TRILLIUM
FLOW TECHNOLOGIES™

74LP SERIES

Installation, Operation,
Maintenance Manual

1 CONTENT

SAFETY SIGNS AND LABELS

Signs or labels are included throughout this document.

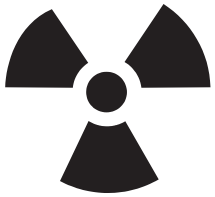
These signs or labels communicate the following messages:

- 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

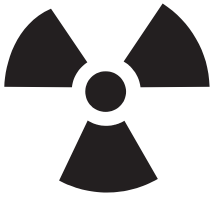
The format is characterised by vertical panels. The panels include a signal word shown below which advises the level of hazard seriousness

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

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

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

2 SAFETY INSTRUCTIONS

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

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

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

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

3 SAFETY PRECAUTION

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

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

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

4 WARRANTY INFORMATION

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

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

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

5 TERMINOLOGY

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

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

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

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

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

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

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

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

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

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

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

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

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

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

6 GENERAL ADVICE

6.1 RESPONSIBILITIES

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

6.2 IDENTIFICATION PLATE

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

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

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

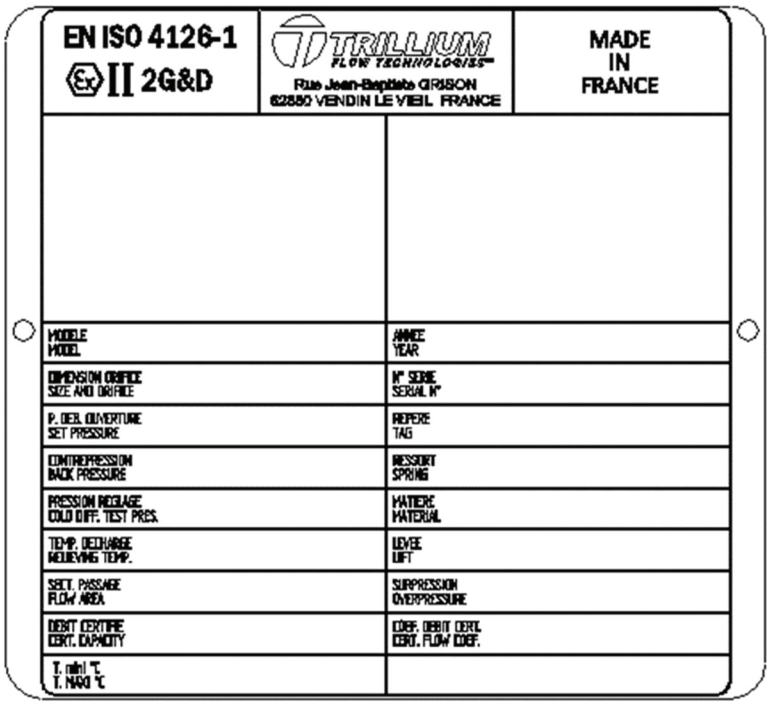


FIGURE 1

6.3 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:

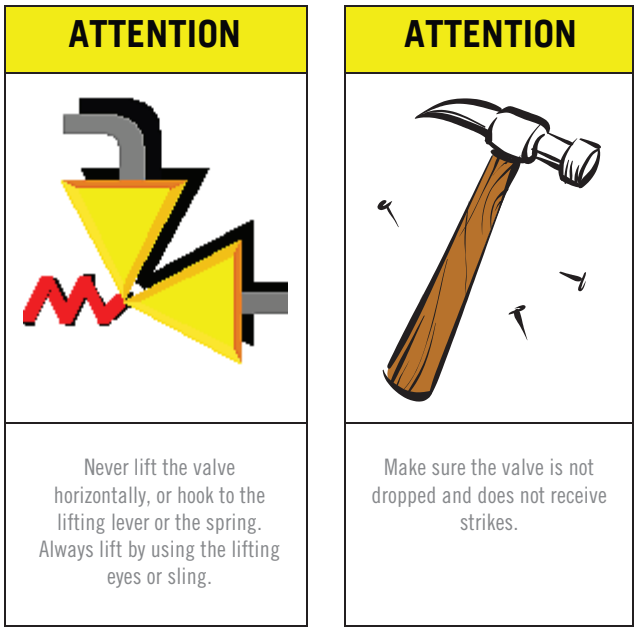
- Effective and accurate lift
- Quick closing (no damping effect when reseating)

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 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



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 a voided.

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.

7 74LP SERIES BASICS

7.1 DESCRIPTION

Pilot operated pressure relief valves dedicated to LNG and FLNG installations but can also be used in any moderated temperature application.

The nozzle has been designed to have the best flow coefficient possible.

7.2 FEATURES AND NOMENCLATURES

Body design in accordance with ASME B16.34

- ASME B&PV Code section VIII div I design
  - o 10% overpressure
  - o Blowdown between 5% and 10%
  - o Capacity certified gas (National Board)
- Semi nozzle design
- Body inlet connection : Flanged
- Pressure rating : from class 150 to class 300
- Operating temperature: -196°C TO 260°C.
- Standard soft goods dimensions.
- Selection of soft goods according the temperature level and chemical compatibility.

8 INSTALLATION

8.1 GENERAL

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

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

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

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

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

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.

8.3 OUTLET PIPING

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

Recommendations

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

8.4 INSTALLATION ON THE PROTECTED EQUIPMENT

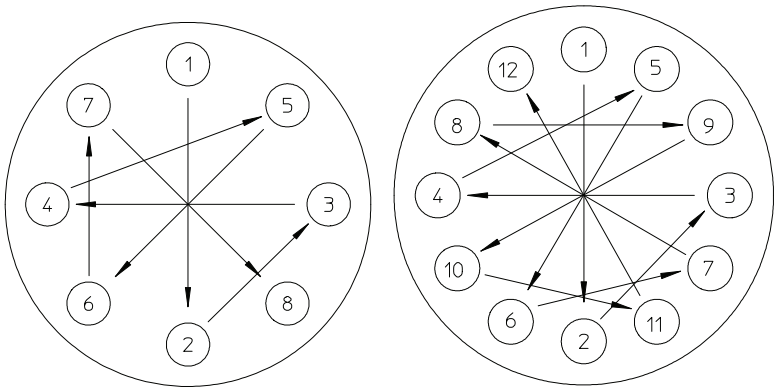
The equipment nozzle on which the safety valve is to be connected must be designed to give direct flow. There must be no obstruction between the equipment and the safety valve.
The pressure relief valve must be mounted on the upper part of the equipment which it is to protect.

Recommendations

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

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

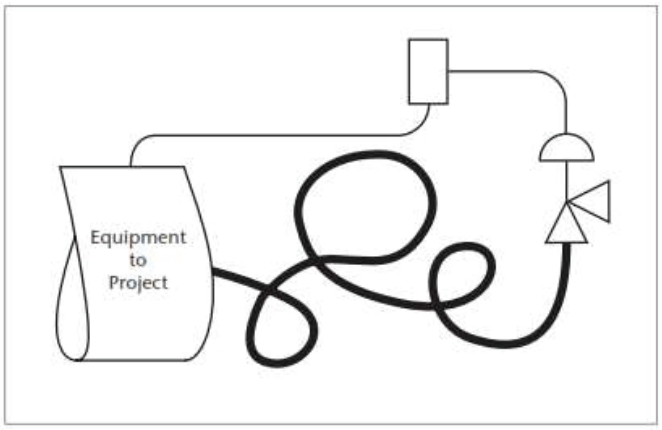
1. A check should be made that the gasket is centered on the flange
2. Tighten to 30% of the nominal torque according to the following figures:



Continue to tighten alternatively until the required torque is reached.
This should be done in 3 or 4 steps. (Nominal tighten torque p.25)
NOTE: Due to the relaxation of the gasket, it should be checked it 24 to 48 hours after the first installation.

