

Pilot-Operated Relief Valves

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Introduction

Scope of Manual

This manual provides instructions for installation, startup, maintenance and spare parts ordering for the VS-FL Series pilot operated relief valves and for PRX/182 pilot.

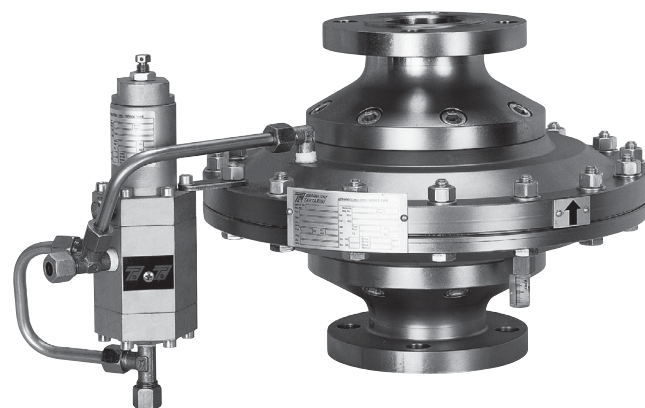


Figure 1. Relief Valve Type VS-FL with PRX/182 Pilot

Product Description

The VS-FL Series relief valves are axial flow type with a single seat and counterbalanced shutter.

They are used in reduction, distribution and conveying stations using suitably filtered natural gas.

This product has been designed to be used with fuel gases of 1st and 2nd family according to EN 437 and with other non aggressive and non fuel gases. For any other gases, other than natural gas, please contact your local sales agent.

The following versions are available:

VS-FL-BP: For low and mid pressure applications
Pilot PRX/182

VS-FL: For mid and high pressure applications
Pilot PRX/182 or PRX-AP/182

Also available version with type SR silencer.

All standard gas pressure devices (relief valves) used in assemblies will comply to EN 12186 and EN 12279 standards.

Any accessories (e.g. pilots) used on the Emerson range of relief valves, must be manufactured by one of the Emerson companies and bear that manual.

If this is not respected, Emerson will not be responsible in the case of any inefficiency.

Type VS-FL

PED Categories and Fluid Group

The VS-FL Pilot-Operated Series relief valves are designed as functional equipments and they are typically used in gas pressure reducing stations for overpressure protection by releasing small amounts of gas in the event of not perfect pressure relief valve closing.

If VS-FL Series relief valve is used as full-capacity relief device (according clause 8.3.2 EN 12186), downstream equipment protected by this products shall have technical features such as not to be category higher than following Pressure Equipment Directive (PED) 2014/68/UE categories.

Table 1. PED Category for VS-FL Series Relief Valves

Product Size	category	fluid group
dn 25 - 40 - 50 - 65 - 80 - 100 - 150 - 200	IV	1

Possible built-in pressure accessories (e.g. pilots PRX Series or filters SA/2, FU and FD-GPL) conform to Pressure Equipment Directive (PED) 2014/68/UE Article 4 section 3 and were designed and manufactured in accordance with Sound Engineering Practice (SEP).

Per Article 4 section 3, these "SEP" products must not bear the CE marking.

Characteristics

Body Sizes and End Connection Styles

VS-FL-BP

DN 25 - 40 - 50 - 65 - 80 - 100 - 150

PN 16

ANSI 150 flanged

VS-FL

DN 25 - 40 - 50 - 65 - 80 - 100 - 150 - 200

ANSI 300 - 600 flanged

Outlet Set Pressure Ranges

VS-FL-BP PN 16 ANSI 150 DN 25-40-50: 0.5 to 8 bar

VS-FL-BP PN 16 DN 65-80-100-150: 0.5 to 16 bar

VS-FL-BP ANSI 150 DN 65-80-100-150: 0.5 to 19.3 bar

VS-FL ANSI 300 all sizes: 1 to 50 bar

VS-FL ANSI 600 all sizes: 1 to 80 bar

Minimum/Maximum Allowable Temperature (TS)

See label.

Temperature

Standard Version: Working -10 to 60°C

Low Temperature Version: Working -20 to 60°C

Materials

Flanges and covers: Steel

Diaphragms: Fabric Nitrile (NBR) + PVC
Nitrile (NBR) rubber

Pads: Nitrile (NBR) rubber
(FKM available on request)

Labelling

Figure 2. Label for VS-FL Series Relief Valves

Note 1: See "Characteristics"

Note 2: Year of manufacture

Note 3: Class 1: -10 to 60°C

Class 2: -20 to 60°C

Note 4: PN 16 PS: 16 bar

ANSI 150 PS: 19.3 bar

ANSI 300 PS: 50 bar

ANSI 600 PS: 100 bar



WARNING

The pressure/temperature limits indicated in this instruction manual or any applicable standard or code limitation should not be exceeded.

Maximum Operating Inlet Pressure

PN 16: 16 bar

ANSI 150: 20 bar

ANSI 300: 50 bar

ANSI 600: 100 bar

At average ambient temperature.

Overpressure Protection

The recommended safety pressure limitations are stamped on the valve label.

Downstream overpressure protection shall be also provided if the inlet pressure can be greater than the PS (see label).

Equipment's operation below the maximum pressure limitations does not preclude the possibility of damage from external sources or debris in the line.

The relief valve should be inspected for damage after any overpressure condition.

Transport and Handling

Established transport and handling procedures shall be followed to avoid any damage on the pressure containing parts by shocks or anomalous stresses.

Ringbolts are designed just for handling of equipment weight.

Built-up sensing lines and pressure accessories (e.g. pilots) shall be protected by shocks or anomalous stresses.

ATEX requirements

Application of ATEX Product Directive:

Table 2. Overview

Type	Classification	ATEX Assemblies	ATEX Labelling
Regulator/SSD	Non-electrical equipment	Not falling under the 2014/34/EU Directive	No
Regulator/SSD + electrical device	Non-electric equipment equipped with an electrical device falling under the scope of the ATEX Directive 2014/34/EU	Constitutes an assembly according to the 2014/34/EU Directive	CE Ex II 2 GT



WARNING

Usage of an "ATEX Assembly" in an explosive atmosphere.

A non-electrical equipment incorporating an electrical device (proximity, microswitch...) is an "ATEX Assembly", and in the scope of the ATEX Directive 2014/34/EU.

