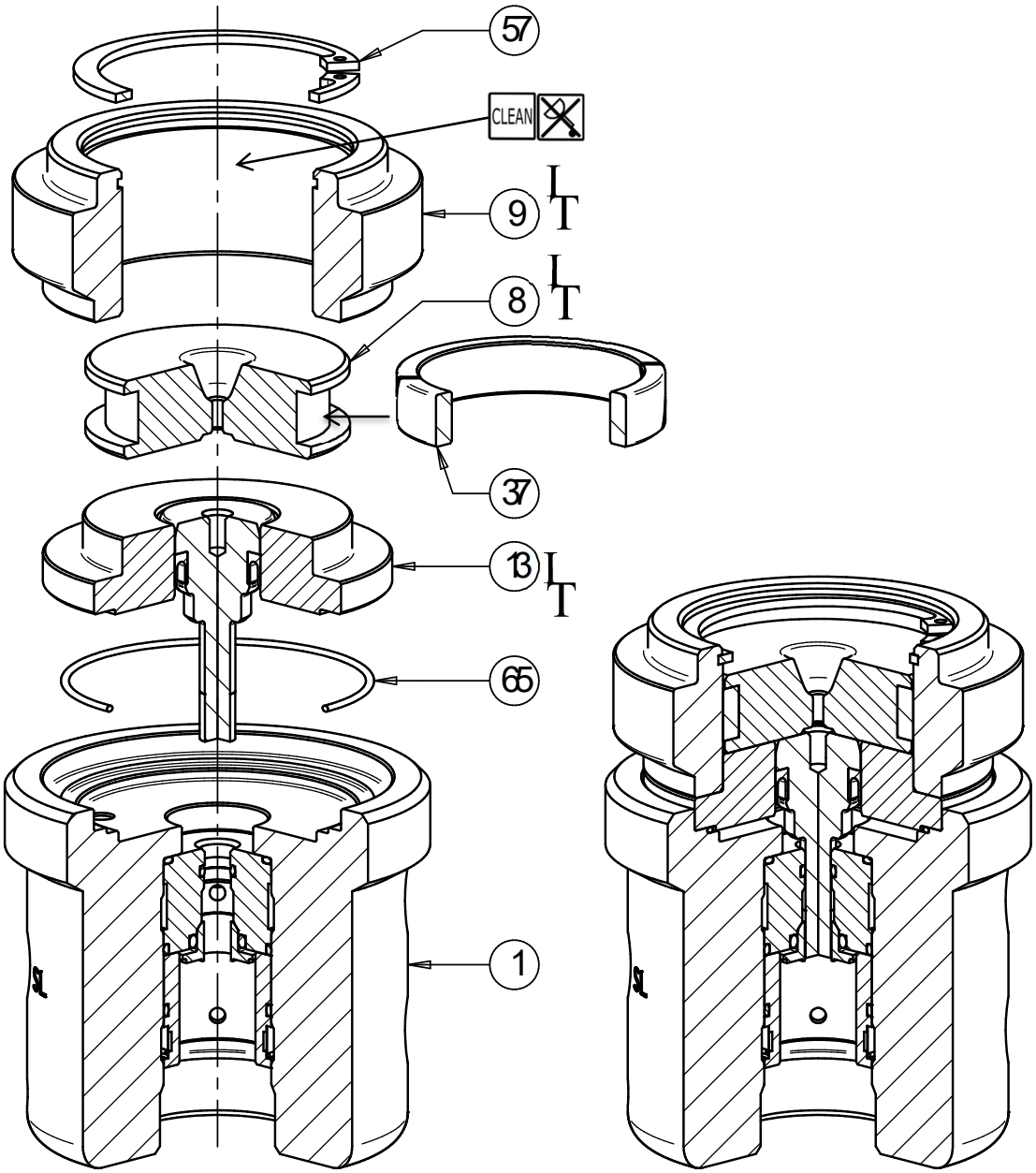
1	1	CORPS	BODY
7	1	ENTRETOISE ALIMENTATION	FEEDING BRACE
25	4	JOINT TORIQUE	O'RING
33	1	ENTRETOISE POP ACTION	POP ACTION BRACE
N°	Qté	Description	EN Desc.