8.5 OPTIONS

REMOTE SENSE



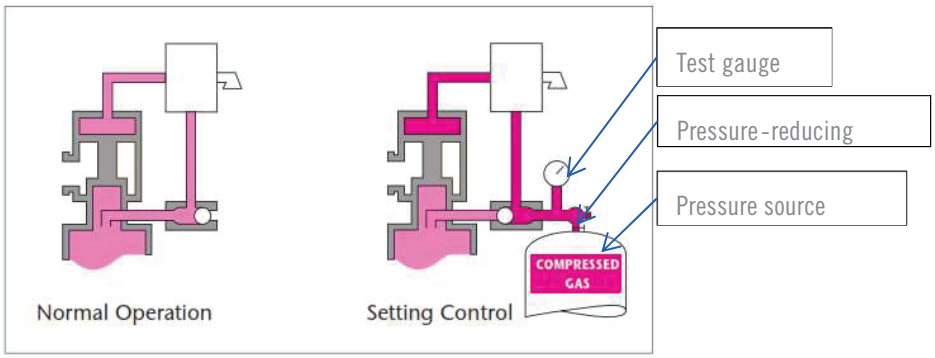
- Safety valve will respond to actual system pressure conditions.
- Eliminates undesirable cycling due to excessive inlet pressure losses.
- Improves safety, under adverse operating conditions.

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.

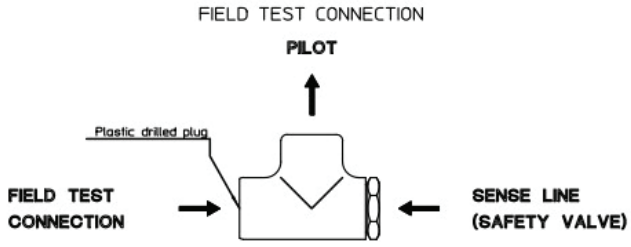
Please note that the addition of a remote pilot sense line allows the pilot to correctly sense system pressure and to keep the valve from rapid cycling or chattering. With remote sensing the piston type, pilot operated safety valves described in this catalogue will remain stable against the effects of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

- **Field test connection**



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

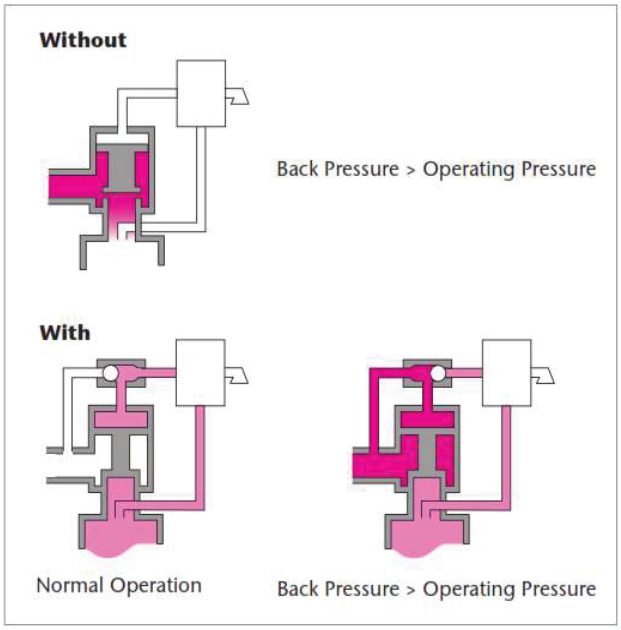
Trillium Flow Technologies™ pilot operated safety valves may be readily tested for verification of set pressure during normal system operation with this option. Its connection is 1/4" NPT. The customer furnishes a pressure source, plus a pressure-reducing valve and a test gauge for the portable field testing system.
When test pressure is slowly admitted through a pressure-reducing valve Sarasin-RSBD™ recommends to increase the pressure up to 80-90% of set pressure and then increase the pressure with a gradient around 0.1 Set pressure/sec, the pilot and the main valve dome are pressurized, simulating an increased system pressure. When set pressure is reached, 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!

- **Back flow preventer**

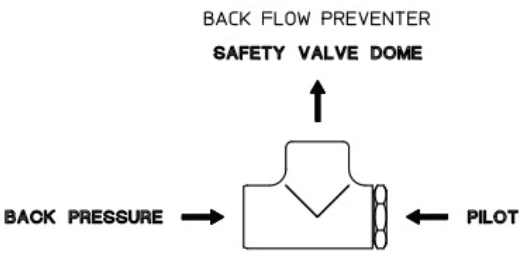
- Prevents accidental reverse flow through safety valve.



This option 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!

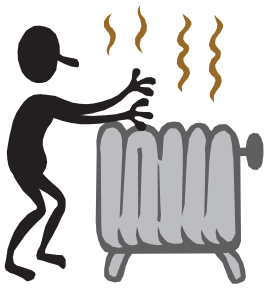
8.6 OUTDOOR INSTALLATION

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).

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 valve. Regarding the pilot, a tool kit is recommended to ease the lapping and the re-assembly of disc in the pilot body. Maintenance may be performed without taking the valve off line. Please contact Trillium Flow Technologies™ SarasinRSBD™ aftersales team in the event of any uncertainty.

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

9.1 DISASSEMBLY

- First, ensure pressure in bled off in the main valve!!!(Outlet & inlet)
  - Unscrew Plug (Rep34)

