

## I 76 SERIES

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

Immediate danger which **WILL** cause serious personal injury or death.

### WARNING

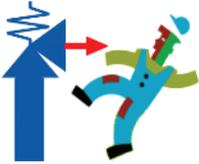
Risk or dangerous practice which **COULD** cause serious personal injury or death.

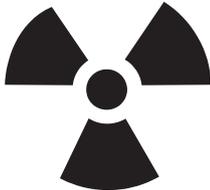
### CAUTION

Risk or dangerous practice which **COULD** cause minor injuries.

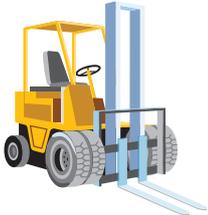
### ATTENTION

Risk or dangerous practice which **COULD** cause damage to equipment.

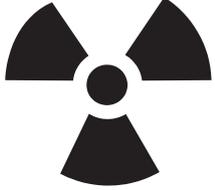
| DANGER   |
|--|
|                             |
| Never face the outlet of a valve when it is discharging as this may result in serious personal injury or death |

| WARNING  |
|--|
|     |
| Be aware of all site safety procedures to prevent the risk of serious injury or death. |

| CAUTION  |
|--|
|        |
| Protect yourself by wearing the necessary protective equipment to prevent possible injury. |

| ATTENTION   |
|---|
|  |
| Use the proper lifting equipment to avoid personal injury or damage to equipment.     |

## 1 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.

## 2 SAFETY PRECAUTION

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

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.

### 3 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™ 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.

## 4 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.

## 5 GENERAL ADVICE

### 5.1 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.

### 5.2 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

|   |  |   |  |                       |  |
|---|--|---|--|-----------------------|--|
| <b>EN ISO 4126-1</b><br> |  | <br>Rue Jean-Baptiste GIRARDON<br>62880 VENDIN LE VIEIL FRANCE |  | <b>MADE IN FRANCE</b> |  |
|   |  |   |  |                       |  |
| MODEL<br>MODEL  |  | ANNEE<br>YEAR   |  |                       |  |
| DIMENSION ORIFICE<br>SIZE AND ORIFICE   |  | N° SERIE<br>SERIAL N°   |  |                       |  |
| P. DEB. OUVERTURE<br>SET PRESSURE   |  | REPERE<br>TAG   |  |                       |  |
| CONTREPRESSION<br>BACK PRESSURE   |  | RESORT<br>SPRING  |  |                       |  |
| PRESSION REGLAGE<br>COLD DIFF. TEST PRES.   |  | MATIERE<br>MATERIAL   |  |                       |  |
| TEMP. DECHARGE<br>RELIEVING TEMP.   |  | LEVEE<br>LIFT   |  |                       |  |
| SECT. PASSAGE<br>FLOW AREA  |  | SUPPRESSION<br>OVERPRESSURE   |  |                       |  |
| DEBIT CERTIFIE<br>CERT. CAPACITY  |  | DEF. DEBIT CERT.<br>CERT. FLOW DEF.   |  |                       |  |
| T. min °C<br>T. MAX °C  |  |   |  |                       |  |

FIGURE 1

### 5.3 PILOT SPRING

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

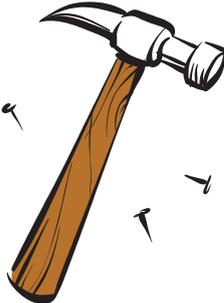
- Effective and accurate lift
- Quick closing (no damping effect when reseating)

The adjustment range of the spring must be within  $\pm 5\%$  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 Flow Technologies™ Sarasin-RSBD™ Aftersales Department.

Spring data should be obtained from Trillium Flow Technologies™ 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

|   |  |
|---|--|
| <b>ATTENTION</b>  | <b>ATTENTION</b>   |
|    |  |
| <p>Never lift the valve horizontally, or hook to the lifting lever or the spring. Always lift by using the lifting eyes or sling.</p> | <p>Make sure the valve is not dropped and does not receive strikes.</p>            |

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.

