



SEMPPELL SERIES VSE 0 SAFETY RELIEF VALVES

OPERATING INSTRUCTIONS

Before installation these instructions must be fully read and understood

Series

VSE 0 Full lift safety relief valve and normal safety valve.

For media of -196°C to +200°C

The application temperature of 200°C must not be exceeded during normal operation. In case of a guaranteed local temperature of the safety valve not higher than 200°C (e.g. because of a remote arrangement), the operational medium temperature of the system to be protected can be clearly exceeded (up to about 300°C).

Design

Design according to TO.270.01.

- closed spring bonnet
- spring-loaded (cylindrical compression spring)

Also applicable to the following accessories:

- SN 102, without easing gear
- SN 123, disc for liquids
- SN 124, disc with O-ring

Seat diameter $d_o = 7.5 \text{ mm}; 9.0 \text{ mm}$

Nominal size: DN 15 and 25, NPS ½ and 1

Observe design data on the tagplate!

ATTENTION!

This operating instruction does not specify the extent of delivery. It is valid for several sizes, designs, accessories and additional devices. It contents generally exceeds the contractual determined extent of delivery.

1 DANGER AND WARNING INDICATIONS

The construction of the Sempell safety valves corresponds to the latest state of engineering and the valid safety regulations.

Nevertheless, improper use or improper installation can cause risks for the personnel or can lead to restrictions in regard of the operational safety. Therefore, the Sempell GmbH recommends the operator of the safety valves to take appropriate measures and make sure that the present operating instructions are read and understood by the assigned personnel.

APPLICATION LIMITS

It is only allowed to use the valves according to the details of these operating instructions and according to the parameters and application cases agreed in the delivery contract (see nameplate). The application of the valve has to take place adequate to the medium tolerances of the used materials.

WARNINGS FOR THE OPERATING AND MAINTENANCE PERSONNEL

Before commissioning and maintenance works familiarise yourself with the legal accident prevention regulations, the local safety instructions and this operating instruction and observe them.

Use the safety valve and its individual parts and accessories only for the purpose intended by us.

Please observe the following points besides the notes given in the text:

- Danger of burning at safety valves and with the connected pipes while operating under increased temperature.
- Disassembly of the safety valve only in case of pressureless plant and after cooling down.
- Protection against risks caused by evaporation also in case of pressureless system; for information please contact the safety inspector concerned.
- After assembly check all sealing points in regard of tightness.
- In case of adjustment make changes at pressure screw and adjusting ring only with clearly reduced pressure to avoid unintended response.
- Carry ear protection during adjustment, if necessary.
- Danger of injury while discharging at disconnected discharge line.
- Extreme vibrations can lead to inadmissible increase of operating pressure with the possibly destruction of the safety valve or to the destruction of the balanced bellows with unintentional escape of medium.

Exclusion of liability

Sempell GmbH cannot be held liable in case of improper maintenance and adjustment of a Sempell safety valve, use of inadmissible spare parts or utilities and in case of a temporary or permanent connection of equipment with the safety valve which is not approved by us.

SEMPELL SERIES VSE 0 SAFETY RELIEF VALVES

OPERATING INSTRUCTIONS

Material specification	Area of operating temperatures
16	-196 to +200°C
17	-10 to +200°C

Take the material specification and the admissible pressure from the nameplate of the valve.

2 DESCRIPTION

Spring-loaded full lift safety relief valves and normal safety valves are direct acting safety valves to protect pressure tanks against inadmissible excess-pressure.

A cylindrical compression spring creates the closing force on the valve disc against the opening pressure of the medium below the valve disc. At normal operating conditions the valve seat will be held tight.

By changing the spring compression it is possible to change the set pressure. In case of exceeding set pressure, the pressure of the medium prevails and the safety valve opens.

With full lift characteristic the safety valve opens rapidly at full lift and discharges the total mass flow necessary to prevent a further pressure increase.

With normal characteristic the safety valve reaches the lift necessary for the mass flow to be discharged after the response within a pressure increase of max. 10%.

After a defined pressure decrease, the safety valve closes again.

By means of the lifting lever at the cap the safety valve can be opened by hand at a set pressure of 85% at least.

The safety valves are type tested and comply with the requirements of the standards and regulations.