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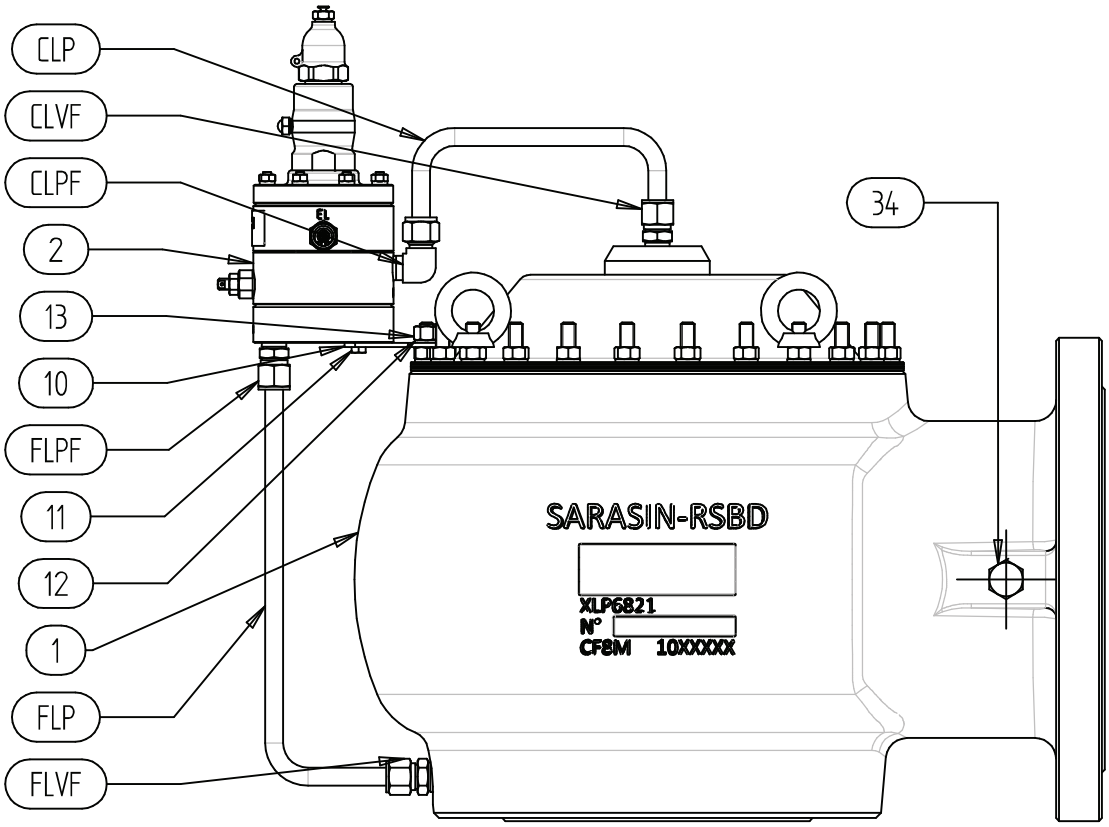
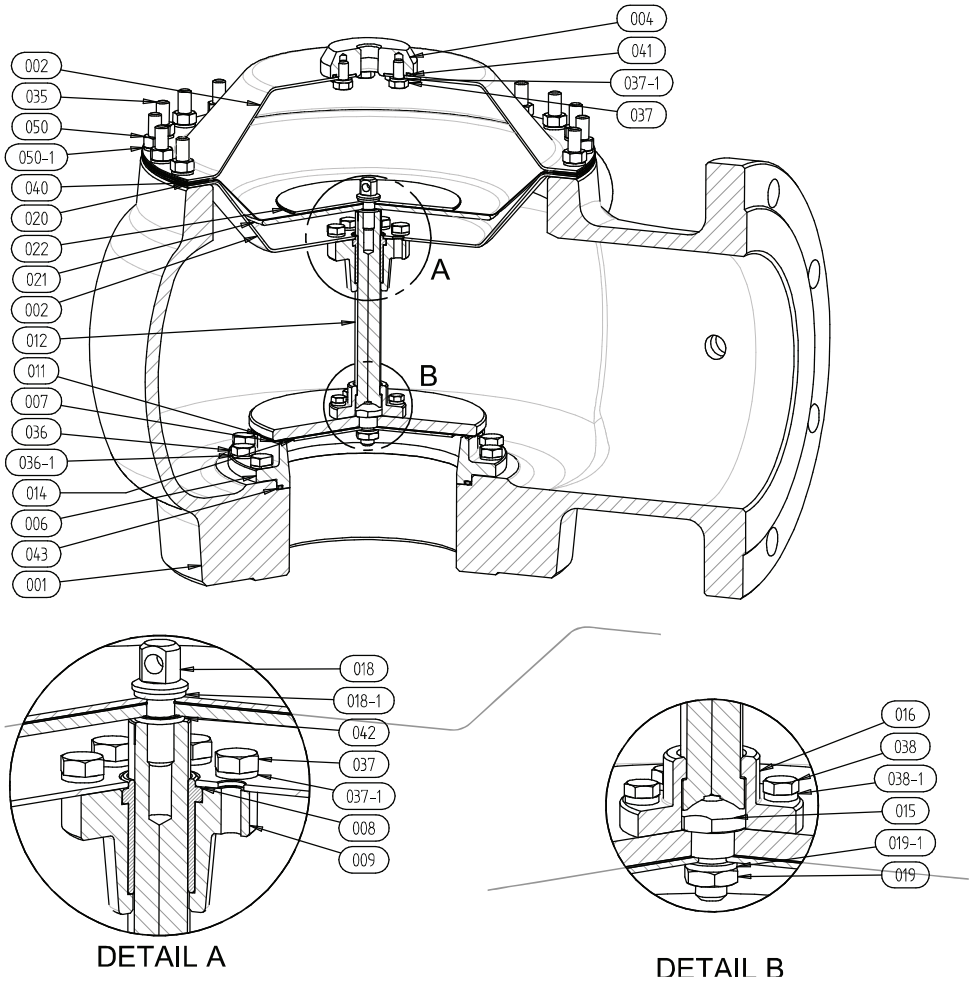
- PILOT /MAIN VALVE DISSASEMBLY
  - Unscrew fitting CLVF and FLPF.
  - Unscrew Nuts (013) and remove Nord-lock® washers (012).
  - Separate pilot, support and tubing. **TAKE CARE OF THE TUBING!**



10	1	PILOT HOLDER
11	2	PILOT SCREW
CLVF,FLPF	2	CONTROL LINE VALVE FITTING,FEEDING LINE PILOT FITTING
FLVF	1	FEEDING LINE VALVE FITTING
12	2	LOCK WASHER
13	2	NUT
34	2	PLUG
FLP	1	FEEDING LINE PIPE
CLPF	1	CONTROL LINE PILOT FITTING
CLP	1	CONTROL LINE PIPE
2	1	PILOT TYPE DGBP
1	1	MAIN VALVE TYPE 74LP
ID Nomenclature	Qté	ID Référence

FIGURE 1-PILOT/MAIN VALVE GENERAL VIEW

- **MAIN VALVE DISASSEMBLY**



050	x	COVER NUT
043	1	SEAT GASKET
042	1	STEM GASKET
041	1	CAP GASKET
040	2	DIAPHRAGM GASKET
038-1	x	LOCK WASHER
038	x	DISC SCREW
037-1	x	LOCK WASHER
037	x	CAP SCREW
036	x	SEAT SCREW
035	x	COVER STUD
021	1	DIAPHRAGM SUPPORT
020	1	DIAPHRAGM
019	1	NUT
018-1,019-1,036-1,050-1	x	LOCK WASHER
018	1	SCREW
016	1	DISC FLANGE
015	1	SPHERICAL SCREW
014,022	2	DIAPHRAGM WASHER,DISC WASHER
012	1	STEM
011	1	DISC
009	1	GUIDE
008	1	GUIDE SLEEVE
007	1	PRIMARY SEAL
006	1	SEAT
004	1	CAP
002	2	LOWER COVER,UPPER COVER
001	1	BODY
ID Nomenclature	Qté	ID Référence