## 5.5 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.

## 6 76 SERIES BASICS

### 6.1 DESCRIPTION

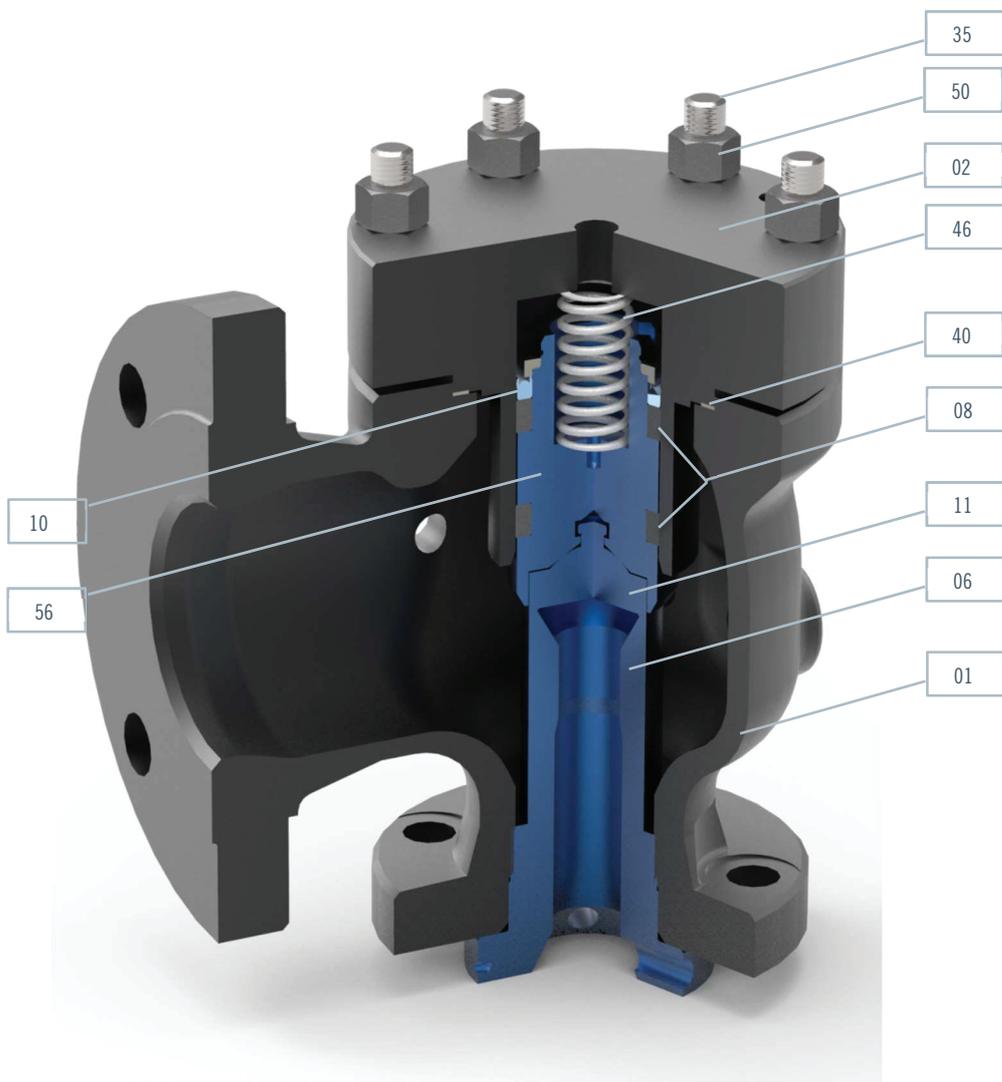
**Materials for standard applications, high temperature, low temperature and corrosivfluids.**

The 76 series is a versatile pressure relief valve. The design of 76 series particularly fit together extreme conditions as Cryogenic, Liquefied Natural Gas and Steam. This valve is particularly suitable when exchanging with an API spring loaded SRV as it will fit into its dimensions and avoid costly piping modification.

### 6.2 FEATURES AND NOMENCLATURES

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

- ASME B&PV Code section VIII div I design o 10% overpressure o Blowdown between 5% and 10% o Capacity certified gas, steam and/or water (National Board)
- 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 and one in the pilot set screw.
- Buffer tank for operating temperature above 260°C (500°F).
- Standard soft goods dimensions.
- Selection of soft goods according the temperature level and chemical compatibility.



| Part N° | Part Name              | SPARE PARTS |
|---------|------------------------|-------------|
| 01      | Body                   | E           |
| 02      | Sleeve Assembly        | D           |
| 06      | Nozzle                 | A           |
| 08      | Piston Ring            | A           |
| 10      | Piston Steel           | A           |
| 11      | Disc                   | A           |
| 35      | Stud                   | D           |
| 40      | Sleeve Assembly Gasket | A           |
| 46      | Return Spring          | D           |
| 50      | Nut                    | D           |
| 56      | Piston                 | D           |

Note : Spare parts chapter 11.

**FIGURE 2**

## 7 INSTALLATION

### 7.1 GENERAL

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

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.

### 7.2 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.

## 7.3 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 for steam applications

- 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  $R \geq 2.5 d$ .

## 7.4 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.

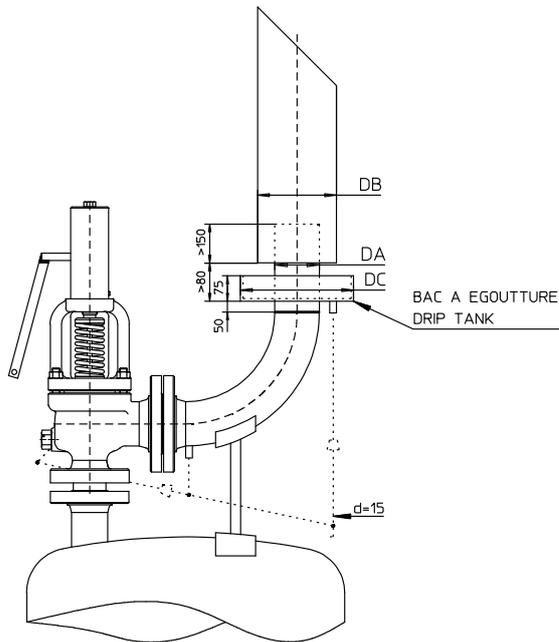
**Recommendations**

- 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.

**Recommendations for steam applications**

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 3 p14. 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 1/4" NPTF.