Use within areas exposed to danger of explosion

The safety valves underwent a hazard analysis according to code 94/9/EC with the following result:

- The safety valves do not have a potential ignition source. ATEX 94/9/EC is not applicable to these valves.
- The valves safety may be used in the EX range
- Electrical / pneumatical accessories have to undergo a separate assessment of conformity according to ATEX.
- The surface temperature does not depend from the valve itself but from the operational conditions. Observe while installing.

3 OPERATION

3.1 Warning indications for the operation

Observe safety regulations!

ATTENTION

Unstable behaviour of safety valves such as chattering or vibrating can destroy the valve seat, the safety valve or the pipe and thus causing the failure of the safety function or the shutdown of the plant. Therefore, observe regulations and empirical notes regarding design and dimensioning, fitting and installation.

- Design and dimensioning: do not use larger safety valves than necessary! In case of back pressure use safety valves with bellows.
- Fitting and installation: lay supply line as short as possible. Use as few bends as possible.
- Keep supply line free from vibrations. Absorb or avoid pressure surges and waves, e. g. caused by pumps or other valves.
- Drain the discharge line and the valve body at their lowest point. Condensate can impair the function of the safety valve.
- Protect lines and valve against freezing.

3.2 Storage rules

To preclude damages during loading and unloading, move the valve cautiously.

Maximum weight: 7 kg

At delivery the outsides of all ferritic parts of the safety valve are supplied with a coat of paint except the welding edges.

The insides of the body are protected by a watery corrosion preservative that has a long-term effect because of the film formative active agents.

All connection inlets are closed by corresponding caps.

In this state the safety valve can be stored in closed, dust-free and dry rooms lying on a pallet without difficulties. Time of storage approx. six months.

A storage of more than six months asks for disassembly and visual check of the inner parts of the safety valve. A weather-protected outside storage is not allowed.

SEMPELL SERIES VSE 0 SAFETY RELIEF VALVES

OPERATING INSTRUCTIONS

For spare parts out of elastic material

(O-rings, scraper rings, rod and piston gaskets) additionally apply:

Temperature: The temperature of the storage shall be between 0°C and 25°C since otherwise a hardening of the material and so a shortening of durability will follow. Shield heating elements and lines in heated storeroom so that no direct heat irradiation arises. The distance between the heat source and the stocks has to be 1 m at least.

Moisture: to prevent the formation of condensate, avoid moist storerooms. A relative humidity of below 65% is at best.

Lighting: the products of elastic materials are to protect from direct sun light and from strong artificial light with a high ultraviolet part. Therefore supply the windows of the storerooms with a red or orange (in no case blue) paint.

Ozone: protect products of elastic materials from ozone (formation of cracks and embrittlement). The storeroom may not contain ozone generating systems (fluorescing sources of light, mercury vapour lamps, electric motors, etc.).

Oxygen: protect products out of elastic materials from draught by storage in airtight tanks. Oxygen causes cracking and embrittlement.

If these requirements are guaranteed for products out of elastic materials, the storage time is approx. 5 years.

For spare parts out of steel

Store the parts in closed, dust-free and dry rooms so that damages do not occur.

Especially the following protection measures have to take place:

Disc (3): wax coat of the gasket, net coat

Guide bush (2): protection by net coat

3.3 Installation instructions

NOTE

Clean pipes before installing safety valves since otherwise the valve seats can be damaged by foreign bodies when discharging!

Remove transport protection just before installation.

Check plant identification and details on the nameplate.

3.3.1 Installation

The installation zone must be easily accessible for maintenance works. Required free space above the safety valve see section "Dimensions". In case of large safety valves provide for additional space for lifting gears, at least 500 mm.

Position of installation vertical, inlet from below. Do not brace valve body when fastening; if necessary compensate bearing of the supporting brackets.

Lay line in such a way that neither static or dynamic forces nor forces caused by thermal expansion may be transferred to the valve body.

PLEASE NOTE

Stresses at the valve body may lead to leaking at the valve seat!

3.3.2 Inlet line

Arrange safety valve directly at the nozzle of the tank to be protected, if possible. Otherwise lay inlet line between tapping point and safety valve as short and as poor in resistance as possible.

In no case the inlet line diameter must be smaller than the inlet nominal size at the safety valve. The pressure loss of the inlet line must not exceed 3% of the set pressure at the greatest possible discharge quantity.