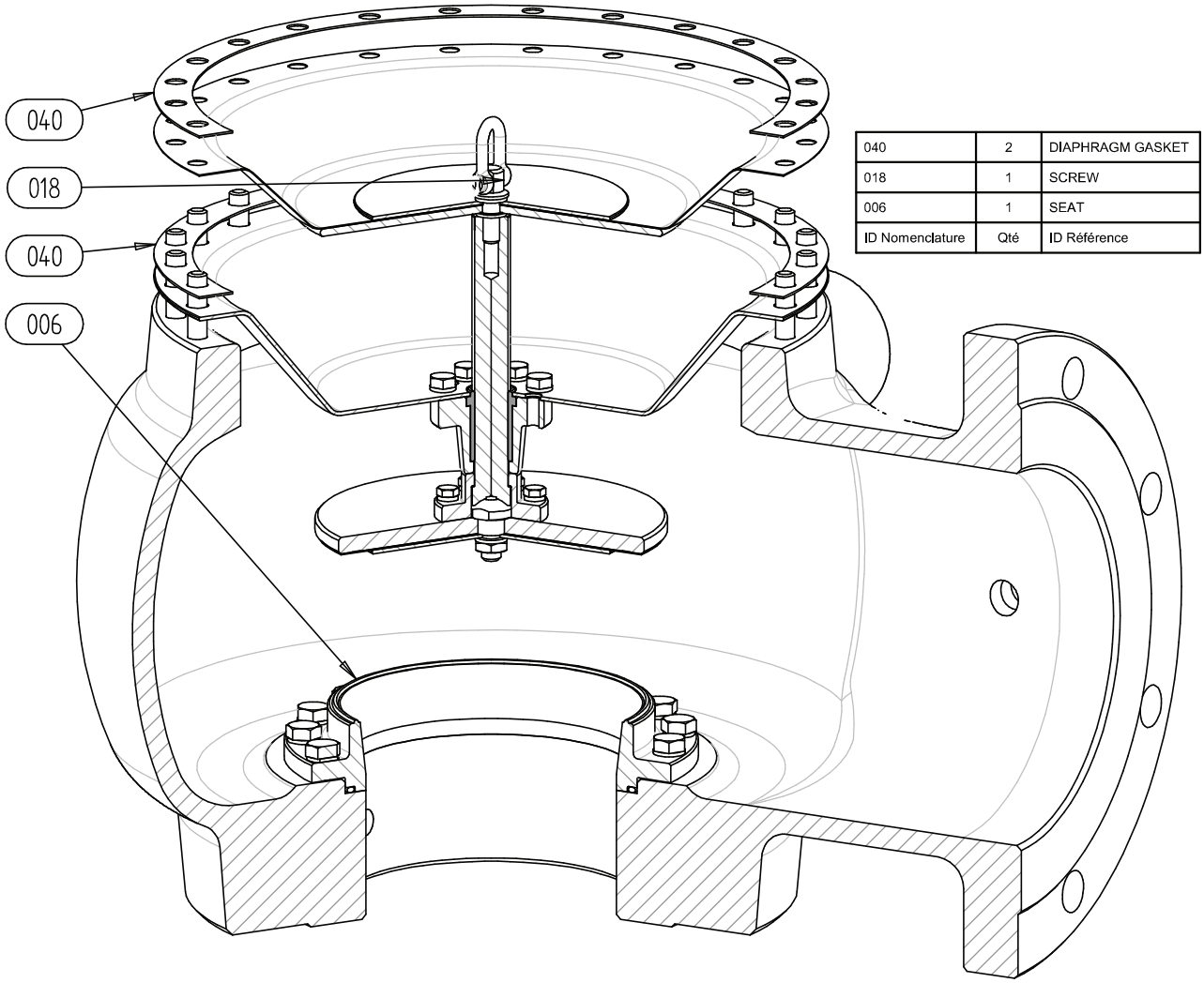
FIGURE 2-MAIN VALVE GENERAL VIEW

- **Disassembly cover (002)**

  - Unscrew lifting lugs.
  - Unscrew nuts (050) and remove lock washers (050-1)
  - Take the upper cover off (002)

- **Disassembly trim/Main Valve**

  - Remove the diaphragm gasket (040)
  - Put a lifting lug through the screw (018) and lift all the trim (Only seat (006) remains in place).

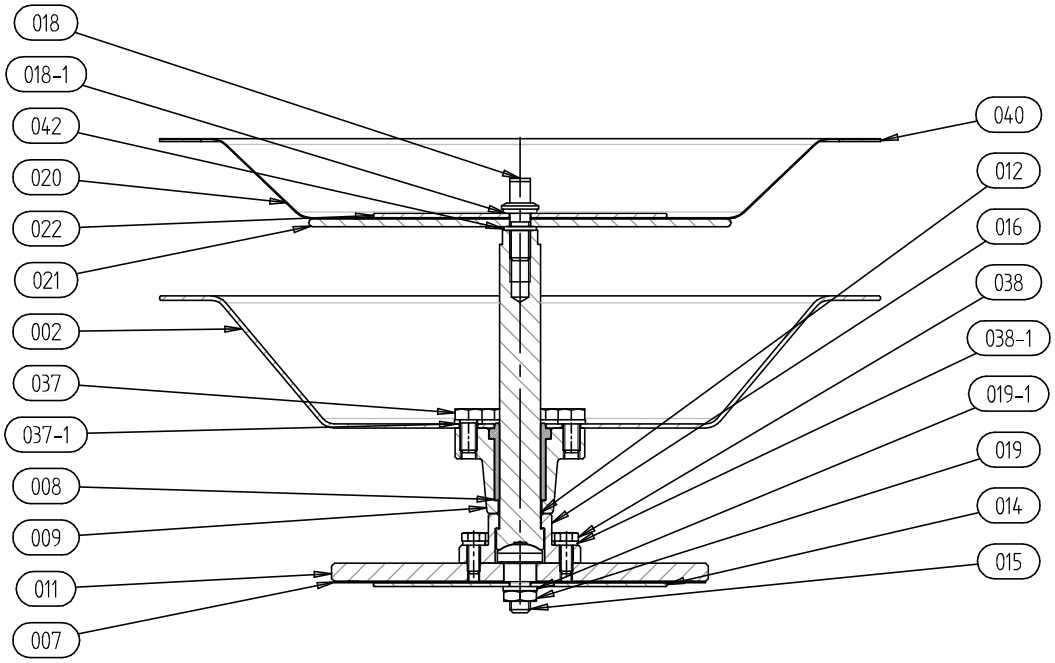


040	2	DIAPHRAGM GASKET
018	1	SCREW
006	1	SEAT
ID Nomenclature	Qté	ID Référence

FIGURE 3 – DISASEMBLY TRIM/MAIN VALVE

- **Disassembly trim**

  - To remove the diaphragm (020), unscrew the screw (018) from spindle (012).
  - To remove the guide sleeve (008), unscrew the screws (037) and remove it of the guide (009).
  - To remove the primary seal(007),unscrew the screws (038)and remove the disc flange(016) Then unscrew the nut (019) and remove the primary seal (007) by holding spherical screw (015).



042	1	STEM GASKET
040	2	DIAPHRAGM GASKET
038-1	X	LOCK WASHER
038	X	DISC SCREW
037-1	X	LOCK WASHER
037	X	CAP SCREW
021	1	DIAPHRAGM SUPPORT
020	1	DIAPHRAGM
019	1	NUT
018-1,019-1	X	LOCK WASHER
018	1	SCREW
016	1	DISC FLANGE
015	1	SPHERICAL SCREW
014,022	2	DIAPHRAGM WASHER,DISC WASHER
012	1	STEM
011	1	DISC
009	1	GUIDE
008	1	GUIDE SLEEVE
007	1	PRIMARY SEAL
002	2	LOWER COVER,UPPER COVER
ID Nomenclature	Qté	ID Référence

FIGURE 4-DISASEMBLY TRIM

9.2 MAIN VALVE PARTS INSPECTION & MAINTENANCE

9.2.1 *GENERAL RECOMMENDATIONS*

We recommend to carefully store the disassembled valves per serial number not to mix-up parts during inspection and maintenance. Changes from one valve part to another can be invisible to the eye and may compromise 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.

9.2.2 *PART INSPECTION*

- **Main valve body (001)**

  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.
  Inspect the seat housing for any deformation or erosion, pitting.

- **Main valve studs & nuts (035 & 050)**

  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 (002)**

  Inspect the Cover for any cracks, erosion, pitting. If the cover has such defects it shall be replaced.

- **Main valve guide sleeve (009)**

  Inspect the internal diameter where the spindle slides.
  If surface is galled, scratched, the guide sleeve shall be replaced.

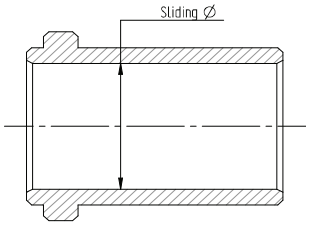


FIGURE 5-GUIDE SLEEVE

- **Main valve stem (012)**

  Inspect the external diameter where the guide sleeve slides. It shall not have any scratches or be galled. If this diameter is damaged carefully check the guide sleeve. It might be damaged.
  Inspect the spherical area. It shall not have any scratches or be galled. If surface is galled, scratched, corroded or pitted. The spindle shall be replaced.