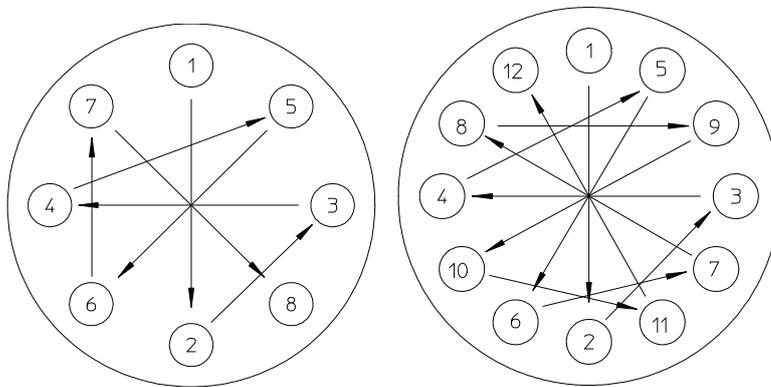


| DA (mm) | DB (mm) | DC (mm) |
|---------|---------|---------|
| 25      | 50      | 150     |
| 40      | 80      | 200     |
| 30      | 80      | 200     |
| 66      | 80      | 220     |
| 80      | 150     | 270     |
| 100     | 150     | 270     |
| 150     | 200     | 320     |
| 200     | 250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

**FIGURE 3**

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:



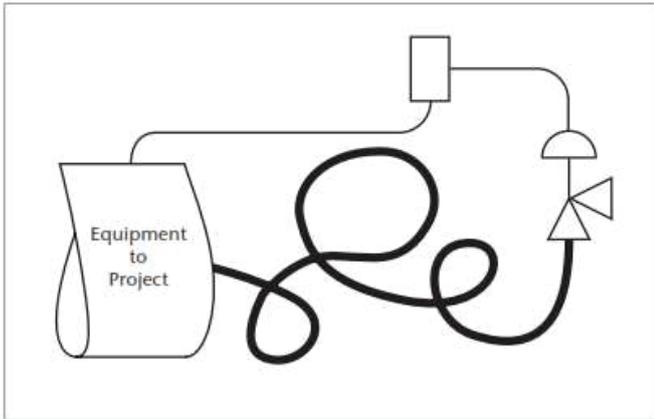
**FIGURE 4**

Continue to tighten alternatively until the required torque is reached. This should be done in 3 or 4 steps.  
(Nominal tighten torque table p.28)

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

## 7.5 OPTIONS

### 7.5.1 REMOTE SENSE



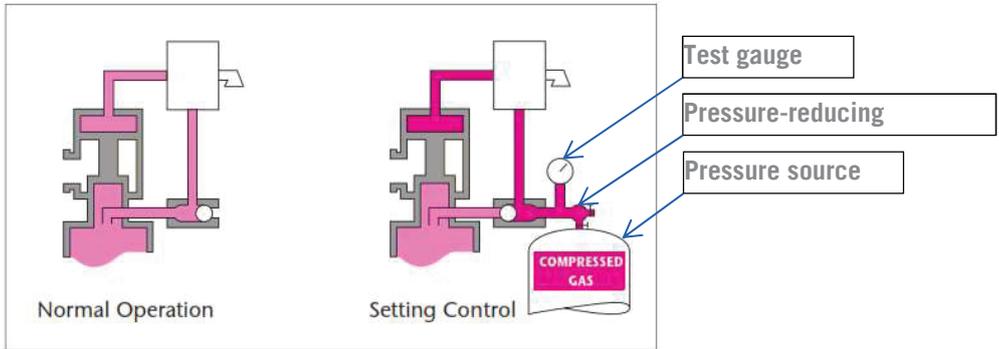
- Safety valve will respond to actual system pressure conditions.
- Eliminates undesirable cycling due to excessive inlet pressure losses.
- Improves safety, under adverse operating conditions.

This optional feature permits the pilot to sense system pressure at a location that most accurately reflects the actual operating pressure of the protected system.

A remote pressure sense connection eliminates the false system pressure indication that will occur during relieving conditions, due to pressure losses in the inlet piping to the safety valve. Most applicable codes recommend that the inlet piping system be designed for a maximum anticipated non-recoverable pressure loss of 3 percent. If this is not possible, the remote pressure sense connection should be specified.

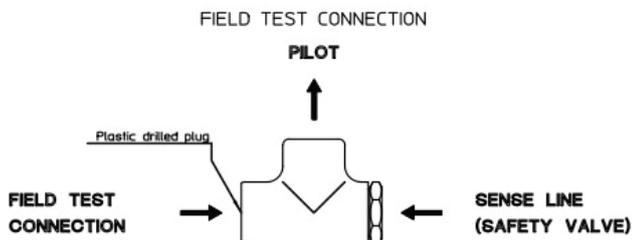
Please note that the addition of a remote pilot sense line allows the pilot to correctly sense system pressure and to keep the valve from rapid cycling or chattering. With remote sensing the piston type, pilot operated safety valves described in this catalogue will remain stable against the effects of high inlet pressure loss phenomena. However, relieving capacity will be proportionately reduced whenever there is inlet pressure loss to the safety valve.