When such equipment(s) is used in a natural gas pressure control and/or measuring station in compliance with the following European standards: EN12186, EN12279 and EN1776, can be installed in any type of classified zones according to the Directive 1999/92/EC dated 16 December 1999, in the following conditions:

- the equipment(s) / electrical circuit is connected to a suitable and certified intrinsically safe apparatus (suitable zener barrier)
- the equipment(s) / electrical circuit is used according to this instruction manual issued by the manufacturer and / or available on our website

ATEX Labelling

The nameplate will be installed on the ATEX assembly.

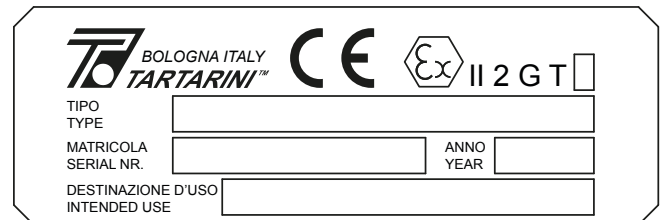


Figure 3. Label for ATEX Assembly

Where:

- Manufacturer:** Name and address and/or logo of the manufacturer
- CE:** Conformity marking to European Directive
- Type:** Description of the ATEX Assembly
- Serial Number and Year of Construction
- Ex:** Specific marking of explosion protection
- II:** Equipment group
- 2:** Equipment Category/level of protection 2 = suitable for zone 1
- G:** For gases, vapour or mists
- T:** Temperature Class (i.e.: T6 > 85 ... ≤ 100°C)
- Intended Use:** Natural Gas infrastructures

Type VS-FL

Pilots

VS-FL relief valves are equipped with the PRX/ series pilots.

Table 3. Pilots Type PRX/182 and PRX-AP/182 Characteristics

MODEL	ALLOWABLE PRESSURE PS, bar	SET RANGE W_d , bar	BODY AND COVERS Material
PRX/182	100	0.5 - 40	Steel
PRX-AP/182		30 - 80	

Note: 1/4 NPT female threaded connections

Operation

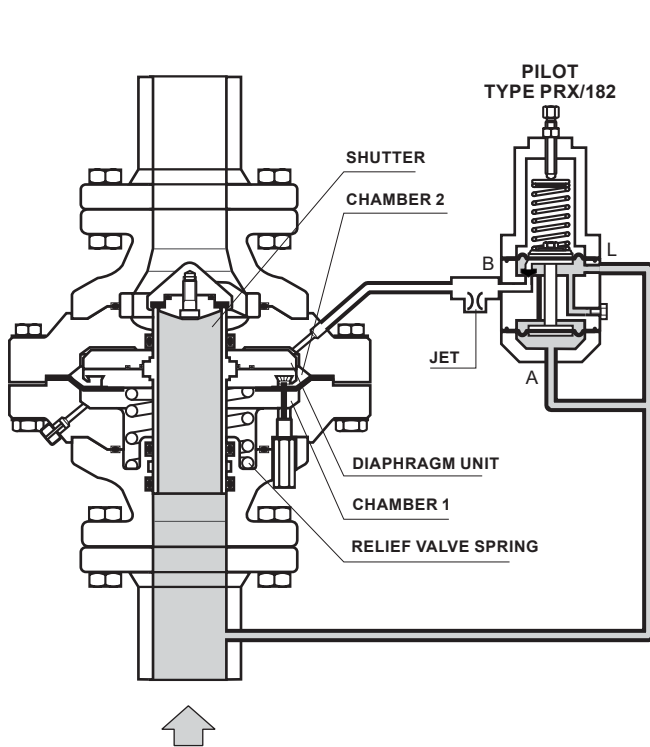


Figure 4. Closed VS-FL Relief Valve

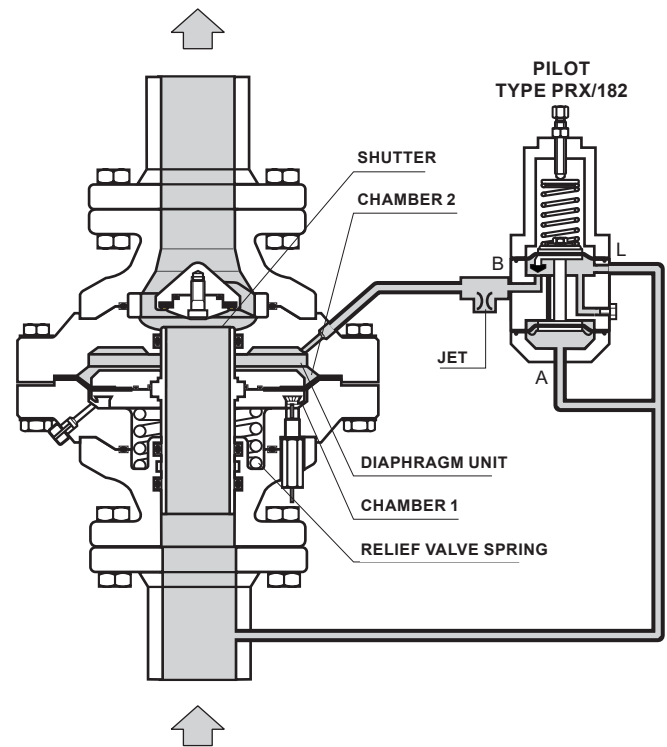


Figure 5. Opened VS-FL Relief Valve

The diaphragm unit (permanently connected to the shutter) divides the relief valve actuator into two chambers.

The chamber 1 is connected to the atmospheric pressure, chamber 2 is connected to the pilot.

In normal working conditions the two chambers are not containing pressure and the relief valve spring acts on the diaphragm unit and closes the shutter.

If the line pressure exceeds the pilot set point, the pilot allows the gas to flow from the line to chamber 2.

The shutter moves to its open position when the force produced by gas pressure acting on the diaphragm unit becomes greater than the load of the relief valve spring.

Once the excess gas is released and line pressure returns to normal working conditions, the pilot stops the pressure flow, Chamber 2 is no longer being fed, it is emptied through the jet.

The diaphragm unit is pushed upward by the relief valve spring and the shutter moves to its closed position.