Check inlet line in regard of pressure vibrations according to FBR 153 as far as possible.

ATTENTION

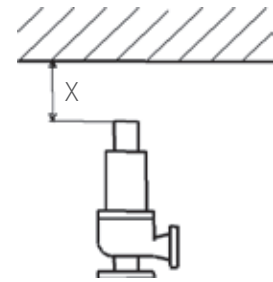
A pressure loss higher than the closing pressure difference may lead to an unstable, uncontrollable behaviour of the safety valve; chattering or vibrating may destroy the valve seat, the safety valve or the pipe and thus lead to failure of the safety function or to shutdown of the plant!

For discharge of condensate in case of gases and vapours, the inlet line must have a slope to the tapping point of 15 degrees at least.

ATTENTION

Condensate at the inlet of the safety valve changes the functional behaviour and may lead to an inadmissible pressure increase. Danger of explosion!

In case of liquids with temperatures higher than the ambient temperature, the inlet line must be assembled with slope to the safety valve, or designed as a siphon-type bend in front of the safety valve. Thereby, a heat transmission to the safety valve is avoided which could impair the tightness at the valve seat.



SEMPELL SERIES VSE 0 SAFETY RELIEF VALVES

OPERATING INSTRUCTIONS

3.3.3 Exhaust line

In no case the exhaust line diameter must be smaller than the outlet nominal size at the safety valve.

Back pressures in the exhaust line are admissible up to 15% of the set pressure

ATTENTION

Higher back pressures may lead to an unstable, uncontrollable behaviour of the safety valve; chattering or vibrating may destroy the valve seat, the safety valve or the pipe and thus lead to failure of the safety function or to shutdown of the plant!

At the deepest point the exhaust line must be equipped with a drain which is big enough to discharge minor leaks, e. g. in case of untight valve seat. Particularly in the open air exhaust line, valve body and drain must be protected against icing and freezing, e. g. by (electrical) trace heating; merely insulation is not sufficient!

ATTENTION

An icy, frozen or clogged exhaust line leads to the failure of the safety function! Danger of explosion in case of excess-pressure!

CAUTION

In case of several safety valves with one common exhaust line, take special safety precautions for disassembling of only one safety valve to exclude danger in case of unintended discharge of other safety valves!

Recommendation! Sound isolate exhaust line and/or provide the same with silencer; in doing so, regard allowable back pressure!

3.3.4 Insulating

In case of hot medium insulate inlet line and valve body. In case of gases and vapours insulate inlet line and valve body very carefully to avoid condensation.

ATTENTION

Condensate at the inlet of the safety valve changes the functional behaviour and may lead to an inadmissible pressure increase; danger of explosion!

The spring bonnet shall not be insulated as with heated spring the set pressure decreases.

3.4 Pressure test

The response of the safety valves must be prevented. For this purpose flange off the safety valve and close the inlet line by means of a blind flange.

ATTENTION!

After the pressure test, restore und control the ready-to-operate state!

3.5 Commissioning

The safety valve is delivered ready to operate. The set pressure is adjusted at works and secured against unauthorized adjustments by lead seal. Higher medium temperatures can lower the set point by about 1% per 100°C and ask for a readjustment under operating conditions.

3.6 Operational test

Function and reliability of the safety valves are proved by the type test. Generally operational tests are therefore not carried out in the system. This is usual for steam boiler safety valves only.

3.7 Discharge test

- Apply ear plugs.
- Slowly increase operating pressure in the system until the safety valve has fully opened.
- Lower operating pressure until the safety valve closes.

In case of several discharge tests with hot medium allow intermediate cooling down of the safety valve as caused by heating of the spring a slight decrease of the set pressure is possible.

ATTENTION

When discharging, some leaking medium may pass at the top of the spring bonnet (8) in case of unscrewed cap (12)(17). Danger of scalding by hot medium!

3.8 Adjustment of the set pressure

ATTENTION

A change of the lead sealed spring adjustment must only take place in the presence of the competent inspector.

The adjustment of the set pressure takes place on the test stand. If the set pressure is adjusted in the plant, the pneumatic measuring device A 143 should be applied as by means of this device the set pressure can be adjusted without increasing the operating pressure.