- Drain spindle / Housing assembly



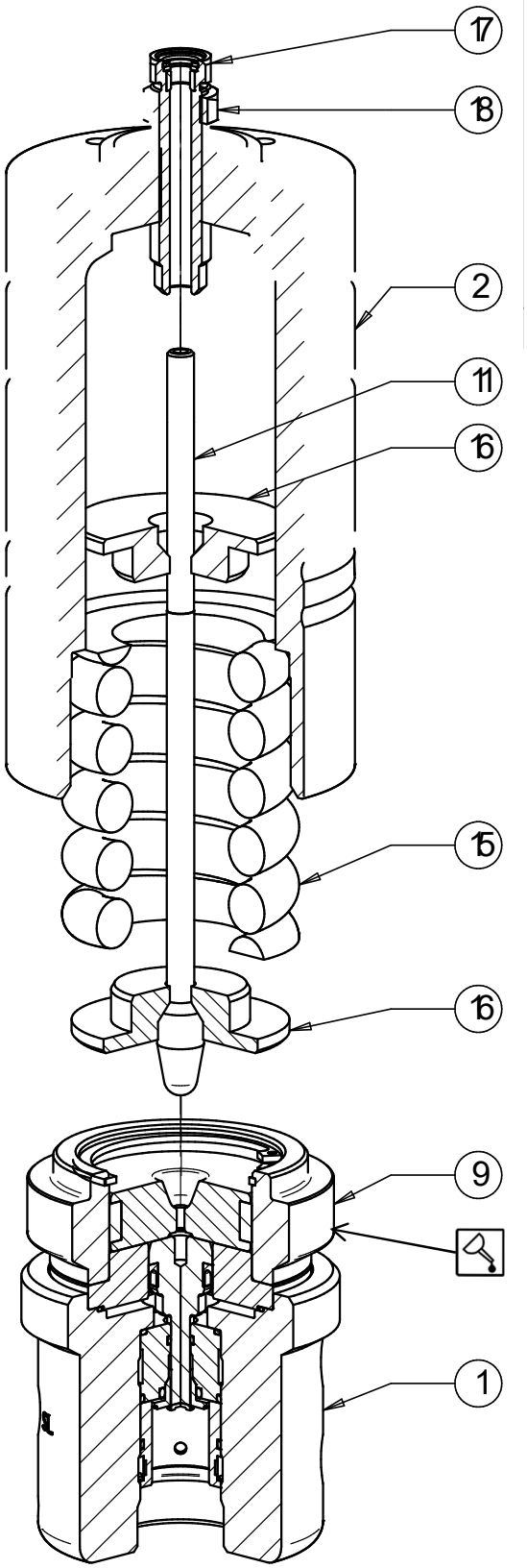
13	1	Detection housing
22	1	Energised seal
38	1	Drain spindle
Tag	**Qty**	**Nomenclature**

- Drain Spindle assembly on the body

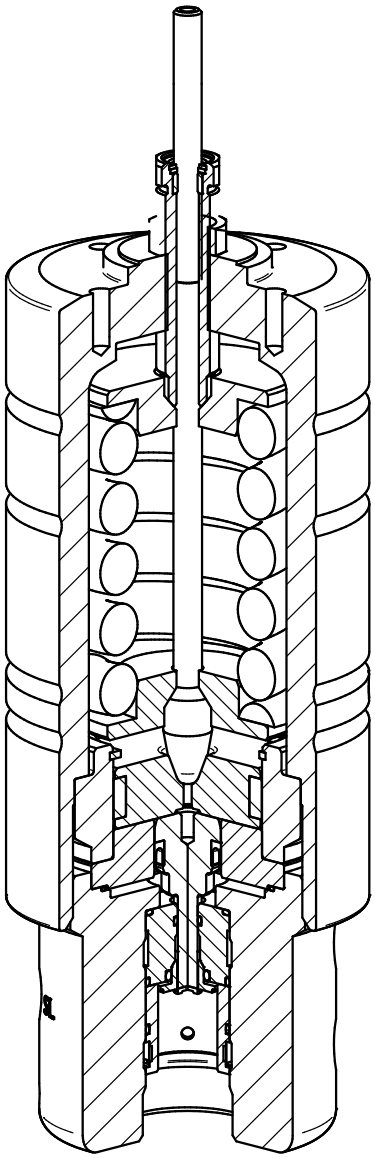


Tag	Qty	Nomenclature
1	1	Body
8	1	Piston
9	1	Guide
13	1	Detection housing
37	1	Guide ring
57	1	Circlips
65	1	O'ring