Dimensions and Weights

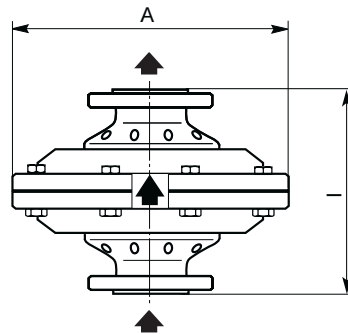


Figure 6. VS-FL Series Dimensions

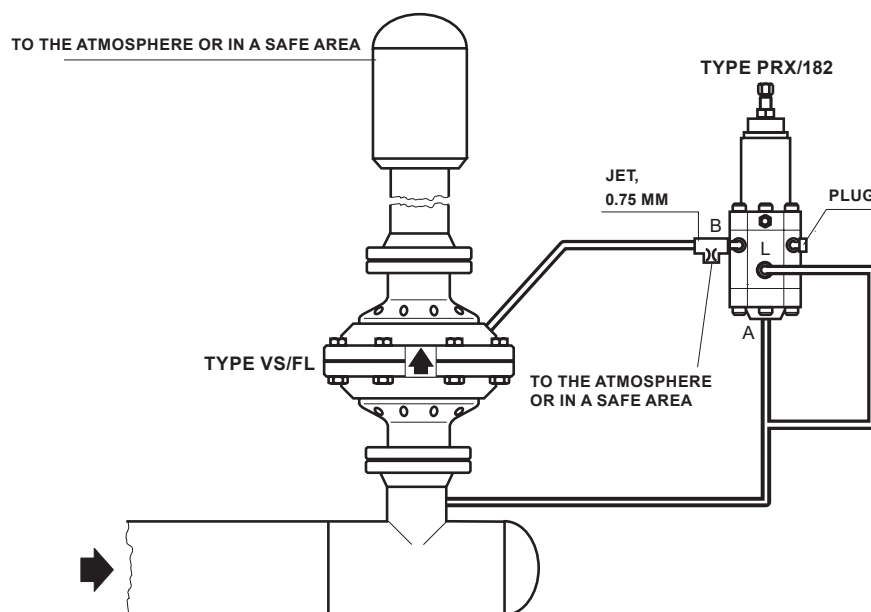
Table 4. VS-FL Series Dimensions

DN	DIMENSIONS, mm				WEIGHTS, Kg	
	FACE TO FACE - I		A		PN 16 - ANSI 150 VS-FL-BP	ANSI 300 - ANSI 600 VS-FL
	PN 16 - ANSI 150	ANSI 300 - ANSI 600	PN 16 - ANSI 150	ANSI 300 - ANSI 600		
	VS-FL-BP	VS-FL	VS-FL-BP	VS-FL	VS-FL-BP	VS-FL
25	184	210	285	225	24	31
40	222	251	306	265	37	47
50	254	286	335	287	48	60
65	276	311	370	355	68	88
80	298	337	400	400	83	148
100	352	394	450	480	105	201
150	451	508	590	610	255	480
200 ⁽¹⁾	----	610	----	653	----	620

1. ANSI 300 I = 568 - 1/4 NPT female threaded connections

Note: (*) ANSI 300 I = 568 - 1/4 NPT female threaded connections

Installation



Note: recommended piping is stainless steel with 10 mm diameter.

Figure 7. VS-FL Series Connection/Installation Schematic

Installation (continued)

- Ensure that the data found on the valve label are compatible with usage requirements.
- Ensure that the valve is mounted in accordance with the direction of flow indicated by the arrow.
- Make the connections as indicated in figure 7.



WARNING

Only qualified personnel should install or service a relief valve.

Relief valves should be installed, operated, and maintained in accordance with international and applicable codes and regulations.

Failure to take the relief valve out of service immediately may create a hazardous condition.

Personal injury, equipment damage, or leakage due to escaping fluid or bursting of pressure-containing parts may result if this relief valve is over-pressured or is installed where service conditions could exceed the limits given in the Specifications section, or where conditions exceed any ratings of the adjacent piping or piping connections.

To avoid such injury or damage, provide pressure-limiting devices (as required by the appropriate code, regulation, or standard) to prevent service conditions from exceeding limits.

Additionally, physical damage to the relief valve could result in personal injury and property damage due to escaping fluid.

To avoid such injury and damage, install the relief valve in a safe location.

Before installation, check shall be done if service conditions are consistent with use limitations.

All means for draining must be provided in the equipment installed before relief valves (ENs 12186 and 12279).

If using a VS-FL Series relief valve on hazardous or flammable gas service, personal injury and property damage could occur due to fire or explosion of vented gas that may have accumulated.

To prevent such injury or damage, provide piping or tubing to vent the gas to a safe, well-ventilated area in accordance also with international and applicable codes and regulations.

In particular, when venting a hazardous gas, the piping or tubing should be located far

enough away from any buildings or windows so to not create a further hazard, and the vent opening should be protected against anything that could clog it.

If installing the relief valve at an outside location, adequate protection, such as rain caps or elbow piping, must be attached to the outlet to keep the relief valve from getting plugged or from collecting moisture, corrosive chemicals, or other foreign materials.

For outdoor installations, the relief valve should be located away from vehicular traffic.

Further the ENs 12186 and 12279, where this product is used:

- provide the cathodic protection and electrical isolation to avoid any corrosion and
- in accordance with clause 7.3/7.2 of aforesaid standards, the gas shall be cleaned by proper filters/separators/scrubbers to avoid any technical and reasonable hazard of erosion or abrasion for pressure containing parts

Pressure equipment in subject shall be installed in non-seismic area and hasn't to undergo fire and thunderbolt action.

Clean out all pipelines before installation of the relief valve and check to be sure it has not been damaged or has collected foreign material during shipping.

For flanged bodies, use suitable line gaskets and approved piping and bolting practices. Install the relief valve in any position desired, unless otherwise specified, but be sure flow through the body is in the direction indicated by the arrow on the body.

Installation must to be done avoiding anomalous stresses on the body and using suitable joint means (bolts, flanges, ...) according equipment dimensions and service conditions.

Note

It is important that the relief valve and relief valve be installed so that the pilots vent holes are unobstructed at all times.

For outdoor installations, the relief valve should be located away from vehicular traffic and positioned so that water, ice, and other foreign materials cannot enter through the valve pilot.

Avoid placing the equipment beneath eaves or downspouts, and be sure it is above the probable snow level.

Start-up

The relief valve's pilot is factory set at approximately the midpoint of the spring range or at the pressure requested, so an initial adjustment may be required to give the desired results.