ATTENTION

Adjusting only with lowered pressure. At operating pressure working on the adjusting screw (10) may lead to unintended response of the safety valve. When discharging, some leaking medium may pass at the top of the spring bonnet (8) in case of unscrewed cap (12)(17). Danger of scalding by hot medium.

Remove lead seal. Unscrew cap (12) or (17). For cap (17) with easing gear, first screw off stuffing box (18) including lever (21); in doing so, hold lever (21) in vertical direction.

Loosen lock nut (11). For working at the adjusting screw (10) secure stem (4) or (14) against torsion, as otherwise the valve seat may be damaged. Hold stem (4) e. g. with a pin or stem (14) e.g. with a fixed spanner at the checked hexagonal nut (16).

Tighten adjusting screw (10) (turn right): set pressure higher

Loosen adjusting screw (10) (turn left): set pressure lower

After the adjustment secure adjusting screw (10) with lock nut (11). Assemble cap (12) or (17) and lead seal.

Standard values for the change of the set pressure in % for a quarter turn of the adjusting screw (10):

Orifice letter SKB	Changes in %
7.5	10
9.5	8

SEPELL SERIES VSE 0 SAFETY RELIEF VALVES

OPERATING INSTRUCTIONS

3.9 FUNCTIONAL DIFFERENCES

Gases / Vapours:

Opening excess pressure:	+5% p or 0.1 bar for p smaller than 3 bar
Closing excess pressure:	-10% p or 0.3 bar for p smaller than 3 bar

Liquids:

Opening excess pressure:	+10% p
Closing excess pressure:	-20% p or 0.6 bar for p smaller than 3 bar

3.10 TROUBLE SHOOTING

Malfunction	Cause	Remedies
Safety valve opens at different pressures	1. Condensate in the inlet line 2. Pressure change by superimposed vibration	1. Improve insulation of line. Observe drain and slope 2. Suppress vibrations at the safety valve
Safety valve opens and closes in rapid succession	1. Pressure loss in the inlet line is greater than the closing pressure difference 2. Discharge quantity is too small because the subsequent flow is too small 3. Admissible back pressure is exceeded in the exhaust line 4. Dynamic pressure drop in the inlet line, especially in case of liquids	1. Reduce flow resistance of the inlet line: Expand, shorten or remove constrictions. Fast remedy: Decrease lift (as far as allowed), therefore diminish outflow 2. Install smaller safety valve or adjust discharge quantity 3. Decrease flow resistance of the blow-off line: e.g. by expanding or shortening the pipe 4. Provide safety valve with a vibration damper
Closing pressure difference is too great	1. Saturated steam with high moisture	1. Insert spring (6) with higher tension
Safety valve stays open after discharge test	1. Foreign bodies between body seat and disc (3)	1. Repeat discharge test or blow off foreign bodies by lifting the lever (21). Otherwise disassemble valve
Safety valve fails to close tightly	1. Valve seat damaged 2. Body forming by pipe forces 3. No slope of the inlet line in case of hot liquids	1. Disassemble valve. Rework valve seat and disc (3) 2. Lay pipe elastically 3. Assemble inlet line with slope to the safety valve or lay siphon-type bend

4 INSPECTION AND MAINTENANCE WORKS

Inspection intervals depending on frequency of response and operating conditions, e. g. annually, under severe conditions twice a year. Keep certificates about performed works.

During patrols

- Check valve in regard of tightness. Therefore observe the following indications: whistling noises, medium emerging at the bonnet, medium at the drain nozzle or in the exhaust line.

During each inspection

- Check all gaskets. Replace them if leaky.
- Control seat faces.
- Smooth valve seat and disc (3) with fine lapping paste. If necessary, replace disc (3).
- Smooth guide areas of the stem (4) and guide bush (2) without material abrading machining.
- In case of damaged ball (5) replace also disc (3) and stem (4) at the same time.

At larger intervals, e.g. each 3 years

- Completely disassemble safety valve.
- Clean and control valve parts.
- Rework valve seat and disc (3) with fine lapping paste; if necessary, replace disc (3). In case of rework observe functionally important outlines at the valve seat.
- Replace spring (6) in case of corrosion or temperature damage and adjust set pressure again.
- Smooth guide areas of the stem (4) and guide bush (2) without material abrading machining.
- Lubricate adjusting screw (10).
- Treat sliding guides not in contact with the medium, fits, gaskets and threads with an assembling lubricant.