7.5.2 FIELD TEST CONNECTION

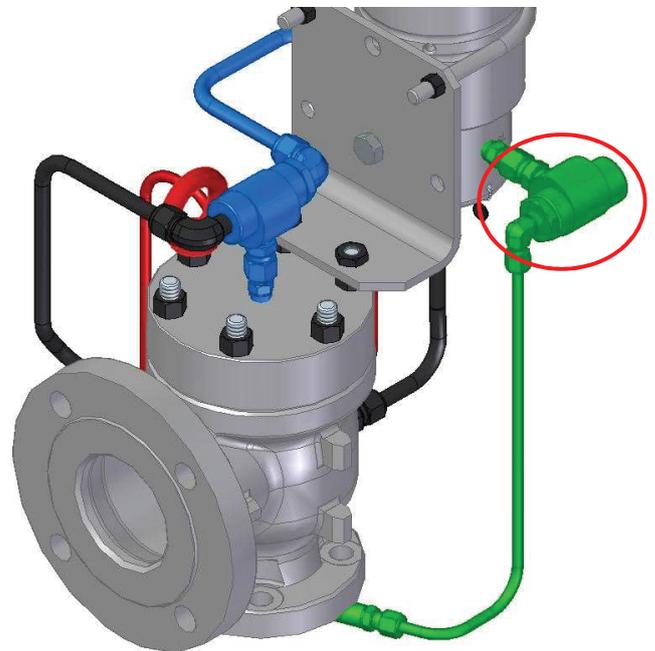


- In-service verification of set pressure.
- Simplifies the periodic testing of safety valves.

Trillium Flow Technologies™ pilot operated safety valves may be readily tested for verification of set pressure during normal system operation with this option. Field Test Connection is an option on most models. Its connection is 1/4" NPT. The customer furnishes a pressure source, plus a pressure-reducing valve and a test gauge for the portable field testing system. When test pressure is slowly admitted through a pressure-reducing valve (Sarasin-RSBD™ preconize to increase the pressure until several bar below the pressure under the disc of the main valve (operating pressure) and then increase the pressure with a gradient around 0.1bar/sec), the pilot and the main valve dome are pressurized, simulating an increased system pressure. When set pressure is reached (pop action pilots only), the pilot will actuate. This actuation pressure may then be compared with the nameplate value. Depending upon the current system pressure, and the characteristics of the specific pilot, the main valve may also briefly open and close, or partially open and close, providing verification that the main valve piston is free to move.



**! Pay attention to connect the field test connection correctly!**

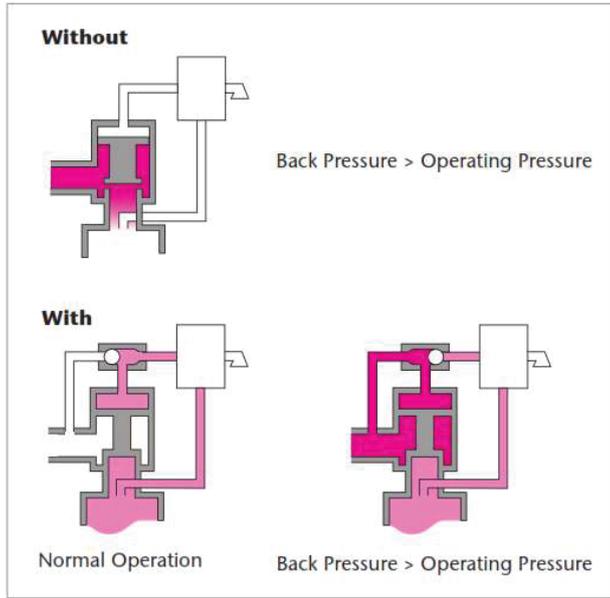


**• USE OF FIELD TEST INDICATOR:**

Trillium Flow Technologies™ pilot operated safety valves equipped with Field Test Connection may be fitted with a Field Test Indication as additional option. Its connection is also 1/4" NPT and it is fitted just before the Field Test Connection (between the Field Test Connection and the Test Gauge on the previous sketch). Trillium Flow Technologies™ pilot operated safety valves shall be pressurized at 90% of the set pressure in order to perform this test. Then, operator can proceed like describe in the previous paragraph and Field Test Indicator will move when the Set Pressure is reached in order to visualize the pilot swing

7.5.3 BACK FLOW PREVENTER

- Prevents accidental reverse flow through safety valve.

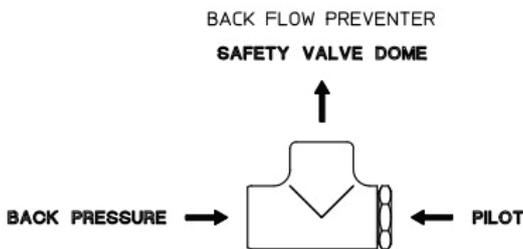


This option, sometimes called a ‘vacuum block,’ prevents a pilot operated safety valve from reverse flow, when sufficient vacuum is present at the inlet flange. The backflow preventer also prevents reverse flow when the pressure at the outlet flange (superimposed back pressure) is greater than the current system pressure. Reverse flow will occur with any standard type or design of pilot operated safety valve, when sufficient reverse differential pressure exists. Reverse flow, should it be induced by a reverse differential pressure, will be prevented by this option. All backflow preventers operate by permitting the introduction of outlet pressure into the dome of the main valve, thereby holding the piston firmly onto the nozzle, overcoming the effect of a reverse differential pressure across the safety valve. The option also includes a built-in provision to prevent reverse flow

