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 of the series S corresponds to the standard technology 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 this operating instruction 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.
Plant downtimes

NOTICE
For longer system downtimes, a downtime preservation must be carried out.

If systems are set out of operation for a shorter or longer time, procedures (VGB - R 116) depending on downtime duration and frequency should be applied to preserve the system.

Limitation of liability
All specifications and notices in this instruction manual were drawn up with consideration of the applicable standards and regulations, the status of technology and our longstanding findings and experiences.

The manufacturer does not assume liability for damages in the following cases:
• Non-adherence to this instruction manual
• Usage deviating from the intended use
• Employment of untrained personnel
• Independent reconstruction
• Technical modifications
• Usage of unauthorized spare parts
• Use of unauthorized operating media
• Improper maintenance and setting of the valve

• Temporary or permanent connection of devices not authorized by us

The actual scope of delivery may deviate from the explanations and figures described here regarding special versions, the utilization of additional order options or due to newest technical modifications.

The obligations, General Business Terms and Conditions and the delivery conditions of the manufacturer agreed upon in the delivery contract are applicable, along with the legal regulations valid at the time of contract conclusion.

2 DESCRIPTION

Spring-loaded safety valves are direct acting safety valves with which pressure vessels are protected 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. Under normal operating conditions the valve seat is kept tight.

By changing the spring compression the set pressure can be changed. When the set pressure is surpassed, the pressure of the medium prevails and the safety valve opens.

In case of full-lift characteristic the safety valve opens abruptly over the full lift and discharges the whole mass flow which is necessary to prevent further increase of the pressure.

The safety valve closes again after a defined pressure reduction.

Please observe the planning manual for the precise design of the safety valves.

For the application of this operating instruction please take the exact type name (e.g. SC, SB) from the nameplate of your valve.

Please observe the following points besides the notes given in the text
• Danger of burning at safety valves and with their connected lines while operating under increased temperature.
• Disassembly of the safety valve only in case of pressureless plant or 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 substantially reduced pressure to avoid unintended response.
• Carry ear protection during adjustment, if necessary.
• Danger of burning by discharge of small amounts of possibly hot medium in case of safety valves with open spring bonnet (type SO).
• Danger of injury while discharging in case of 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.
• In case the valve is provided with a steam jacket or a steam flushing device, the corresponding design must be considered while connecting.

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 area
• Electrical / pneumatically 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 line 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: design 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 valves cautiously. At delivery the outsides of all ferritic parts of the safety valve are supplied with a coat of paint except the welding edges and gasket surfaces. The insides 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 about six months. Storage of more than six months asks for a disassembly and a visual check of the inner parts of the safety valves. A weather-protected outside storage is not allowed.

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 boxes. Oxygen causes cracking and embrittlement. If these requirements are guaranteed for products out of elastic materials the storage time is about 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
- Disc holder (7): protection by net coat

3.3 Transport instructions

The welding ends or flanges are protected by plastic caps. The coating is a primer which is designed to provide protection against corrosion during transport and storage. Do not damage the layer of coating. Transport is only permitted on original manufacturer’s transport items (e.g. pallets).

WARNING

Material damage due to improper transport!
If not transported properly, transport items can fall or crash. This can result in significant material and personal damage.
3.4 Installation instructions

NOTE
Clean lines before installing safety valves as otherwise the valve seats can be damaged by foreign particles when discharging!

• Remove plastic caps protection just before installation.
• Check plant identification and details on the nameplate.
• Vertical installation position, inlet from below. Prevent bracing of the valve body by connected line.

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

The installation point must be easily accessible so that necessary maintenance works can be carried out. The free space above the valve should at least correspond to the dimension X (see table). In case of major valves (over 4") additional space should be provided for lifting gears, at least 500 mm.

In case of hot medium, e.g. steam, insulate supply line and valve body. The spring bonnet must remain free. Without insulation the produced condensate may cause malfunction.