With proper installation completed and relief valves properly adjusted, slowly open the upstream and downstream line valves.

Pilot Adjustment

Mount upstream of the relief valve a unit capable of generating the pressure at which the valve is to release gas (a pressure regulator, a compressed air or gas cylinder or the like) and a pressure gauge with appropriate scale.

Adjust the load of spring by means of adjusting screw proceeding as follows:

- Fully tighten adjusting screw.
- Bring pressure upstream of relief valve up to set point.
- Slowly loosen adjusting screw until relief valve opens. This is revealed by the escape of gas through vent.
- Decrease and subsequently increase pressure a few times to check for proper valve operation and make any adjustment in setting, if necessary.

Shutdown

WARNING

To avoid personal injury resulting from sudden release of pressure, isolate the relief valve from all pressure before attempting disassembly and release trapped pressure from the equipment and pressure line.

In case of disassembly of main pressure retaining parts for checks and maintenance procedures, external and internal tightness tests have to be done according applicable codes.

Periodical Checks

CAUTION

It is recommended that relief valve and pilot are checked periodically.

In order to check the efficiency of the relief valve, line pressure increase must be simulated using the same procedure as described in previous "Pilot Adjustment" paragraph.

Valve is in proper working order if gas release is noticed upon pressure increase. Gas release must cease immediately as pressure is brought back to its normal working value.

It is also recommended that both pilot's and relief valve's seal pads are checked periodically as described in the following paragraphs.

Relief Valve Maintenance (see Figures 8 to 12)

WARNING

All maintenance procedures must be carried out only by qualified personnel.

If necessary, contact our technical support representatives or our authorized dealers.

VS-FL Series Relief valve and its pressure accessories are subject to normal wear and must be inspected periodically and replaced as necessary.

The frequency of inspection/checks and replacement depends upon the severity of service conditions and upon applicable National or Industry codes, standards and regulations/recommendations.

In accordance with applicable National or Industry codes, standards and regulations/recommendations, all hazards covered by specific tests after final assembling before applying the CE marking, shall be covered also after every subsequent reassembly at installation site, in order to ensure that the equipment will be safe throughout its intended life.

Before proceeding with any maintenance work, shutoff the gas upstream and downstream from the valve, also ensure that there is no gas under pressure inside the body by loosening the upstream and downstream connections.

Replacing Seal Pad

- Disconnect all fittings preventing removal of outlet stub pipe and take the latter off.
- Loosen screws (key 5) and slide out outlet flange (key 22), replace O-ring (key 18).
- Remove pad holder (key 19) from the outlet cover (key 13). Only for the DN 200 size the pad holder remain attached to the outlet flange and it is not necessary dismount it.
- Loosen screw (key 25), pad retainer (key 21), remove and replace pad unit (key 20).
- Check that the part of sleeve (key 16) that touches pad unit (key 20) is intact. If not, carry out general maintenance and replace sleeve.
- Reassemble by reversing the above sequence, being careful not to damage O-ring (key 18). To facilitate fitting of pad holder (key 19), use an air pump that, when connected to fitting (key 17), causes sleeve (key 16) to open fully.

Relief Valve General Maintenance

- a. Disconnect all fittings, remove regulator from the line and place it in upward vertical position.
- b. Mark the position of inlet and outlet flanges (key 1 and 22) and cover (key 11 and 13) to keep the correct alignment during the following reassembly phase.
- c. Separate covers (key 11 and 13) by removing screws (key 9).



WARNING

Spring (key 6) is compressed between covers (key 11 and 13); its sudden release could cause them to fly apart dangerously.

To prevent this, replace the two screws (key 9) with threaded rods and their nuts, remove the remaining screws and use nuts to slowly release spring tension.

- d. Slide sleeve-diaphragm assembly (key 16 and 10) out of inlet cover (key 11) and remove indicator (key 34).
- e. Loosen screws (key 27), axially slide out of sleeve (key 16) plates (key 8 and 12) and diaphragm (key 10). Replace O-rings (key 26 and 28).
- f. Loosen screws (key 5 or 64 for DN 150 and DN 200 sizes) and dismount inlet flange (key 1). Replace anti-friction rings (key 2) and O-ring (key 3).
- g. Unscrew travel indicator support (key 36) from inlet cover (key 11), dismount parts, replace O-rings (key 35 and 37) and O-ring (key 4) on the inlet cover (key 11).
- h. Loosen screws (key 5) and axially slide out outlet flange (key 22). Replace O-ring (key 18), anti-friction rings (key 2) and O-ring (key 3).
- i. Remove pad holder (key 19) from the outlet cover (key 13). Only for the DN 200 size the pad holder remain attached to the outlet flange and it is not necessary dismount it.
- j. Loosen screw (key 25), pad retainer (key 21), remove and replace pad unit (key 20).
- k. Check that the part of sleeve (key 16) that touches pad unit (key 20) is intact. If not replace sleeve.
- l. Check all moving parts, paying special attention to nickel plated surfaces. Replace any that are worn or damaged.
- m. Clean all stripped-down parts with petrol and dry with compressed air.

Reassembly

Lubricate all seals with Molykote® 55 M, being very careful not to damage them when reassembling. Reassemble the parts by reversing the above steps.

As you proceed, make sure that parts move freely and without friction.

In addition:

- a. Before fitting sleeve-diaphragm assembly (key 16 and 10), recompose indicator group (key 34, 35, 36, 37, 38 and 40) and mount it on inlet cover (key 11). Attach spring collet (key 33) to plate (key 8) upon completion of reassembly. Don't execute this assembly for the DN 200 size.
- b. Complete reassembly and make sure to tighten all screws uniformly.
- c. Remove cap (key 40) and tap with a rubber or wooden hammer indicator (key 34) so as to couple spring collet (key 33) and plate (key 8).

Only for DN 200 size insert indicator (key 34) and hook it to plate (key 8), recompose indicator group (key 35, 36, 37, 38 and 40) and mount it on inlet cover (key 11).
- d. Use an air pump connected to fitting (key 7) to check proper regulator working order.
- e. After the reassembly completion, check the proper functioning of all parts. Check the regulator with soapy water, making sure there are no leaks.
- f. Remount regulator on the line and reestablish all connections.

Type PRX/182 Pilot Maintenance (see Figure 13)

Installation

- a. Make sure that specifications on the pilot plate comply with the intended use.
- b. Make sure that all connections are correctly made.