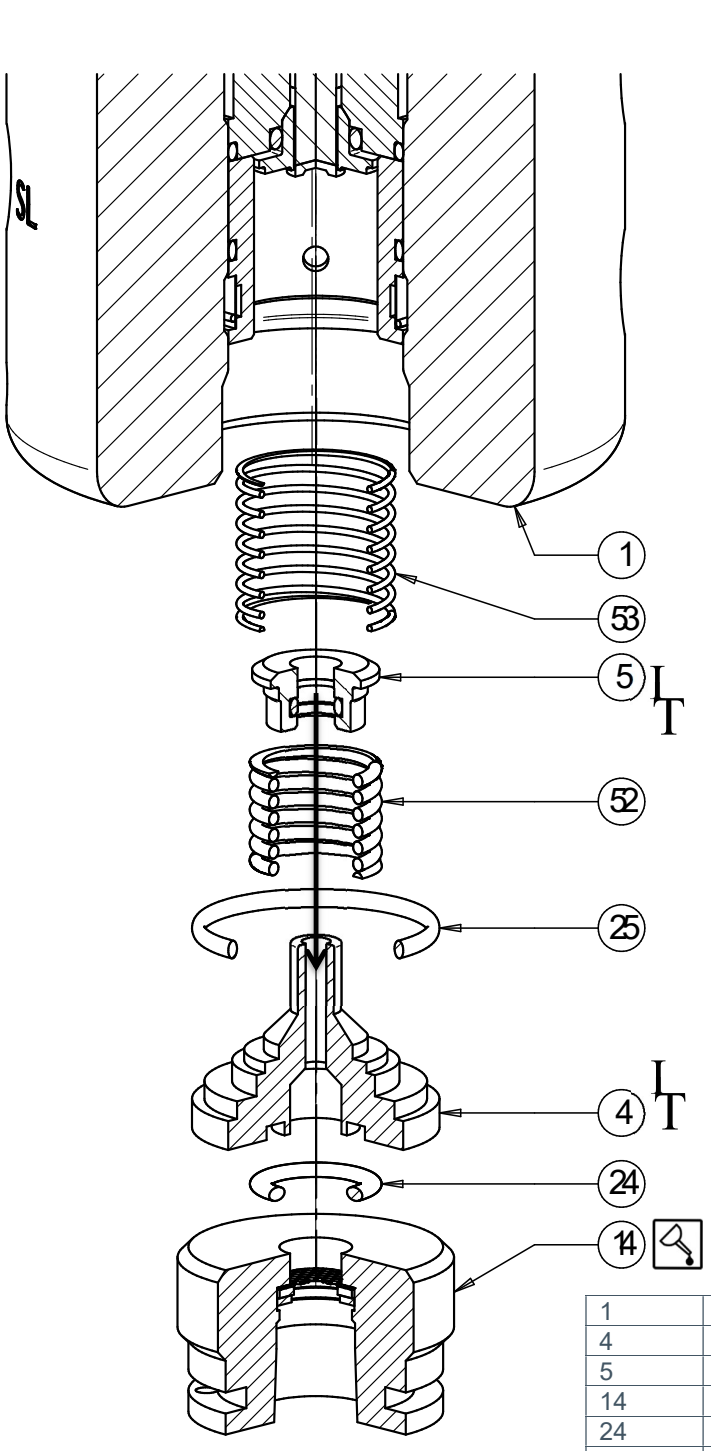
- Spring and bonnet assembly

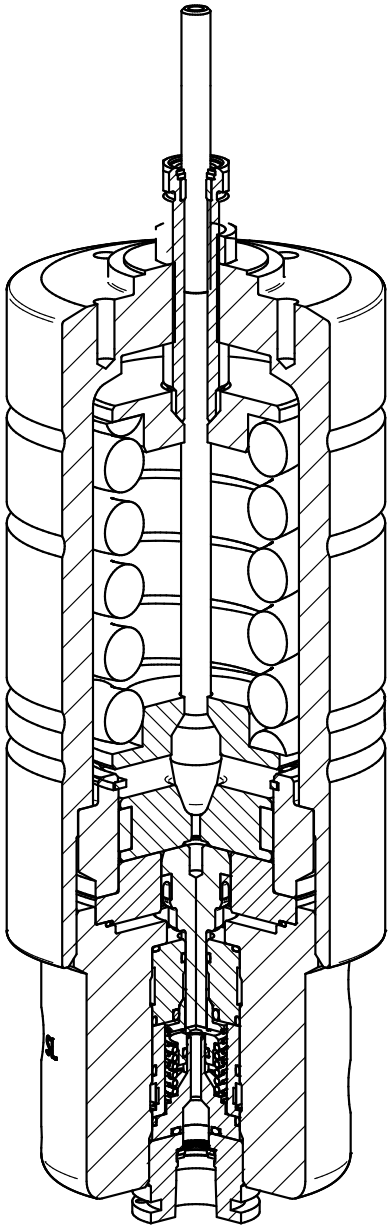


Tag	Qty	Nomenclature
1	1	Body
2	1	Bonnet
9	1	Guide
11	1	Spindle
15	1	Spring
16	2	Spring washer
17	1	Set screw
18	1	Locknut



- TRIM assembly





Tag	Qty	Nomenclature
1	1	Body
4	1	Exhaust nozzle
5	1	Disc
14	1	Drain plug
24	2	O'ring
25	4	O'ring
52	1	Spring
53	1	Spring

10 SET AND TESTING

10.1 GENERALTIES