### Orifice letter Overhead dimension X [mm]

<table>
<thead>
<tr>
<th>Orifice letter</th>
<th>Overhead dimension X [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>D – J</td>
<td>300</td>
</tr>
<tr>
<td>K – R</td>
<td>700</td>
</tr>
<tr>
<td>T</td>
<td>900</td>
</tr>
<tr>
<td>T1</td>
<td>1000</td>
</tr>
<tr>
<td>U – Z</td>
<td>1200</td>
</tr>
</tbody>
</table>

Y = Upper edge insulation

3.5 Connection of lines

3.5.1 Inlet line
If possible arrange safety valve directly at the nozzle of the tank to be protected. Otherwise lay inlet line between tapping point and safety valve as short and as low in resistance as possible. In no case the inlet line diameter shall be smaller than the inlet nominal size of the safety valve.

The pressure loss in the inlet line must not exceed 3% of the set pressure at the highest 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 line and thus lead to the failure of the safety function or to the shutdown of the plant!

In order to facilitate the drainage of condensate, the inlet line must be mounted to the valve with at least a 15-degree ascending slope position.

**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.
3.6 Pressure test of installation

The response of the safety valve must be prevented. Either flange off the safety valve and close the supply line with a blind flange or block the valve. In case of welded-in safety valve a pressure test insert can be used.

ATTENTION

In case of a blocked safety valve the test pressure can amount up to 1.5 x of the set pressure without consultation with Sempell.

3.5.2 Exhaust line

In no case the exhaust line diameter must be smaller than the outlet nominal size of the safety valve. For valves type SO and SC back pressures up to 15% of the set pressure and for valves with bellows of type SB and valves with compensating piston (SN 144) back pressures up to 50% are acceptable unless there are other restrictions such as mechanical loading capacity of the bellows or insufficient strength of the body connection flange.

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 line and thus lead to failure of the safety function or to shutdown of the plant!

ATTENTION

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

At the deepest point the exhaust line must be equipped with a drain large enough to enable the discharge of 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 insulating is not sufficient!

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!
For orifice D to T1 loosen the 4 cap bolts (21) and for orifice U to Z the four hexagonal screws (21.1). Remove the cap top (20) and put it reversed on place again. Now it rests on the spindle end (11) and will be retightened again. Now the valve is blocked. The signal pin (35) or the blocking screw fixed in the cap top (20) points upward and so shows the blocked state.

**ATTENTION**

*After the pressure test restore and control the ready-to-operate state.*

### 3.7 Commissioning

The blocking screw must be removed for all valves delivered in the blocked position. The safety valve is ready for operation. The set pressure is adjusted and lead sealed to prevent unauthorized adjustment. Higher medium temperatures can lower the response point by about 1% per 100 °C and require a readjustment under operating conditions. Please take standard values from the table in section 3.9, "Adjustment of the set pressure".

### 3.8 Operational test, discharge test

The function and reliability of the safety valves, type S, have been proved by a type test conducted by the US National Board of Boiler and Pressure Vessels Inspectors as well as by a component test according to VdTÜV 966. Therefore, an operational test in the plant need not be conducted and is restricted to exceptions, normally at the time of revision of steam boiler safety valves.

Before discharge test, apply ear plugs. Slowly increase the operating pressure in the plant until the safety valve is fully opened. Lower the operating pressure until the safety valve closes. In case of several discharge tests with hot steam allow intermediate cooling down of the safety valve as, caused by the heating of the spring, a slight decrease of the set pressure is possible.

**ATTENTION**

*In case of safety valves, type SO.. (with open valve bonnet) some leaking medium may pass out at the bonnet (12) when discharging. Danger of scalding by steam!*

### 3.9 Adjusting 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. It shall be adjusted in the plant only if there is no other possibility. In any case the adjustment in the plant should be applied with the pneumatic measuring device A 143 as by means of this device the set pressure can be adjusted without increasing the operating pressure (see Technische Schrift KW 271; Sesi-Test, "Mobile Device A 143 for the Test of Spring-loaded Safety Valves").