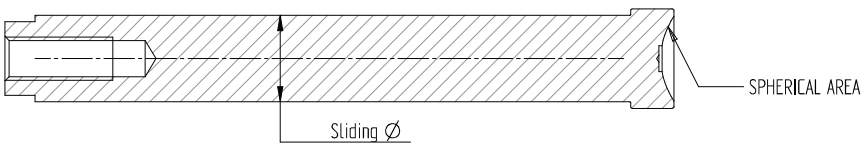


FIGURE 6-STEM

- **Main valve spherical screw (015)**

  - Inspect the hinge surface (sphere) of the spherical screw.
  If it is galled, scratched, corroded or pitted the disc shall be replaced.

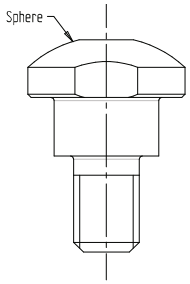


FIGURE 7-SPHERICAL SCREW

- **Main valve seat (006)**

  - Inspect the centering diameter. It shall be free of any burrs.
  - Inspect the seating. Any scratch or impact mark less than 0.5mm deep on the seating surface shall be removed by lapping. The remachining or replacement of the nozzle seating surface is recommended if there is any impact mark deeper than 0.5mm.

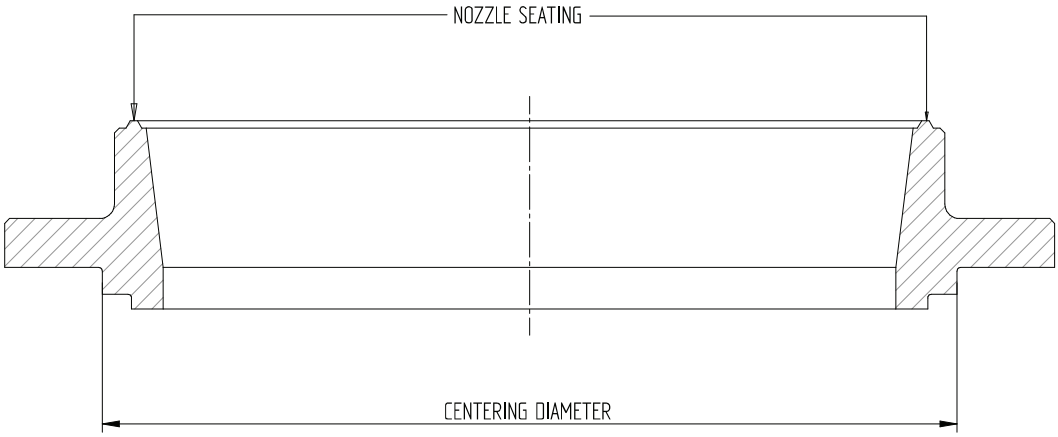


FIGURE 8-SEAT

- **Main valve disc and disc washer (011,014)**

Inspect each face of the disc and disc washer in particular the surface in contact with the primary seal (007). If it is galled, scratched, corroded or pitted there shall be replaced.

- **Main valve diaphragm support and washer (021,022)**

Inspect each face of the diaphragm support and washer in particular the surface in contact with the diaphragm(020).If it is galled, scratched, corroded or pitted there shall be replaced.

9.2.3 MAIN VALVE RE-ASSEMBLY

- **Seat (006) /O-Ring seat gasket (043)**

  - Ensure the body groove is clean and insert the gasket (043) into it.
  - Tighten the screws (036) with Nord-Lock® washer to rated torque shown on Table 1.
  Grease the threads with cryogenic grease.

Nota: Trillium Flow Technologies™ recommended to use cryogenic and oxygen grease type ORAPI CT830 (-40°C/+280°C) or CT1240(-40°C/320°C).

043	1	SEAT GASKET
036-1	x	LOCK WASHER
036	x	SEAT SCREW
006	1	SEAT
001	1	BODY
ID Nomenclature	Qté	ID Référence

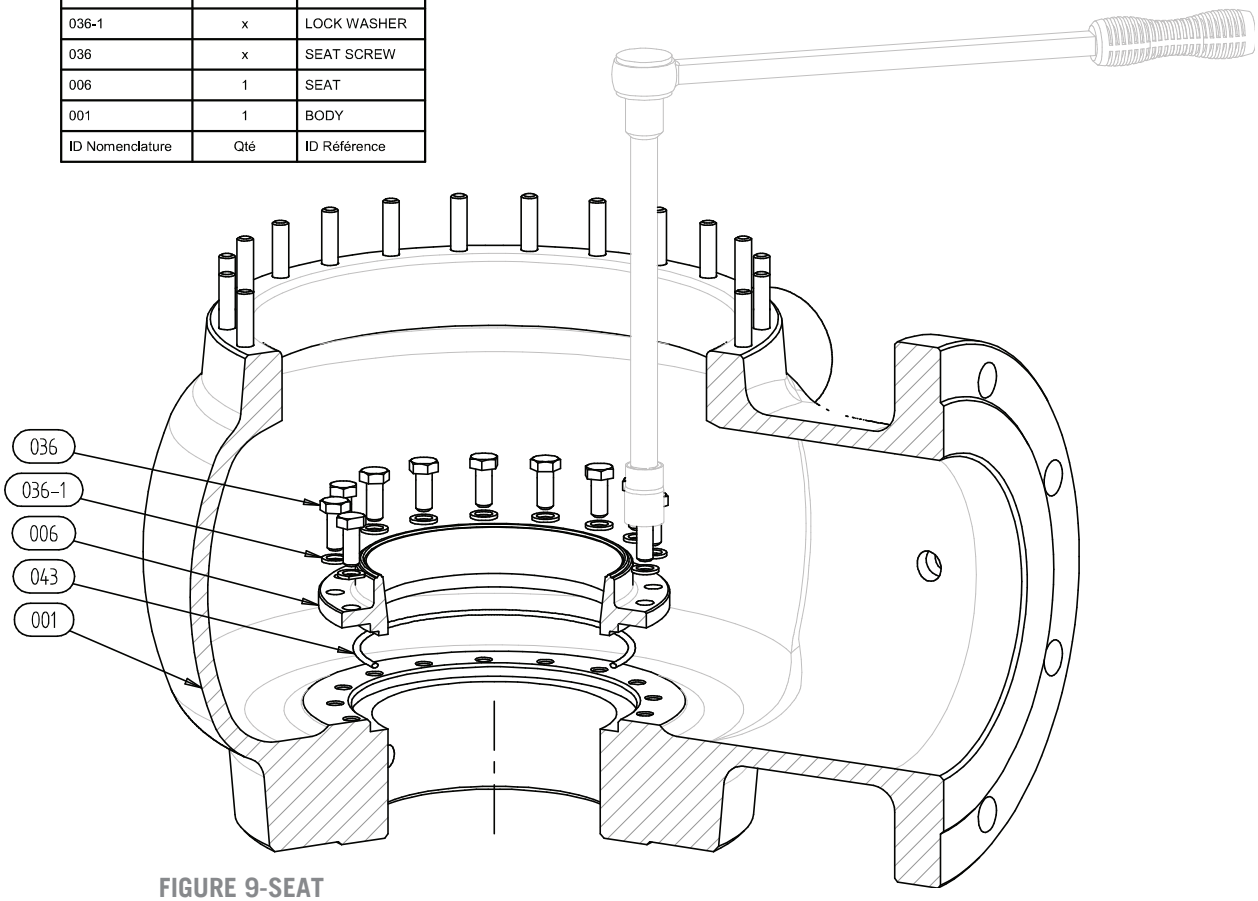


FIGURE 9-SEAT

Warning: The Nord-Lock® washer (036-1) is in 2 parts. Ensure there are correctly stacked like the Figure 10.