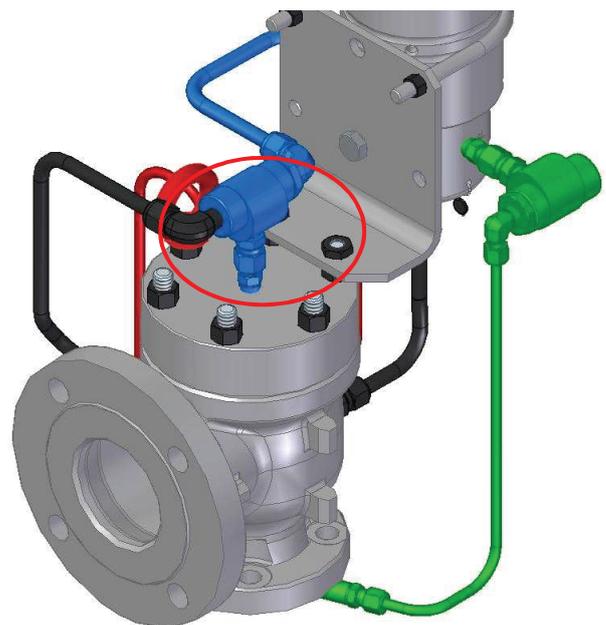
through the pilot that would otherwise pass through the pilot supply line, back into the system.

A Backflow Preventer should be specified whenever:

- A vacuum may be present at the inlet connection due to unusual operating conditions or a temporary vacuum condition that may occur under startup conditions.
- The discharge of the safety valve is connected to a downstream pressure vessel, where pressure may vary from time to time, in excess of the pressure in the upstream system.



**!Pay attention to connect the back flow preventer correctly!**



## 7.6 OUTDOOR INSTALLATION

A safety 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 valve is insulated from the inlet neck to the cover. Excessive variations in temperature may affect the set pressure or the body structure (thermal stress).

## 8 MAINTENANCE

| DANGER  | CAUTION   | CAUTION   |
|---|---|---|
|    |                              |                      |
| <p>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.</p> | <p>Any person who is working on the valve should be aware of any potential dangers such as retained heat)</p> | <p>Helmets and gloves must be worn to prevent any injuries while operating or working on the valve.</p> |

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.

### 8.1 DISASSEMBLY

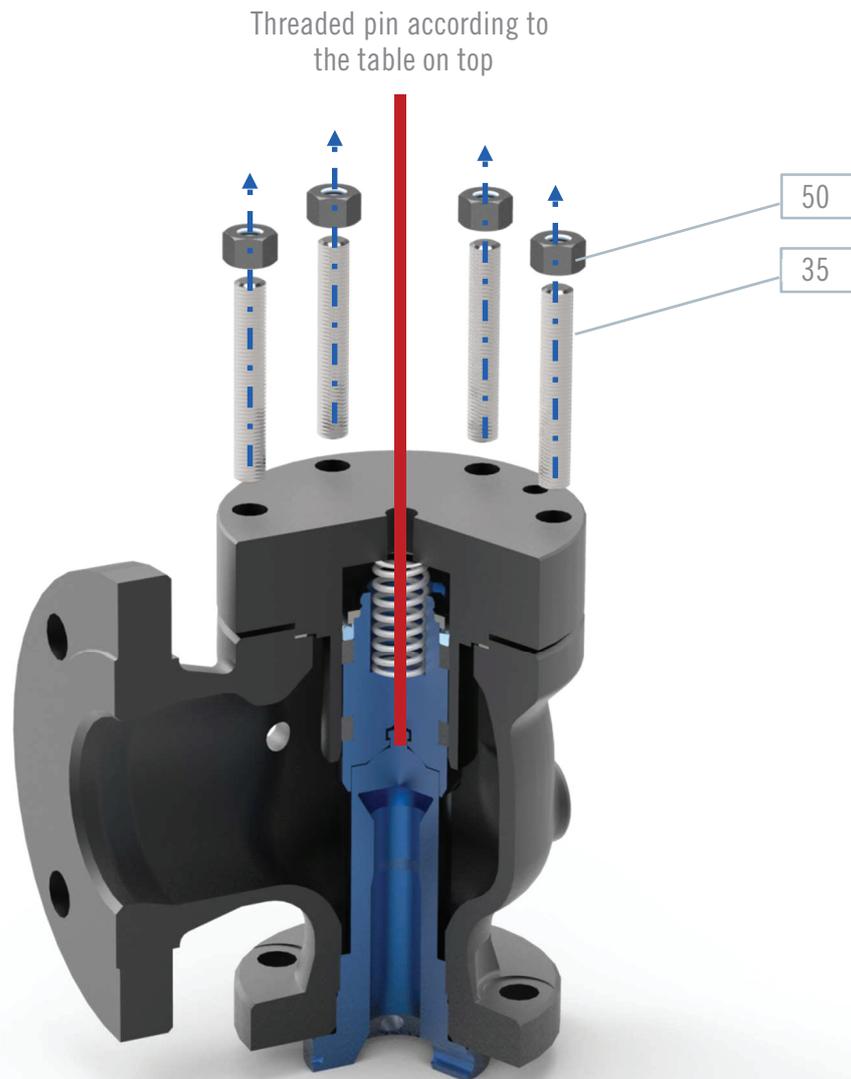
Separate pilot and water tank (if any), support and pipes. **TAKE CARE OF THE PIPES!**