Apply ear plugs.

**ATTENTION**

Perform adjusting works only at lowered pressure. At operating pressure, unscheduled response of the safety valve can occur when the adjusting screw (17). Small amounts of leakages can escape at the spindle guide of the adjusting screw (17).

Remove the lead seal; take off cap (19, 20, 21). Loosen adjusting screw nut (18). For work at the adjusting screw (17) secure spindle (11) (or (7.2) (at orifice U-Z), SOH) against turning for otherwise the valve seat (2.1) or the bellows (8) can be damaged. Tighten adjusting screw (17) (turn right) = set pressure higher

Loosen adjusting screw (17) (turn left) = set pressure lower.

Secure adjusting screw (17) with adjusting screw nut (18). Mount cap (19 ... 21) and lead seal.

Standard values for the change of the set pressure in % for a quarter turn of the adjusting screw (17):

<table>
<thead>
<tr>
<th>Orifice letter</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>D/E</td>
<td>10</td>
</tr>
<tr>
<td>F</td>
<td>7</td>
</tr>
<tr>
<td>G-K</td>
<td>4</td>
</tr>
<tr>
<td>L-N</td>
<td>3</td>
</tr>
<tr>
<td>P-R</td>
<td>1.5</td>
</tr>
<tr>
<td>T</td>
<td>1</td>
</tr>
<tr>
<td>T1</td>
<td>1</td>
</tr>
<tr>
<td>U-Z</td>
<td>0.5</td>
</tr>
</tbody>
</table>
3.10 FUNCTIONAL DIFFERENCES

<table>
<thead>
<tr>
<th>Gases / Vapours:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening excess pressure</td>
<td>+5% p or 0.1 bar for p smaller than 3 bar</td>
</tr>
<tr>
<td>Closing excess pressure</td>
<td>-10% p or 0.3 bar for p smaller than 3 bar</td>
</tr>
<tr>
<td>By means of the adjusting ring (5) a closing pressure difference of -7% p or 0.2 bar can be reached for p smaller than 2 bar.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Liquids:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening excess pressure</td>
<td>+10% p</td>
</tr>
<tr>
<td>Closing excess pressure</td>
<td>-20% p or 0.6 bar for p smaller than 3 bar</td>
</tr>
</tbody>
</table>

Change of the functional differences
(only valves with adjusting ring):

ATTENTION
Remove adjusting ring pin (6) only at reduced pressure.

Push a screwdriver through the hole and adjust the adjusting ring (5) groove by groove. One notch pitch corresponds to about 0.2 mm of change in height. The adjusting ring (5) has a right-hand thread.

Turn adjusting ring (5) up = closing pressure difference increases.

After the adjustment screw in adjusting ring pin (6) again.