ATTENTION

Do not treat valve seats, metallic sealing surfaces and sliding guides in contact with the medium.

ATTENTION

For oxygen application all parts in contact with the medium must be free from oil and grease. Danger of explosion!

SEMPELL SERIES VSE 0 SAFETY RELIEF VALVES

OPERATING INSTRUCTIONS

5 DISASSEMBLY

5.1 Danger and warning indications

ATTENTION

Take work order and wait until the installation is switched free.

Check if the valve is pressureless and cooled down.

Residual medium may escape when opening and disassembling the valve; also at pressureless plant further evaporations are possible.

Loosen spring bonnet (8) only when the spring (6) is released as otherwise the thread of the spring bonnet (8) cannot absorb the initial stress of the spring (6).

5.2 Instructions for disassembly

- For works at the adjusting screw (10), secure stem (4) or (14) against torsion as otherwise the valve seat can be damaged. Hold stem (4) e. g. with a pin. Hold stem (14) e.g. with a fixed spanner at the checked hexagonal nut (16).

5.3 Tools

- fixed spanner 10 - 55 mm
- seal wire, lead seal, lead-sealing pliers
- piston ring pliers
- vernier calliper
- flatnose pliers
- lapping wheel according to valve seat
- side cutting pliers
- fine emery cloth
- pin Ø 2 mm

5.4 Operating materials

5.4.1 Lubricating the removable valve components

To lubricate the removable or detachable valve components during assembly, use the greases specified in Table A. Removable or detachable valve components are all screw connections, especially pressure-retaining screw connections, and other components within the distribution of forces. All removable or detachable valve components are lubricated with the same grease if they are lubricated in the assembly process.

The operating temperature of the valve is definitive for selecting the grease to be applied for the removable valve components (cf. Table A).

TABLE A: Greases for lubricating the removable valve components

Design temperature of the valve T_B	Grease
$T_B < 400^\circ\text{C}$	Molykote® BR 2 Plus ^[1]
$400^\circ\text{C} \leq T_B < 700^\circ\text{C}$	Molykote® P 37 ^[1]

^[1] Before applying the grease, ensure that the surfaces are metallically blank (free of oil, grease, etc.) and free of dirt particles.

The greases specified in Table A are manufactured and/or supplied by the following manufacturers and/or suppliers:

Grease:	Manufacturer / Supplier:
Molykote® BR 2 Plus	Dow Corning GmbH Wiesbaden Rheingastr. 34, 65201 Wiesbaden
Molykote® P 37	Dow Corning GmbH Wiesbaden Rheingastr. 34, 65201 Wiesbaden

5.4.2 Lapping abrasives

It is necessary to use special lapping abrasives that contain finely distributed hardened particles for lapping seat surfaces on body and disk seats. The lapping abrasive specified in Table B is recommended by Sempell:

TABLE B: Lapping abrasives, suitable for the finishing of valve seats

Lapping abrasive:	Manufacturer / Supplier:
TETRABOR® Boron carbide (F 100 - F 1200)	ESK Ceramics GmbH & Co. KG Max - Schaidhauf-Str. 35, 87437 Kempten - Germany

5.4.3 Further operating materials

Further required operating materials and their usage are specified in Table C and are manufactured and/or supplied by the following manufacturers and/or suppliers:

TABLE C: Further operating materials

Usage	Type	Manufacturer / Supplier
Degreasing agent	Isopropylalkohol (2-Propanol)	
Assembly lubricant (colloidal graphite) for parts in contact with the medium	DAG® 156	Acheson Industries, Dornstadt

ATTENTION

For oxygen application all parts in contact with the medium must be free from oil and grease. Danger of explosion.

SEMPELL SERIES VSE 0 SAFETY RELIEF VALVES

OPERATING INSTRUCTIONS

5.5 Dismantling the safety valve

Remove lead seal. Unscrew cap (12) or (17). For cap (17) with easing gear, first screw off stuffing box (18) including lever (21); in doing so, hold lever (21) in vertical direction. Measure and record distance between upper edge of stem (4) or (14) and adjusting screw (10).