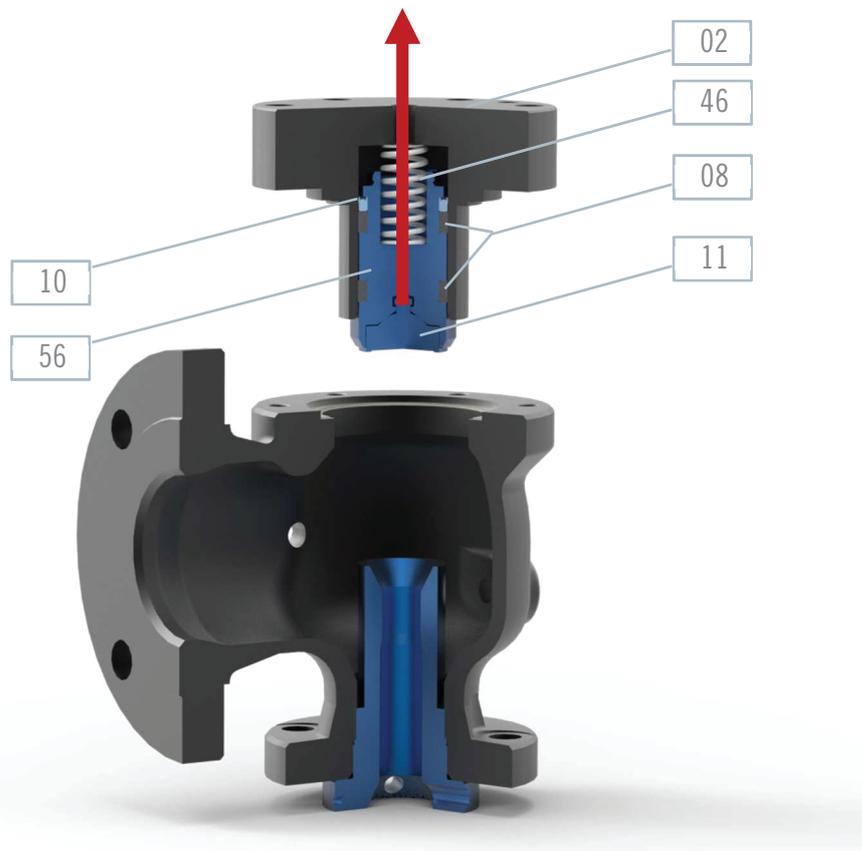
(For the disassembly, assembly of the pilot and the testing part, please refer to the following manuals:

- NT.056
- NT.062
- NT.065
- Screw a threaded pin in the piston (56), put a washer (Ø20) and a nut in contact with the fitting (A) to maintain the piston.

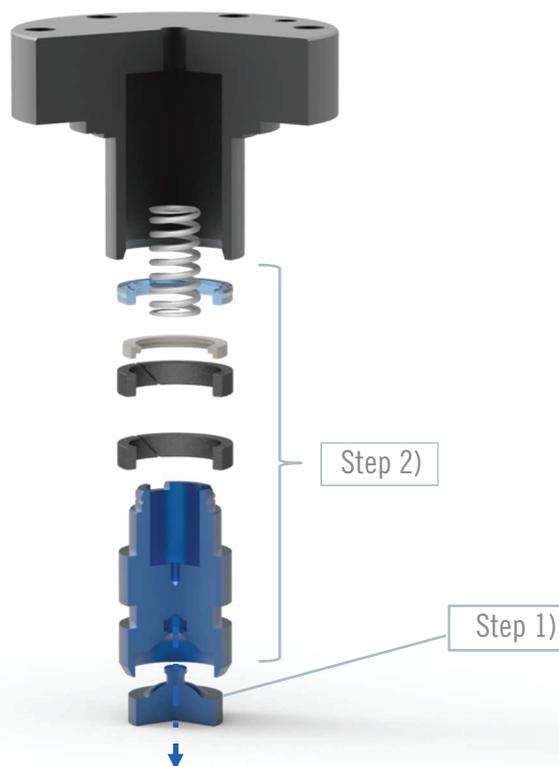
| Orifices                          | Thread |
|-----------------------------------|--------|
| D – E                             | M4     |
| F – G – H – J                     | M6     |
| K – L – M – N – P – Q – R – S – T | M8     |

- Unscrew nuts (50) and remove assembly sleeve assembly (02), piston (56), return spring (46), piston rings (08) Piston seal (10) and disc (11).

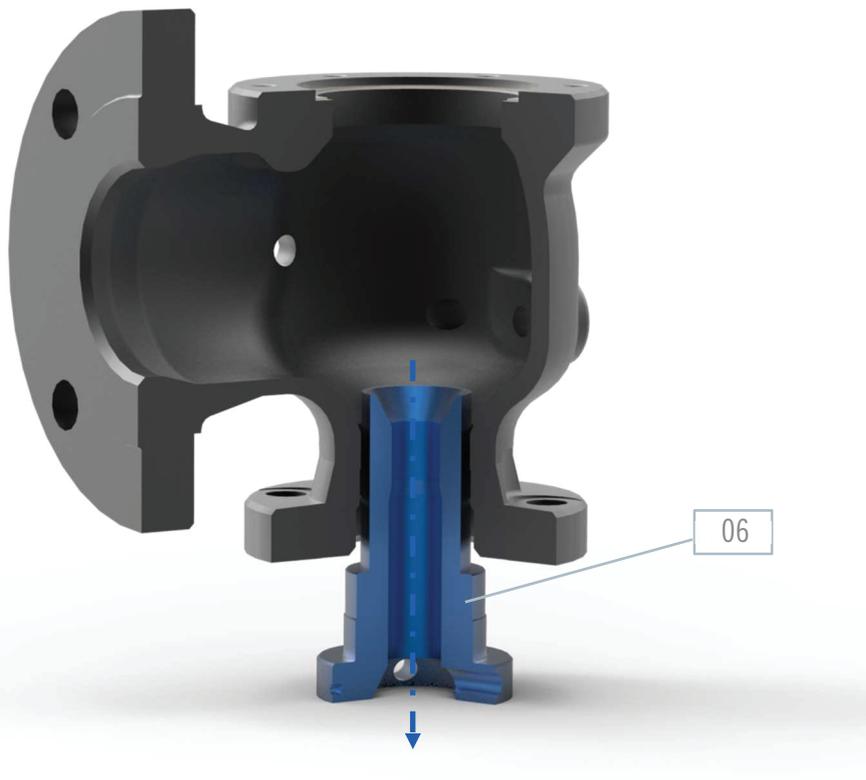




- Step 1) Maintain assembly (02), (56), (46), (08), (10) and (11) vertically and unscrew disc (11).
- Step 2) Then remove the piston (56).