Nominal diameter (mm)	Tightening torque m.daN
6	0.5
8	1
10	1.5
12	2.6

TABLE 1 - TIGHTENING TORQUE

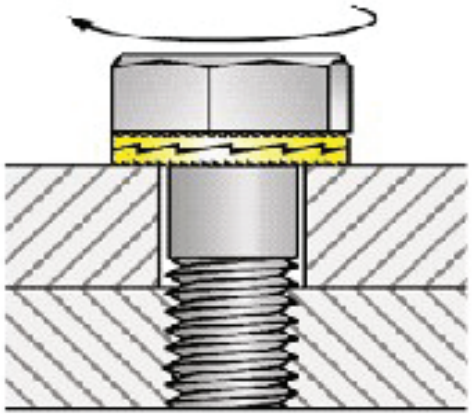
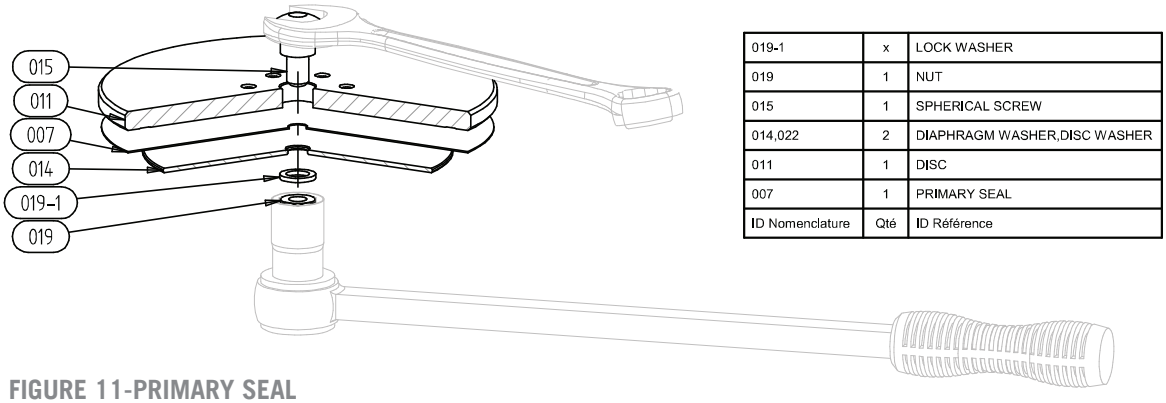


FIGURE 10-NORD-LOCK® STACKING

Primary seal (007)

- Tighten the screw (019) with Nord-Lock® washer to torque show on Table 1.

Nota: For the Nord-Lock® washers stacking, please refer to the Figure 10.
The primary seal should be replaced after each service



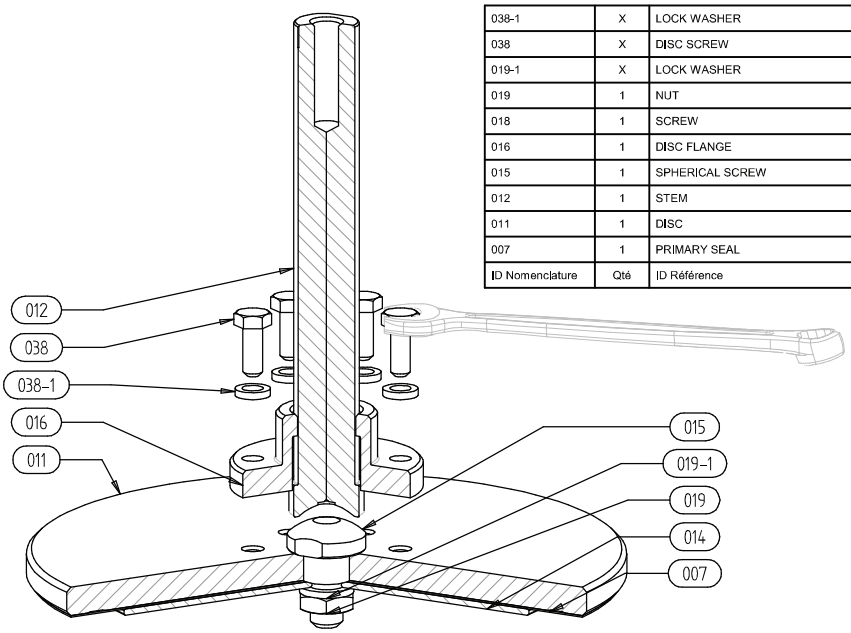
019-1	x	LOCK WASHER
019	1	NUT
015	1	SPHERICAL SCREW
014,022	2	DIAPHRAGM WASHER,DISC WASHER
011	1	DISC
007	1	PRIMARY SEAL
ID Nomenclature	Qté	ID Référence

FIGURE 11-PRIMARY SEAL

- **Disc flange (016)**

  - Slightly grease the spherical screw (015) hinge surface (sphere).
  - Tighten the screw (038) with Nord-Lock® washer (038-1)to torque show on Table 1.
    Grease the thread.

  Nota: For the Nord-lock® washers stacking, please refer to the Figure 10.



038-1	X	LOCK WASHER
038	X	DISC SCREW
019-1	X	LOCK WASHER
019	1	NUT
018	1	SCREW
016	1	DISC FLANGE
015	1	SPHERICAL SCREW
012	1	STEM
011	1	DISC
007	1	PRIMARY SEAL
ID Nomenclature	Qté	ID Référence

FIGURE 12-DISC FLANGE ASSEMBLY

- **Guide (009)**

- Slide the guide sleeve (008) in the guide (009). Do not grease!!
- Tighten the screw (037) with Nord-Lock® washer (037-1) to torque show on Table 1.

Nota: For the Nord-Lock® washers stacking, please refer to the Figure 10.