Detach and remove checked nuts (15) (16). Loosen lock nut (11) and release spring (6) by means of adjusting screw (10). Screw off spring bonnet (8). Remove spring (6) and spring plate (7). Lift off disc (3) and guide bush (2) simultaneously e. g. with a piston ring pliers.

Disassemble stuffing box (18) with lever (21) only if necessary.

6 ASSEMBLY

Assemble disc (3), guide bush (2), sealing ring (9), stem (4) or (14), spring (6) with spring plates (7) and spring bonnet (8). Prestress spring (6) by means of adjusting screw (10) onto the same dimension as measured before disassembling. Thus, the same set pressure as before. Secure adjusting screw (10) with lock nut (11).

Lay on gasket (13). Screw on cap (12). In case of cap (17) with easing gear, screw off nuts (15) (16) at the upper end of the stem (14) and secure it. Screw open cap (17) and thread in stuffing box (18) with lever (21) over gasket (24); in doing so, hold lever (21) in vertical position. In case of unscrewed cap (17) the lever (21) shall have a backlash of approx. $\pm 15^\circ$. Otherwise shift checked nuts (15) (16). Lead seal cap (12) or (17).

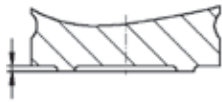
SEMPELL SERIES VSE 0 SAFETY RELIEF VALVES

OPERATING INSTRUCTIONS

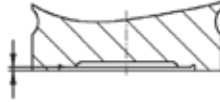
7 DIMENSIONS FOR MOUNTING BRACKET

d0	d1	d2	f1	f2	f3
H8	+0.10	-0.05	+0.05	-0.10	+0.05
7.5	8.25	9.45	0.50	0.50	0.30
9.0	9.90	10.95	0.50	0.50	0.30

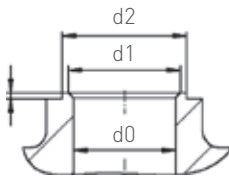
Disc for gases, vapours



Disc for liquids SN 123



Valve seat for gases, vapours and liquids



8 METHODS TO PRODUCE SUPERFINISHED SEALING SURFACES

ATTENTION

Lapping is a precision operation and must be carried out by trained personnel. Various operating areas ask for various operating methods.

8.1 Lapping area production

8.1.1 Disc (3)

Parts with flat seats are normally machine lapped.

Procedure

Allow boron carbide lapping emulsion (a mixture of grade 800 lapping powder and lapping oil) to drip onto the constantly rotating lapping machine wheel. Load the items to be lapped into a suitable locator that is set eccentrically to the table.

The lapping operation takes 15 to 20 minutes depending on the quality of the prepared sealing surface. Afterwards the parts will be polished. In case of parts made of material 1.4980 the parts will additionally be polished on a tin plate with a diamond suspension; grain size 2 - 3. A sight control and a test with an interference glass follow to check whether the surface is plane and not convex or concave.

8.1.2 Valve seat

The preferred method is hand operated machine lapping in case the valve seat is installed in the body (screwed in, welded in or in another connection). Thereby it is important that the required force is constantly and steadily transferred through a spring.

Procedure

Grinding and/or lapping foils of different grain sizes are pasted onto a plain carrier wheel of the machine. The prepared seating areas with 3.2 Ra roughness are alternately lapped with grain sizes of 200-600-1000. After lapping with 200 grain size, there should be no visible tool marks. The change takes place at intervals of about 1 minute. Lapping is carried out with oscillating movements. Finally the seating area is cleaned and visually inspected.

8.2 Lapping area site

As a rule, there is no lapping machine available so only a manual method or the method described in Section 8.1.2 can be used.

8.2.1 Disc (3)

Depending upon their size, lap the parts on glass plates or discs or rings made of grey cast iron. Lapping abrasive: Tetra Bor lapping paste (grade 120 to 1200).

Procedure

Up to a size of about 200 mm diameters lap the parts on the plates. In case of greater diameters, use the part to be lapped as a pad and move the discs or rings. Thinly distribute the lapping abrasive on one side and up a grain size > 400 additionally sprinkle it with oil drops. Oscillatingly move the valve part or the lapping wheel with constant hand pressure. This operation takes several minutes. Remove the paste with a cold cleaning and repeat the procedure using progressively finer lapping paste. Finally a sight control follows.