- Remove nozzle (06) using a drift.



**8.2 MAIN VALVE PARTS INSPECTION & MAINTENANCE**

**8.2.1 GENERAL RECOMMENDATIONS**

We recommend to carefully 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.

**8.2.2 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.

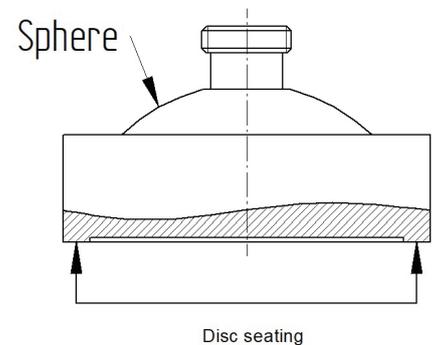
• Main valve boltings (1)

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.

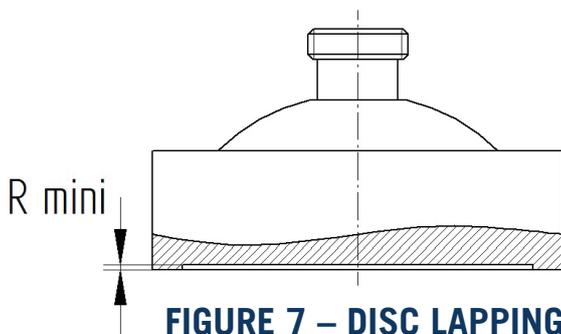
• Main valve disc (11)

o General

- Inspect the surface's sphere of the disc. If it is galled, scratched, corroded or pitted the disc shall be replaced.
- Inspect the disc seating surface (figure 6).  
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 6 - DISC**



**FIGURE 7 – DISC LAPPING**

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

**TABLE 1- MAX. LAPPING**

• Main valve nozzle (6)

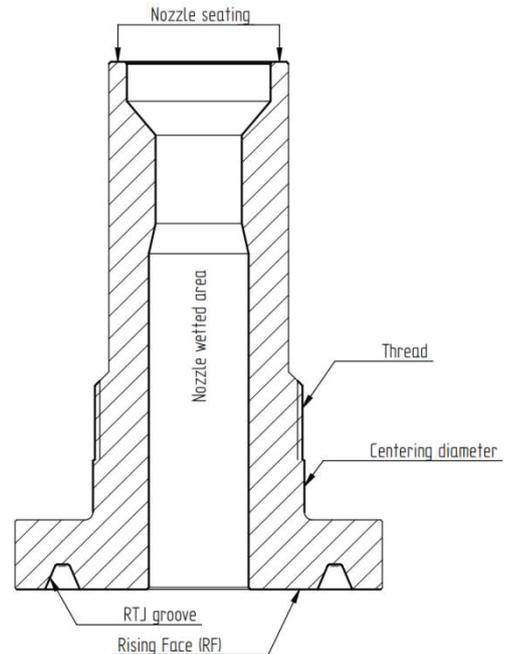
o General

- 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.

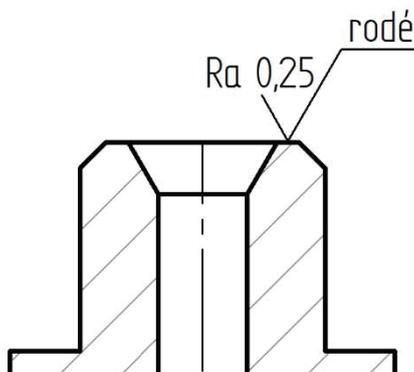
The nozzle seating surface inspection and rework are critical to ensure the tightness of the main valve after reassembly.



**FIGURE 8 - NOZZLE**

o 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).



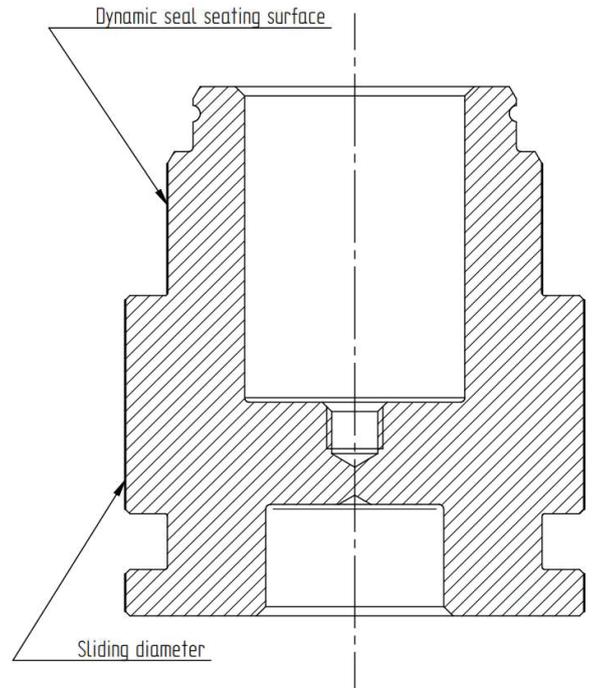
**NOZZLE LAPPING**

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

**TABLE 2 – MAX. LAPPING**

- Main valve piston (56)

Inspect the external diameter of the piston part. It shall not have any scratches or be galled. If this diameter is damaged, carefully 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 seating surfaces according to ISO 2632 (or equivalent) test specimen. If the surface is scratched, pitted or corroded, the piston shall be changed.