- The test bench must be clean, without any particules.
- As the sensing volume is working fully static, the test bench can be on air or water.
- The valve must open at the set pressure with a tolerance of 1% only according the ASME BPVC Section I.
- The tightness test must be achieved at the operating pressure value only according the ASME BPVC Section I.

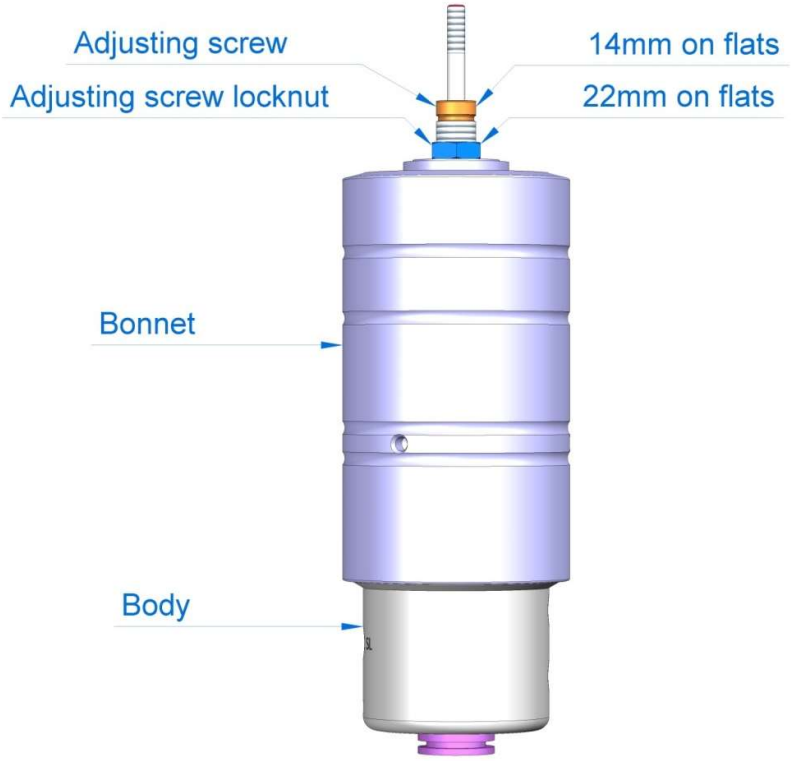
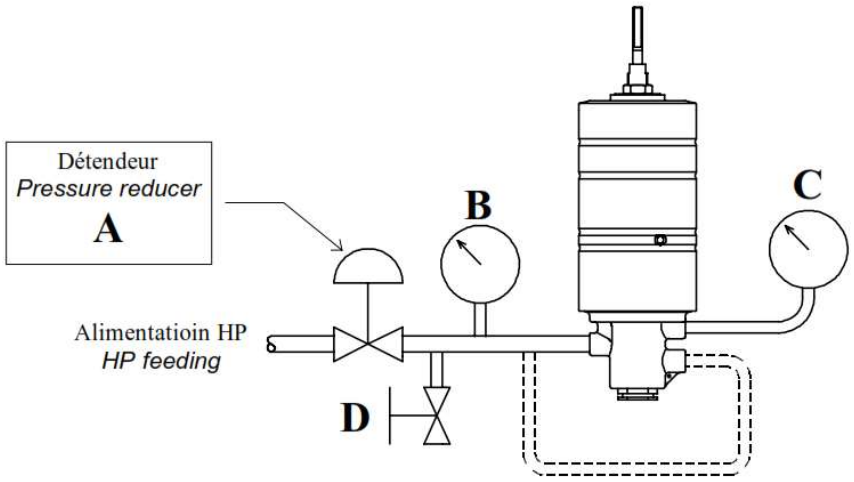