Up to a size of approx. 200 mm diameter lap the discs with a mobile manual lapping machine according to section 8.1.2.

8.2.2 Valve seat

Procedure see Section 8.1.2.

ATTENTION

Check body seats regularly to verify that the seat surfaces are still rectangular to the body center. If this is not the case, restore squareness by using a flat grinding machine.

9 DECLARATION TO EC-DIRECTIVE

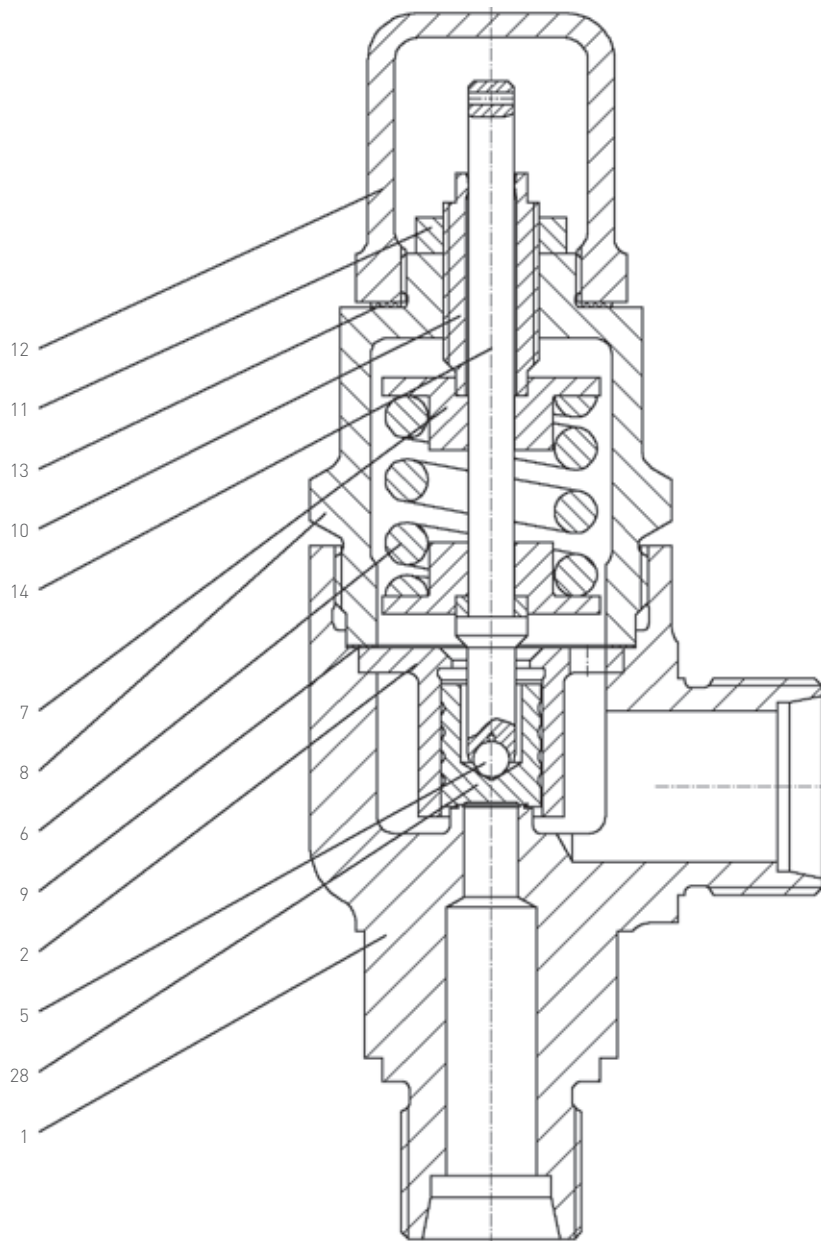
The declaration of conformity can be found in the documentation.