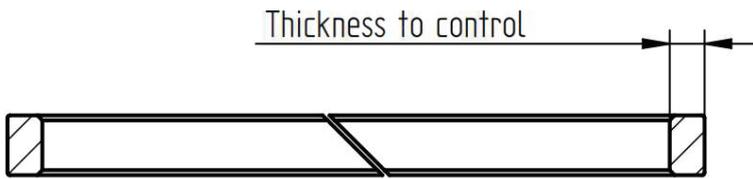


**FIGURE 9 - PISTON**

- Main valve sliding rings (8)

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 10). If any sliding ring thickness falls below the tolerancy given in table below, the sliding ring pair shall be replaced.



**FIGURE 10 – SLIDING RING**



**FIGURE 11 – SLIDING RING**

| Sliding ring thickness (mm) | D-E           | F-G-H-J       | J-K-L         | M-N-P-Q-R-S-T |
|-----------------------------|---------------|---------------|---------------|---------------|
| olerancy (mm)               | -0.02 / -0.08 | -0.02 / -0.08 | -0.02 / -0.08 | -0.02 / -0.1  |
| Piston                      | 4             | 5             | 7             | 7             |

**TABLE 2 – 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.

### 8.3 MAIN VALVE RE-ASSEMBLY

#### 8.3.1 PROCEDURE

- 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       | Tightening Torque (daN.m) |
|---------------|---------------------------|
| D – E         | 10                        |
| F – G         | 12                        |
| H             | 15                        |
| J – K         | 25                        |
| L – M – N – P | 45                        |
| Q             | 48                        |
| R – S – T     | 45                        |

**TABLE 3 – NOZZLE ASSEMBLY TORQUES**

- Sliding ring (8)
  - If you replace the sliding rings (8), you may need to make the 45° angle cuts. Trillium Flow Technologies™ 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 12 – SLIDING RING CUTTING**



**FIGURE 13 – SLIDING RING**

- Disc (11)
  - > Slightly grease (high temperature grease) the disc hinge surface (sphere).
  - > Screw the disc (11) in the piston (56).
- Assemble the 2 sliding rings (2 segments per ring) (61) to the disc-holder (56) and insert the piston (56) in the sleeve assemble (9).
- Grease one sleeve assembly gasket (40). Place it on the body (1)

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

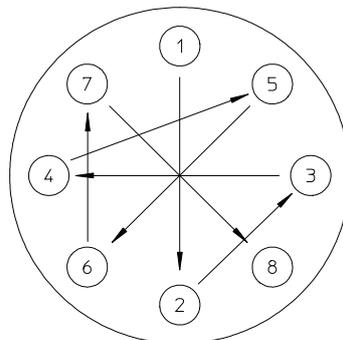
- Use the threaded hole on top of the disc-holder to lift the assembly and insert it onto the body.  
Release lifting force progressively until the disc come in contact with the nozzle. Ensure you correctly position the guide hole on the outlet flange side.



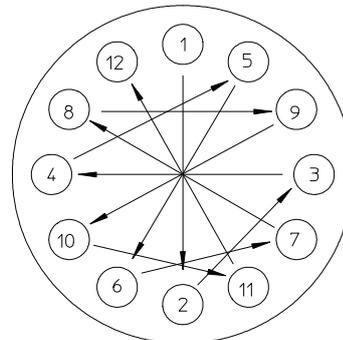
**FIGURE 14 – PISTON ASSEMBLY**

**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 (56), by fitting on it the two sliding rings (8), the piston seal (10) and the return spring (46). Take care not to damage the spring seal during assembly.
- Insert the piston assembly on the sleeve assembly. 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 (56) inside the sleeve assembly (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 (See figures below)



**FIGURE 15**



**FIGURE 16**

Continue to tighten alternatively until the required torque is reached (in 3 or 4 steps).

| Nominal diameter<br>(mm) | Core section<br>(mm <sup>2</sup> ) | 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            |

**NOMINAL TIGHTENING TORQUE**

**9 MAINTENANCE TOOLS**

- Lapping tools and LAMPLAN diamond paste (1.213, 3.213, 6.213)
- Lifting eyes
- Piston removal and assembly tool
- Pilot disc re-inserting spindle (included in pilot tool kit for DCS)
- Drain spindle support for manual lapping (included in pilot tool kit for DCS)
- Spindle of 6 to 9 mm diameter and approximately 150 mm length.

## 10 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 Flow Technologies™.                             |
|                                  | The upstream pressure drop is too high  | Sensing the pressure remote instead of through the sensing ring.   |

## 11 SPARE 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 |

Parts classification can be found in section 6.2.

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.

## 12 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.

## 14 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:

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