Startup

Refer to the relief valve startup instructions.

Periodical Checks

Pilot tightness should be tested regularly by referring to the following procedure:

- a. Supply fitting A with normal operating pressure.
- b. Make sure there is no gas outflow from fitting B.

Maintenance



Maintenance should be carried out by skilled personnel to ensure good servicing results. Contact our technical support representatives or our authorized dealers for any information. Let gas under pressure flow out of the relevant part of the system before servicing.

General Maintenance

- a. Disconnect and remove the pilot from the line.
- b. Fully unscrew the adjusting screw (key 1).
- c. Unscrew the cap (key 3), for the AP version also the extension (key 35), remove the spring holder (key 6) and the spring (key 7). Replace the O-rings (key 4 and 5).
- d. Loosen screws (key 10), remove the upper cover (key 8) and the lower cover (key 21). Replace the O-ring (key 18).
- e. Lock the stem (key 23) by inserting a key into the notches and unscrew nuts (key 20 and 26).
- f. Disassemble the parts and replace the diaphragm (key 14) and the pad (key 22).
- g. Unscrew the seat (key 19) and replace the O-ring (key 17).
- h. Use petrol to cleanse the pilot body and all metal parts. Blow them thoroughly with compressed air and check for clear holes along the gas conduits. Replace any worn parts.

Troubleshooting

Table 5. General Troubleshooting for VS-FL Series Relief Valves

SYMPTOMS	CAUSE	ACTIONS
The valve does not open	Lack of incoming gas	Check the station feeding
	Pilot is not being supplied	Check pilot connections
	Valve diaphragm is broken	To be replaced
	Pilot setting is higher than required	Check pilot setting
The valve is not sealed properly	Tight shutoff gaskets are worn	To be replaced
	Deposits of grime on the tight shutoff pad are obstructing proper positioning of the shutter	Clean or replace it
	Pilot setting is lower than required	Check pilot setting

Reassembly

Reassemble all parts by following in reverse order the assembly as described above (see General Maintenance section).

As parts are assembled, make sure they move freely causing no friction.

Make sure to:

- a. O-rings and diaphragms should be lubricated by applying a thin layer of 'Molykote® 55 M' grease.

Pay attention not to damage them during reassembly. All other pilot parts require no lubrication.
- b. The cover clamping screws (key 10) should be tightened evenly to ensure proper tightness.
- c. Pilot operation, calibration and tightness should be tested as described in the Periodical Checks paragraph.
- d. Previously disassembled fittings must be connected. Check for leaks by using suds.

Calibration

See the paragraph Pilot Adjustment on page 6.

Spare parts

Spare parts storage shall be done by proper procedures according to national standard/rules to avoid over aging or any damage.

Type VS-FL

Parts Lists

VS-FL Relief Valve (See Figures 8 to 12)

Key	Description
1	Inlet flange
2	Anti-friction ring*
3	O-ring*
4	O-ring*
5	Screw
6	Spring
7	Fitting
8	Inlet plate
9	Screw
10	Diaphragm
11	Inlet Cover
12	Outlet plate
13	Outlet cover
14	Washer
15	Nut
16	Sleeve
17	Fitting
18	O-ring*
19	Pad holder
20	Pad unit*
21	Pad retainer
22	Outlet flange
25	Screw
26	O-ring*
27	Screw
28	O-ring*
29	Label support
30	Label
31	Rivet
32	Label
33	Spring collet
34	Indicator
35	O-ring*
36	Support
37	O-ring*
38	Bush
39	Indicator label
40	Cap
43	SR silencer
46	O-ring*
47	O-ring*
48	Washer
59	Eyebolt
61	Special screw
62	Screw
63	Elastic washer
64	Screw
64	Screw
65	Elastic pin
400	Plate
401	Bush

Key	Description
402	O-ring*
403	Support
404	O-ring*
405	Spring collet
406	Indicator
407	Nut
408	Bracket
409	Support
410	Proximity switch
411	Fitting

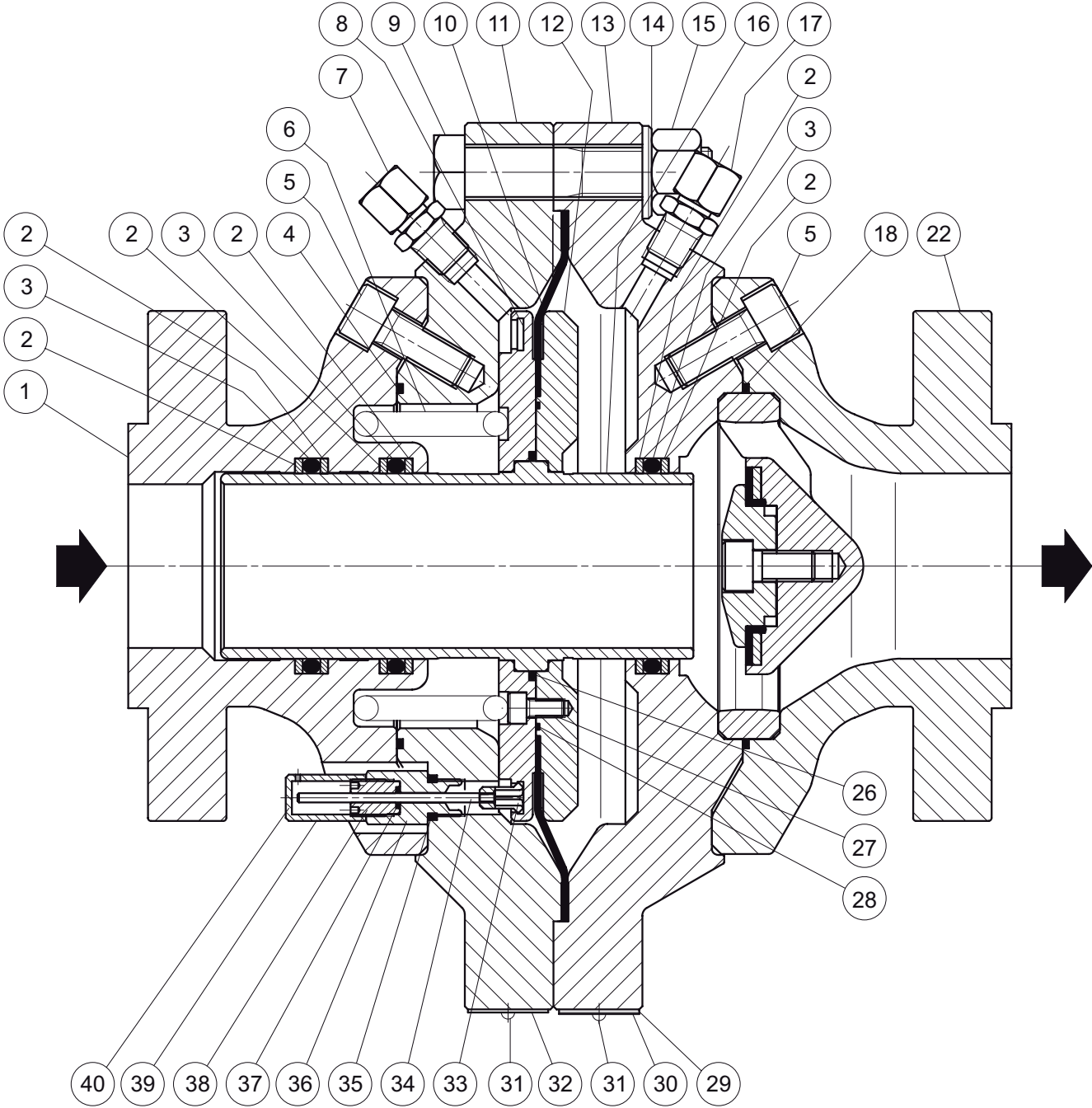
Type PRX/182 Pilot (See Figure 13)