SEMPELL SERIES VSE 0 SAFETY RELIEF VALVES

OPERATING INSTRUCTIONS

10 PART LIST AND ASSEMBLY DRAWINGS

VSE 0 WITHOUT EASING GEAR



PARTS LIST

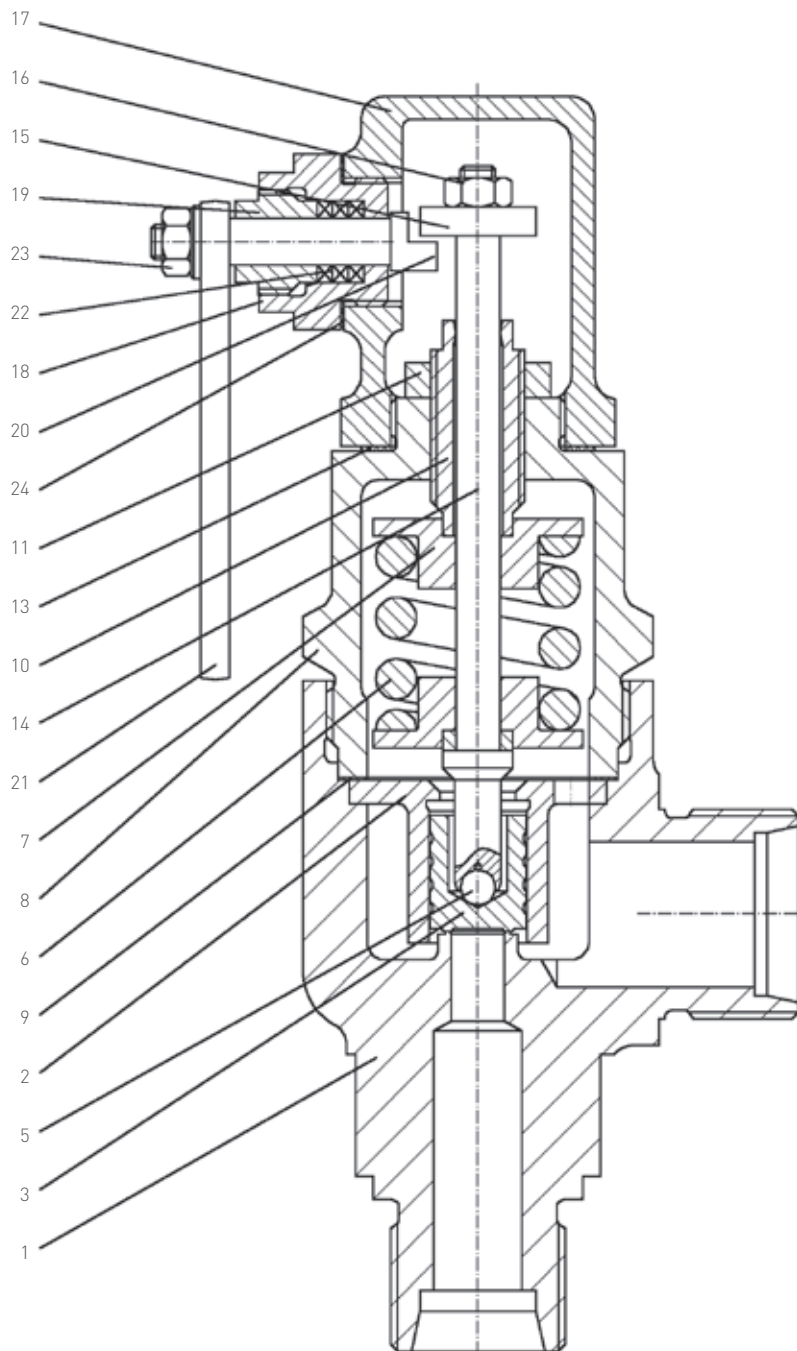
Part	Name
1	Body
2	Guide bush
3 •	Disc
4 •	Stem
5	Ball
6	Spring
7	Spring plate
8	Spring bonnet
9	Gasket
10	Adjusting screw
11	Lock nut
12	Cap
13 •	Gasket
14 •	Stem
15	Round nut
16	Hexagonal nut
17	Cap
18	Stuffing box
19	Gland
20	Shaft
21	Lever
22	Packing
23	Hexagonal nut
24 •	Sealing ring
25	Inlet flange
26	Outlet flange
27	Gasket
28	Disc for liquids
30	Disc with O-ring

• Recommended spare parts

SEPELL SERIES VSE 0 SAFETY RELIEF VALVES

OPERATING INSTRUCTIONS

VSE 0 WITH EASING GEAR



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