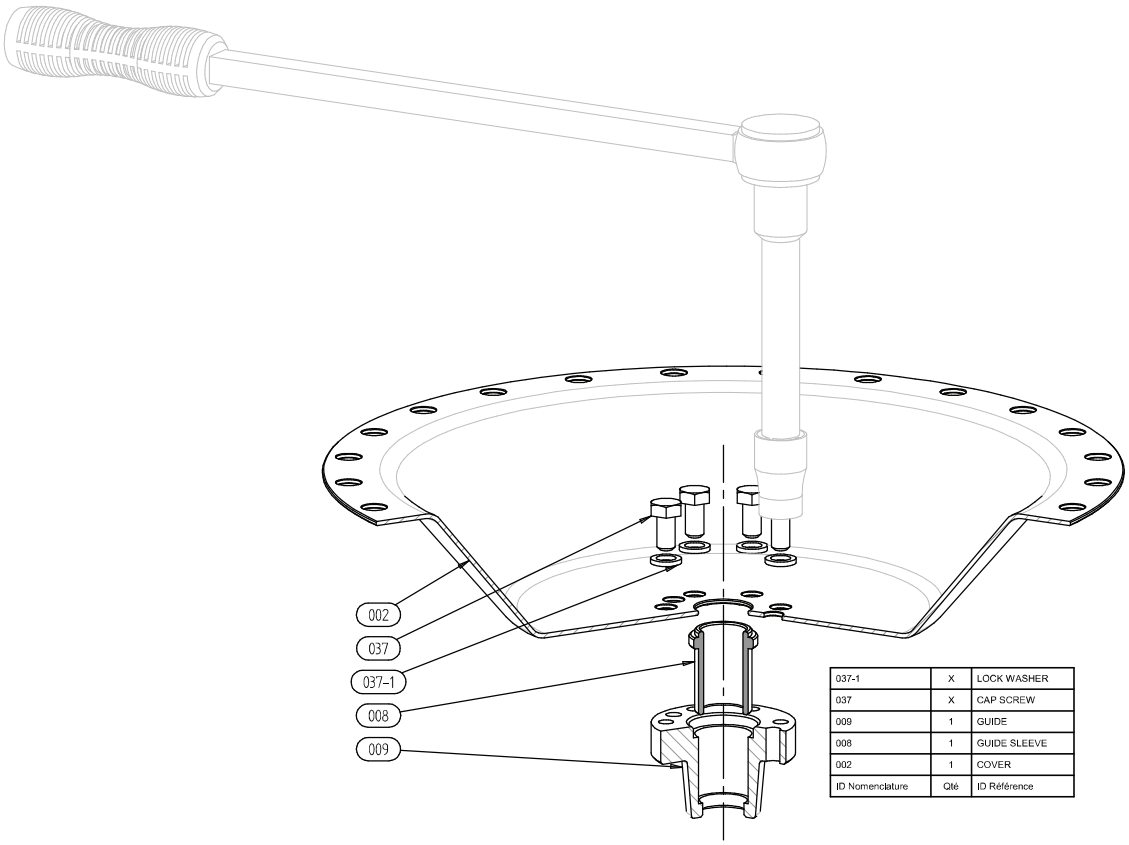
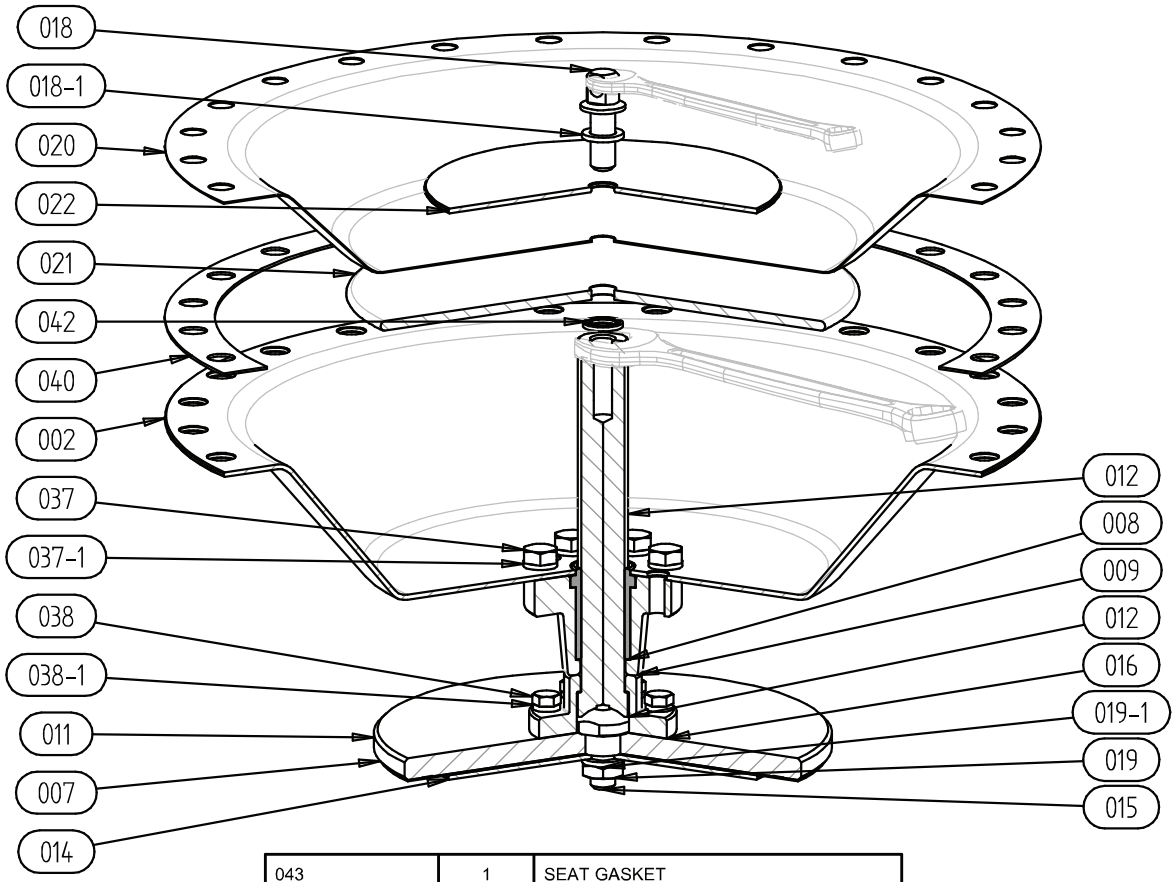


FIGURE 13-GUIDE ASSEMBLY

- **Diaphragm (020)**

- Slide the stem (012) on the guide sleeve assembly.
  Do not grease between the stem (012) and the guide sleeve (008).
- Put the gasket (040) on the lower cover (002).
  Stack parts as show in Figure 14
- Tighten the screw (018) with Nord Lock® washer (018-1) through the diaphragm washer (022), diaphragm (020), diaphragm support (021) and spindle gasket (042) on spindle (012) to torque shown Table 1.

Nota: For the Nord-Lock® washers stacking, please refer to the Figure 10



043	1	SEAT GASKET
042	1	STEM GASKET
040	2	DIAPHRAGM GASKET
038-1	X	LOCK WASHER
038	X	DISC SCREW
037-1	X	LOCK WASHER
037	X	CAP SCREW
021	1	DIAPHRAGM SUPPORT
020	1	DIAPHRAGM
019	1	NUT
018-1,019-1	X	LOCK WASHER
018	1	SCREW
016	1	DISC FLANGE
015	1	SPHERICAL SCREW
014,022	2	DIAPHRAGM WASHER,DISC WASHER
012	1	STEM
011	1	DISC
009	1	GUIDE
008	1	GUIDE SLEEVE
007	1	PRIMARY SEAL
002	2	LOWER COVER,UPPER COVER
ID Nomenclature	Qté	ID Référence

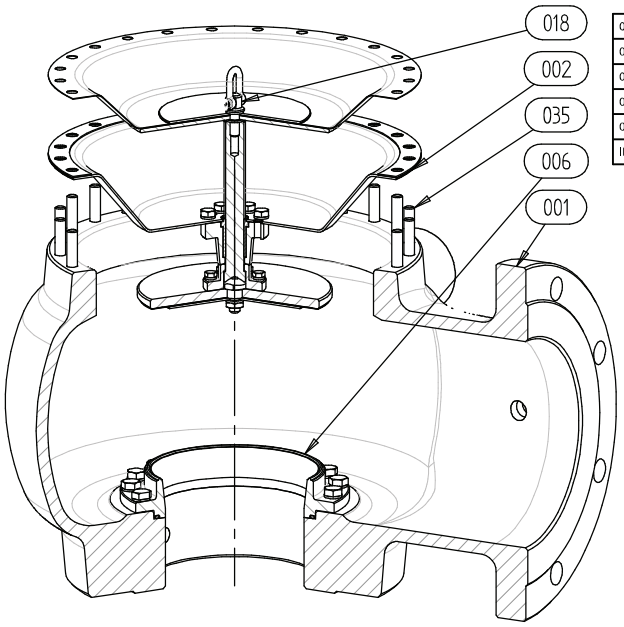
FIGURE 14-DIAPHRAGM ASSEMBLY

- **Trim assembly**

- Put a lifting lug through the screw (018).