FIGURE 35 : DCS-E PILOT



A : Pressure regulator

B : Control gauge

C : Dome gauge

D : Vent valve

FIGURE 36 : PILOT TEST BENCH SKETCH

10.2 PILOT SETTING

Turning clockwise the adjusting screw (17) inscrease the set pressure.
Turning counterwise the adjusting screw (17) decreases the set pressure.
The blowdown is not adjustable. To amend it, it is required to change internals (contact the Trillium aftersales department)..

Note : All these operations must be done without any pressure in the pilot.

Definitions :
The set pressure is the pressure at which the pilot begin to fill out the main valve dome through its vent (as it is a "non flowing" pilot type, only this volume exhausts through the drain and then the flow stops). This action is shown by the decreasing of the pressure read on gauge C.
The closing pressure is the pressure at which the pilot fills in the MV dome.

1. Close D
2. Slowly increase the pressure until the pilot begins to drain the dome (set pressure)
3. With the valve D, slowly vent the tank until the pilot feeds the dome. When it occurs, the manometer B have a small quick fall (feeding of the volume). The closing of the pressure is measured just before this rapid fall.

   Before any adjustment, vent the pilot using D.

4. Adjust the set pressure (there is no temperature correction factor) and tight the locknut
   The actual set pressure must be within +/- 1% of the requested set pressure.
5. After the setting, carry out 3 complete cycles to verify the consistency of the operation.

10.3 PILOT LEAKAGE TEST

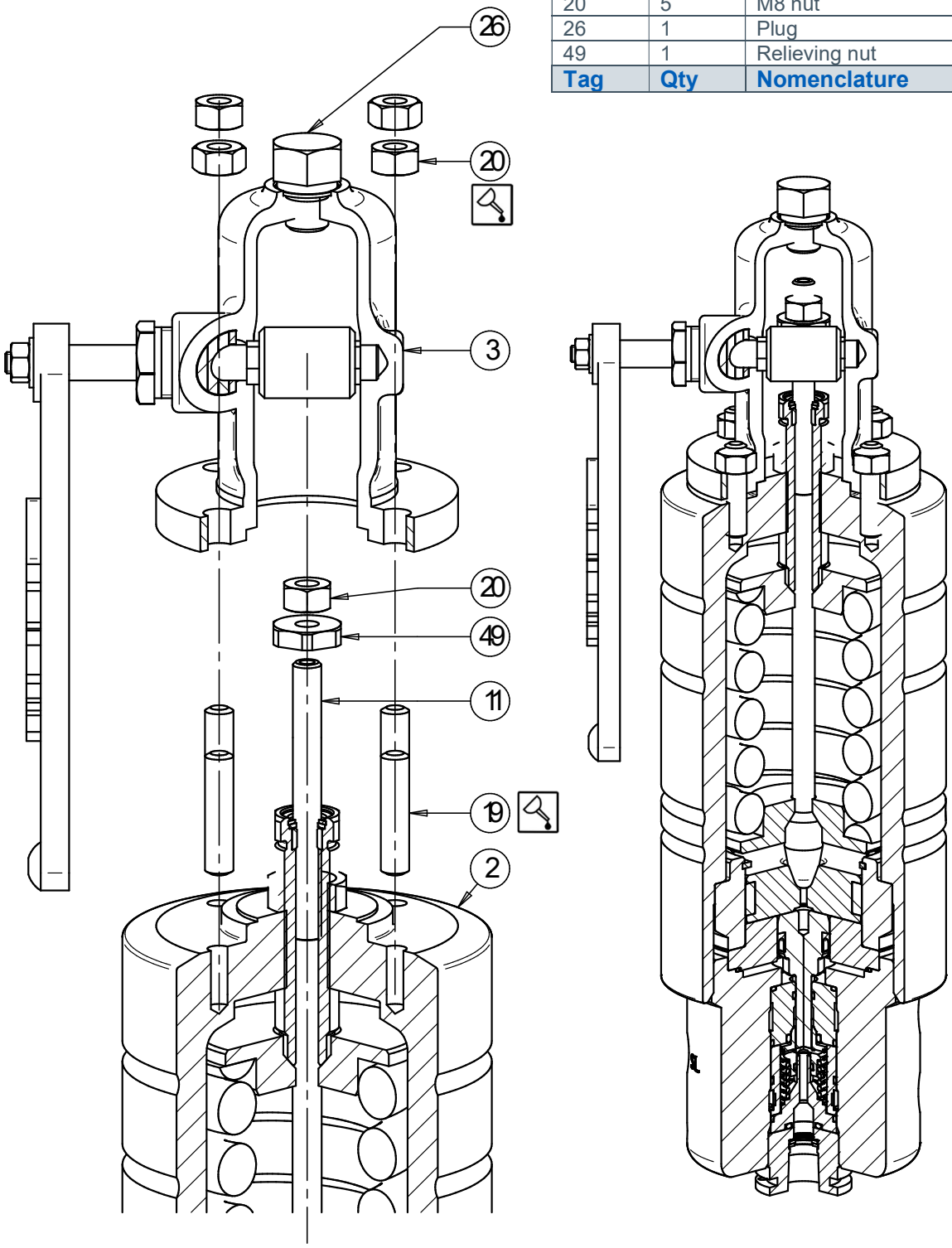
1. Measure the leak at the exhaust of the pilot with the chosen device at 95% of the set pressure.
   Test duration is 1 minute. Acceptance criteria is as follows :