Key	Description
1	Adjusting screw
2	Nut
3	Cap
4	O-ring*
5	O-ring*
6	Spring carrier plate
7	Spring
8	Upper cover
9	Spring carrier plate
10	Screw
11	Washer
12	Filter
13	Plate
14	Diaphragm*
15	Plate
16	Body
17	O-ring*
18	O-ring*
19	Seat
20	Nut
21	Lower cover
22	Pad holder unit*
23	Stem
24	Plate
25	O-ring*
26	Nut
28	O-ring*
29	Plate
31	Screw
33	Plug
34	Plug
35	Extension

Rubber parts marked with (*) are supplied in the "spare parts kit", recommended as stock.

To order the kit it is necessary to communicate to us the type of the relief valve or pilot and its serial number.

Schematic Assemblies

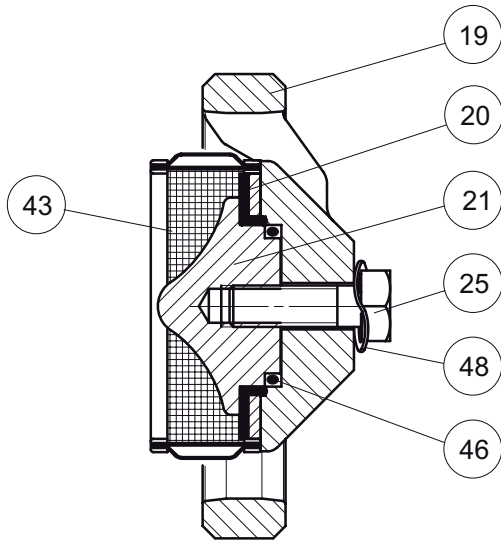


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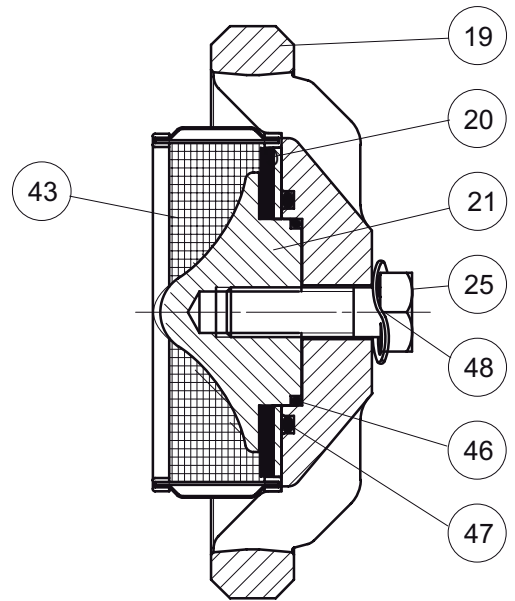
Figure 8. VS-FL Relief Valve DN 25 to DN 150

Type VS-FL

SILENCED VS-FL

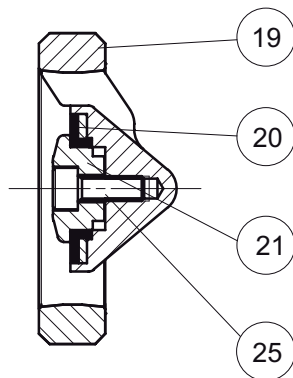


**PAD HOLDER
DN 25 TO DN 50**

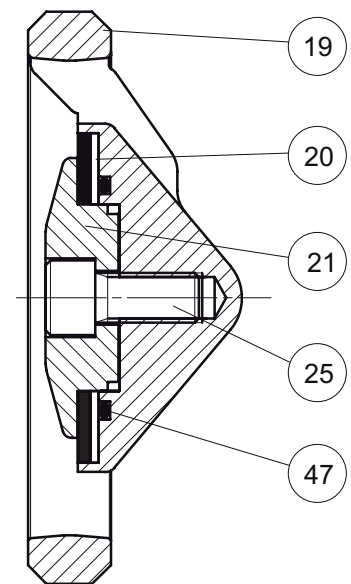


**PAD HOLDER
DN 65 TO DN 150**

NOT SILENCED VS-FL



**PAD HOLDER
DN 25 TO DN 50**



**PAD HOLDER
DN 65 TO DN 150**

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Figure 9. Pad Holder for VS-FL Relief Valve DN 25 to DN 150