Slide the lower cover (002) on the body threaded rods (035).Once the lower cover is landed on the body, slide progressively the disc flange assembly until the primary seal come in contact with the disc.

Warning: Relieving suddenly the assembly will make impact marks on the primary seal and the disc seating surfaces. The Main Valve cannot remain tight with such marks on those surfaces.

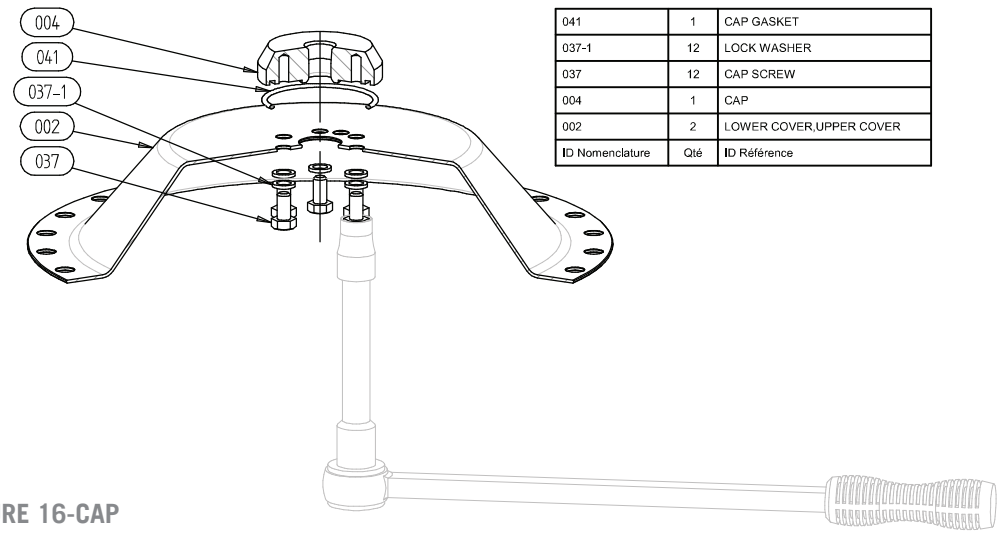


035	X	COVER STUD
018	1	SCREW
006	1	SEAT
002	1	LOWER COVER
001	1	BODY
ID Nomenclature	Qté	ID Référence

- **Cap (004)**

- Insert the gasket (041) into the cap groove.
- Tighten the screws (037) with Nord-Lock® washer (037-1) through the upper cover (002) on cap to torque shown on Table 1.

Nota: For the Nord-Lock® washers stacking, please refer to the Figure 10

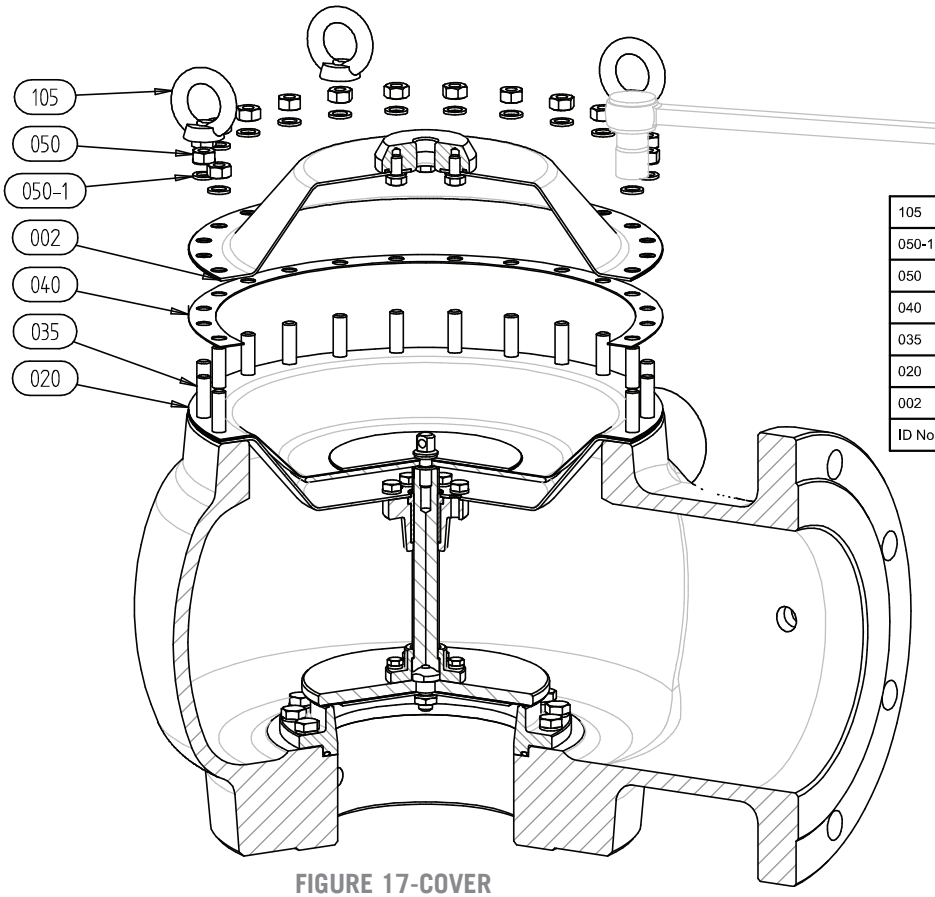


041	1	CAP GASKET
037-1	12	LOCK WASHER
037	12	CAP SCREW
004	1	CAP
002	2	LOWER COVER,UPPER COVER
ID Nomenclature	Qté	ID Référence

FIGURE 16-CAP

- **Cover (002)**

- Insert the second gasket (040) on the diaphragm (020).
- Insert the upper cover (002) on the body treaded rods (035).
- Grease the studs(035),tighten the nuts (050)with Nord-lock® washer(051) to torque show on Table 2 for PTFE or NBR Diaphragm.
  Respect the bolting pattern show on Figure 18 !!
  Nota: For the Nord-Lock® washer stacking, please refer to the Figure 10



105	4	LIFTING LUG
050-1	X	LOCK WASHER
050	x	COVER NUT
040	1	DIAPHRAGM GASKET
035	x	COVER STUD
020	1	DIAPHRAGM
002	2	LOWER COVER,UPPER COVER
ID Nomenclature	Qté	ID Référence

FIGURE 17-COVER

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

VALVE SIZE	Inlet valve diameter	Bolting diameter	Nominal torque	
			PTFE membran	Elastomer membran
Inch	mm	mm	N.m	N.m
2x3	50	M6	10	5
3x4	80	M6	10	5
4x6	100	M8	20	5
6x8	150	M10	30	14
8x10	200	M12	52	30
10x12	250	M12	52	37
12x16	300	M12	52	43

TABLE 2 - COVER BOLTING TIGHTENING TORQUE

FIGURE 18- BOLTING PATTERN

10 MAINTENANCE TOOLS

- Lapping tools and LAMPLAN diamond paste (1.213, 3.213, 6.213)
- Lifting lugs.
- Cryogenic and Oxygen grease type ORAPI CT830 (-40°C/+280°C) or CT1240 (-40°C/320°C).

11 TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
The disc does not move (no lift)	Damaged diaphragm	Carry out maintenance to remove the diaphragm and to overhaul the potential damaged parts.
	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 lower cover to the seat. Check also the stem alignment and concentricity.
	Disc hinge has not sufficient articulation	Inspect the disc and stem 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	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 is 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.

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:

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

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