Set pressure (barg)	Number of bubbles allowed
1 to 69	20
70 to 103	30
104 to 130	40
131 to 172	50
173 to 207	60
208 to 276	80
277 to 385	100
385 to 414	100

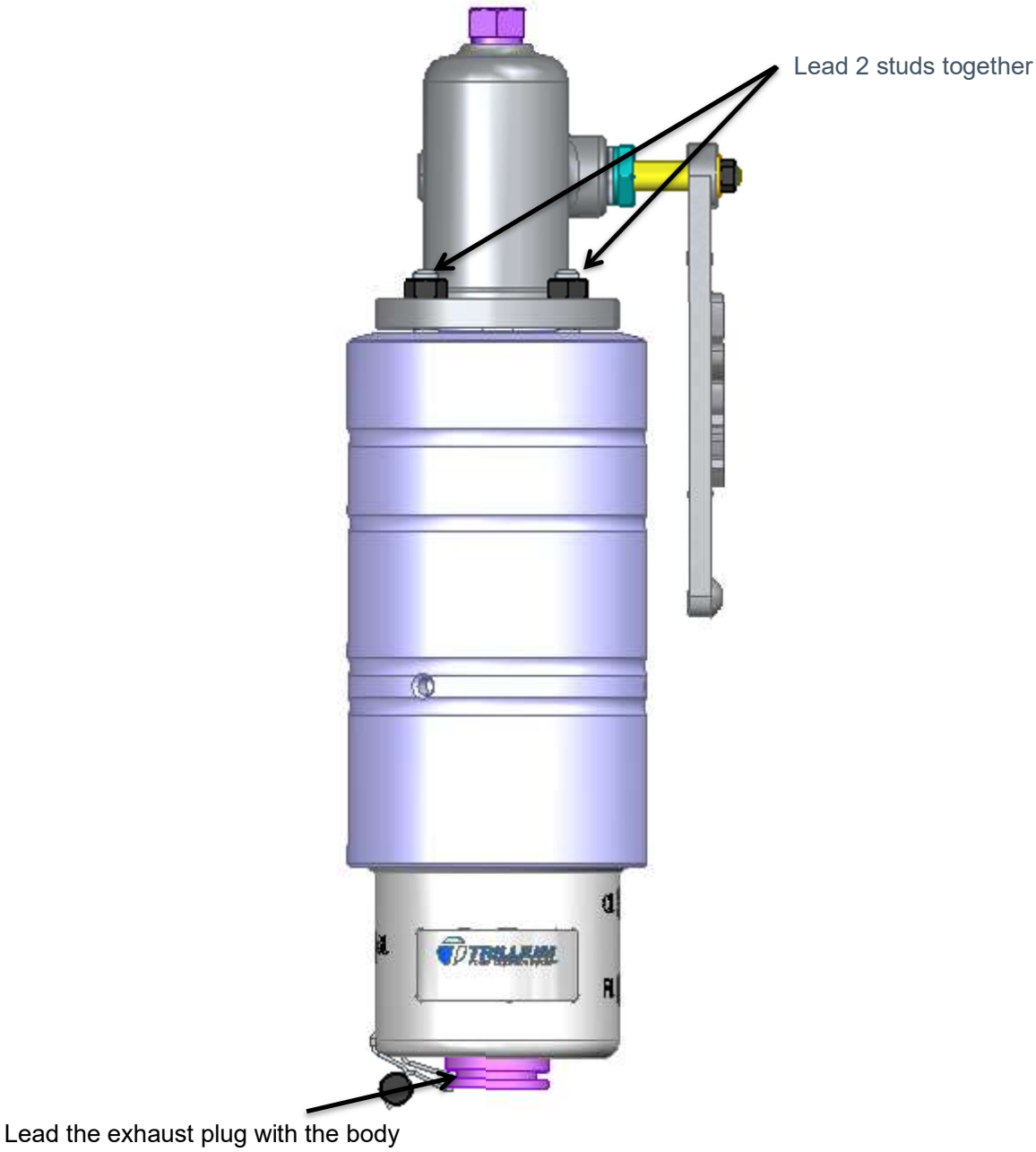
2. Check external leakage after internal leakage test. No leakage is acceptable.
3. Check the setting for the last time
4. A report shall be established displaying following informations :
   a. Pilot actual set pressure
   b. Pilot internal and external tightness
   c. Functionning verification
   d. Company doing the resetting
   e. Name of the operator
   f. Identification mark on the lead
5. Proceed with leading