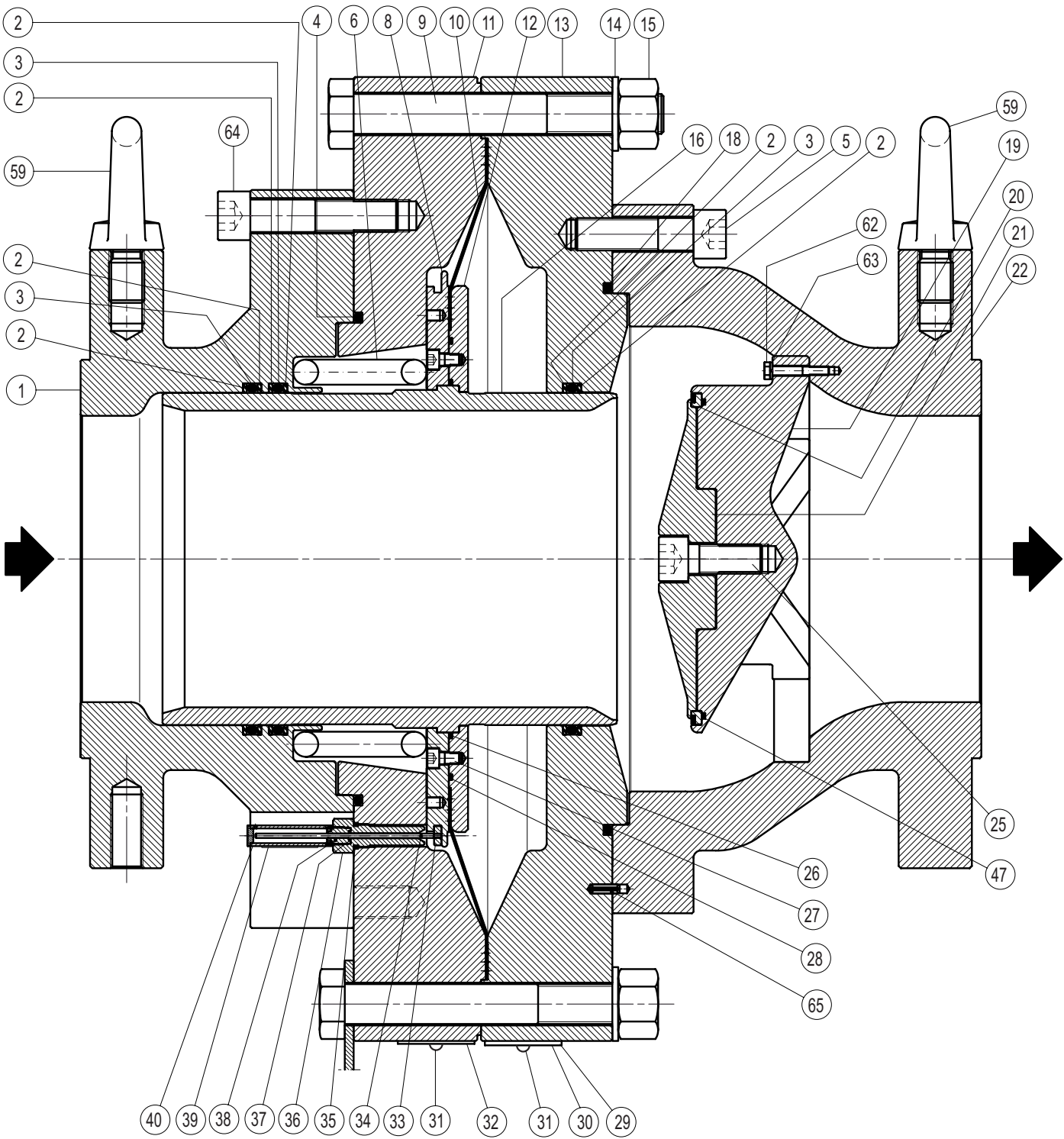


Figure 10. VS-FL Relief Valve DN 200

Type VS-FL

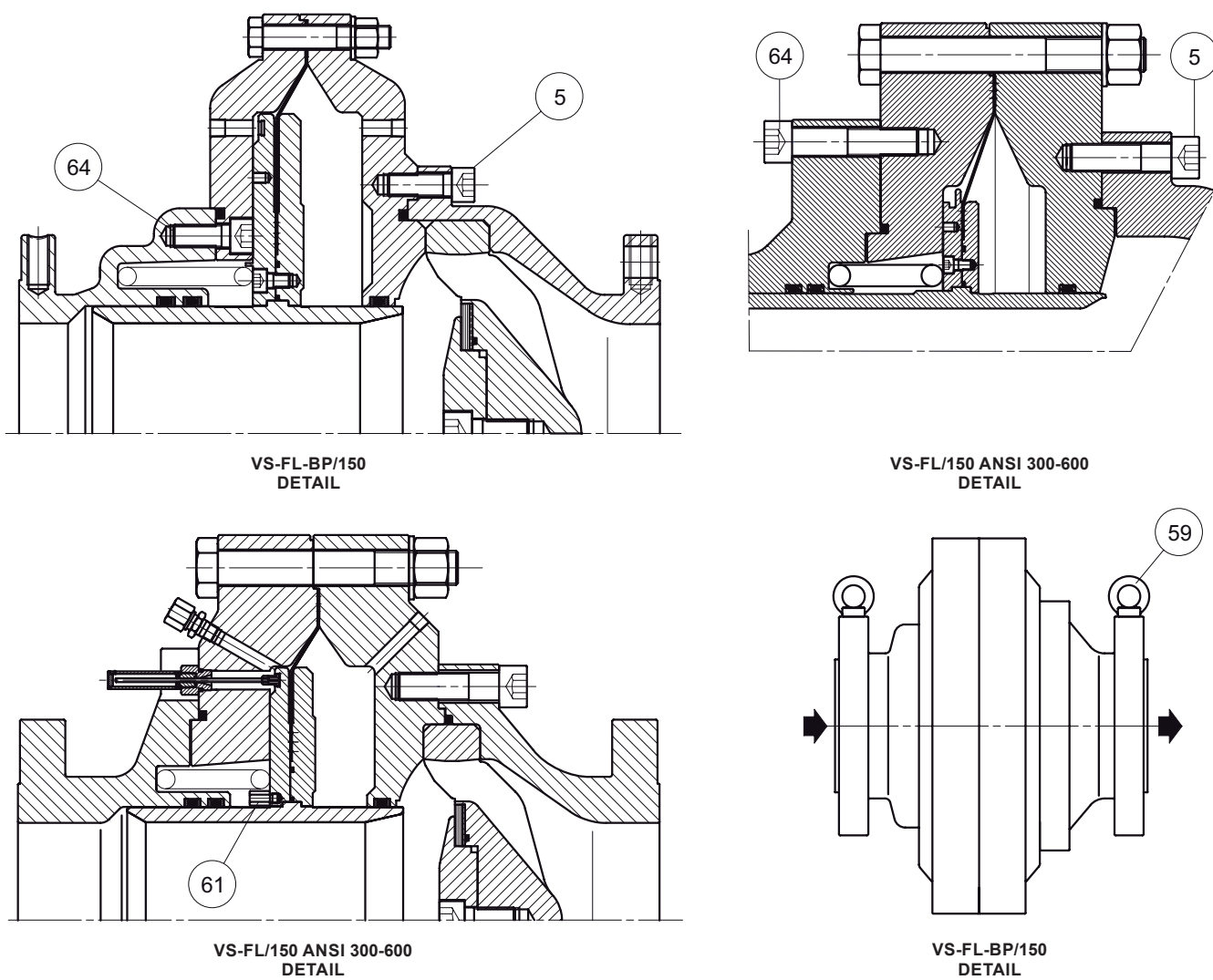
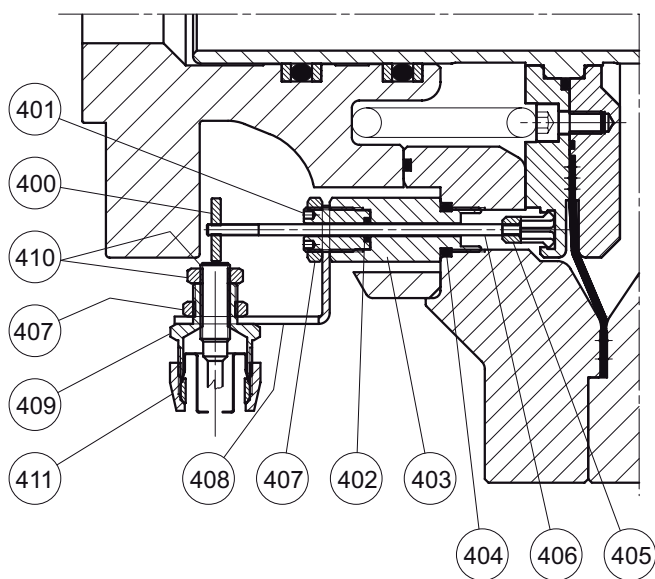
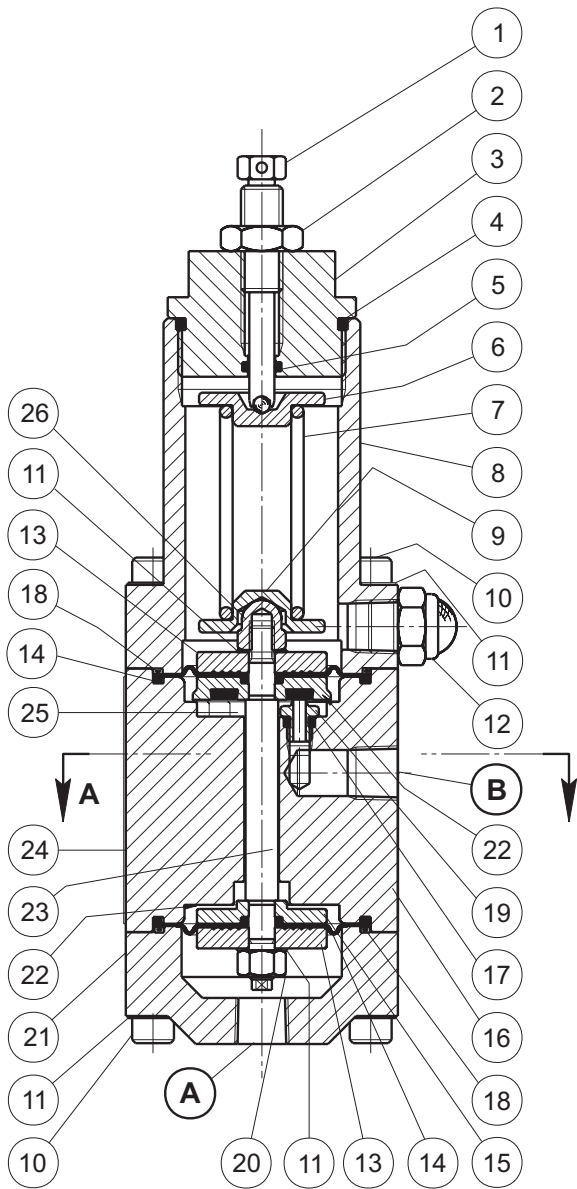


Figure 11. VS-FL Relief Valve DN 150 Various Versions

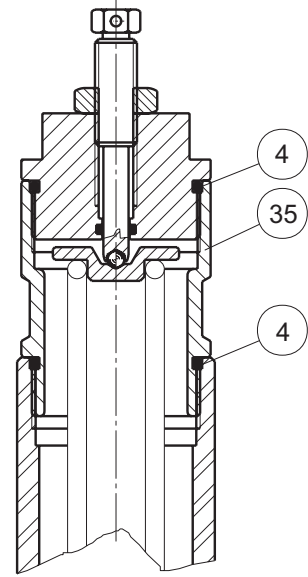


VS-FL/ AND VS-FL-BP/
WITH PROXIMITY SWITCH VERSION

Figure 12. VS-FL Relief Valve DN 25 to 150 with Proximity



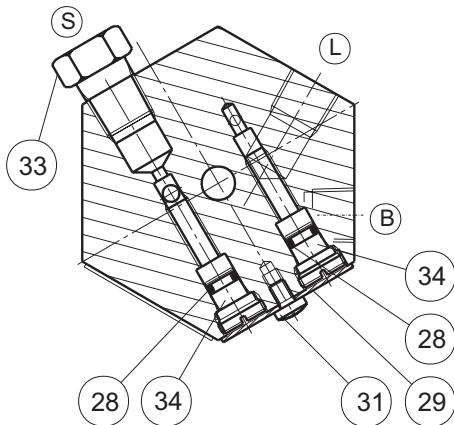
TYPE PRX/182



AP VERSION

Table 6. Type PRX/182 and PRX-AP/182 Connections

A	B	I
To the controlled pressure	To Chamber 2 of the relief valve	To the controlled pressure



SECTION A-A

LM/1390

Figure 13. Type PRX/182 and PRX-AP/182 Pilots


Type VS-FL

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