10.4 FINAL ASSEMBLY

Tag	Qty	Nomenclature
2	1	Bonnet
3	1	Cap
11	1	Spindle
19	4	Stud
20	5	M8 nut
26	1	Plug
49	1	Relieving nut



- Pilot leading



11 MAINTENANCE TOOLS

- Lapping tools and LAMPLAN diamond paste (1.213, 3.213, 6.213)
- Lifting eyes
- Guide and disc-holder removal and assembly tool
- Pilot disc re-inserting spindle (included in pilot tool kit)
- Drain spindle support for manual lapping (included in pilot tool kit)
- Bench vise
- 13mm flat spanner
- 14mm flat spanner
- 22mm flat spanner
- 30mm flat spanner
- 104mm capacity lug spanner (lug of 6 to 8 mm diameter)
- Tool 1 : O-ring fitter (7,8 to 8 mm diameter).
- Tool 2 : Spindle of 6 to 9 mm diameter and approximately 150 mm length.

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.
	Pilot sensing entry not connected	Connect the pilot sensing entry to the valve entry or remote to the equipment.
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.	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.
	Upstream pressure drop too high.	Redesign the inlet piping to reduce the pressure drop to less than the ½ blowdown value
The valve chatters	The valve is oversized	Investigate what are the real process condition and check the sizing with Trillium.
	The upstream pressure drop is too high	Sensing the pressure remote instead of through the sensing ring.

13 SPARE PARTS

After prolonged and intensive use or in exceptional working conditions, a pressure relief valve will need to be serviced or overhauled.
Such work must be carried out by a skilled technician. The Trillium Group offers trainings and education programmes to cover all areas of maintenance and repair. Please consult your nearest Trillium 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

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 source or a Trillium 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 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:

Trillium Flow Technologies France
Rue Jean-Baptiste Grison – ZI du Bois Rigault
62880 Vendin-le-Vieil - France
Tel: +33 3 21 79 54 50
Fax: +33 3 21 28 62 00
Aftersales department: WVCFR.aftersalessarasinrsbd@trilliumflow.com
Service : aftermarket.sarasinrsbd@trilliumflow.com
Sales : sales.sarasinrsbd@trilliumflow.com