3.11 TROUBLE SHOOTING

<table>
<thead>
<tr>
<th>Malfunction</th>
<th>Causes</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety valve opens at different pressures.</td>
<td>1. Condensate in the supply line. 2. Pressure change by superimposed vibration.</td>
<td>1. Improve insulation of line. Observe drain and slope. 2. Suppress vibrations at the safety valve.</td>
</tr>
<tr>
<td>Safety valve opens and closes in rapid succession.</td>
<td>1. Pressure loss in the supply 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 supply line, especially in case of liquids.</td>
<td>1. Increase closing pressure difference. Otherwise reduce flow resistance of the supply line: expand, shorten or remove area reductions. Fast remedy: reduce lift (as far as allowed), thus reduce discharge. 2. Install smaller safety valve. 3. Decrease flow resistance of the exhaust line; e.g. by expanding or shortening the line. 4. Provide safety valve with a vibration damper.</td>
</tr>
<tr>
<td>Closing pressure differences are too great.</td>
<td>1. Saturated steam with high moisture. 2. Adjusting ring (5) is set incorrectly.</td>
<td>1. Install spring with a higher spring rate. 2. See section 3.10</td>
</tr>
<tr>
<td>Safety valve remains open after discharge test.</td>
<td>1. Foreign bodies between body seat and disc (3).</td>
<td>1. Open valve again by pressure increase or A 143. In case of valves with lifting lever, lift and release it. Exhaust surge can blow off foreign bodies. Otherwise disassemble valve.</td>
</tr>
<tr>
<td>Safety valve does not close tightly.</td>
<td>1. Valve seat (2.1) damaged. 2. Difference between operating and set pressure is too small. 3. Forming of the valve body caused by too great line forces. 4. In case of liquids with high temperatures, no slope in the line to the safety valve.</td>
<td>1. Disassemble valve. Rework valve seat (2.1), if necessary replace disc (3). 2. Enlarge difference (section 3.9). 3. Lay line elastically. 4. Assemble supply line with slope to the safety valve or as a siphon.</td>
</tr>
</tbody>
</table>
SEMPPELL SERIES S, TYPES SO, SC, SB, SOH FULL-LIFT SAFETY VALVES
OPERATING INSTRUCTIONS

4 INSPECTION AND MAINTENANCE WORKS

Determine inspection intervals in dependence on response frequency and operating conditions. Keep certificates about performed works at the safety valves.

During tour
• Check valve in regard of tightness. Therefore observe the following indications: Whistling noises, medium emerging at the bonnet (12), medium at the drain nozzle or in the exhaust line.

During each inspection
• Check all gaskets. Replace them if leaky.
• Control seat faces.
• Recondition valve seat (2.1) and disc (3) with fine lapping paste; if necessary, replace disc (3) [section 7].
• Smooth disc holder (7) in the guide areas [without material abrading machining].
• Check bellows (8) of valves type SB.

At longer intervals, e. g. every 3 years
• Completely dismount safety valve (section 5.5).
• Clean valve parts.
• Recondition valve seat (2.1) and disc (3) with fine lapping paste; if necessary, replace disc (3). In case of rework observe functionally important dimensions at the valve seat [see table].
• Replace spring (15) in case of corrosion or temperature damage and adjust set pressure again (section 3.9).
• Lubricate bearing (33) and adjusting screw (17).
• Treat fits, gaskets and thread with a lubricant for assembly.

ATTENTION
Do not treat valve seats, metallic sealing faces and the guidings at the disc holder (7) and guide (10).

5 DISASSEMBLY

5.1 Danger and warning indications
Take work order and wait until the installation is switched free.

ATTENTION
Check if the valve is pressureless and cooled down.

CAUTION
Residual fluid may escape when opening and disassembling the valve.

FUNCTIONALLY IMPORTANT DIMENSIONS AT THE VALVE SEAT

<table>
<thead>
<tr>
<th>Orifice letter</th>
<th>Dim. in mm</th>
<th>D(API)</th>
<th>D(DIN)</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>d0</td>
<td>H11</td>
<td>10.5</td>
<td>14.0</td>
<td>14.0</td>
<td>14.0</td>
<td>17.5</td>
<td>22.5</td>
<td>28.0</td>
<td>36.0</td>
<td>43.0</td>
<td>53.0</td>
<td>60.0</td>
</tr>
<tr>
<td>d1</td>
<td>0,1</td>
<td>14.5</td>
<td>14.5</td>
<td>14.5</td>
<td>14.5</td>
<td>18.2</td>
<td>23.5</td>
<td>29.0</td>
<td>37.5</td>
<td>44.8</td>
<td>55.2</td>
<td>62.5</td>
</tr>
<tr>
<td>d2</td>
<td>0,1</td>
<td>15.4</td>
<td>15.4</td>
<td>15.4</td>
<td>15.4</td>
<td>19.4</td>
<td>24.8</td>
<td>30.8</td>
<td>39.5</td>
<td>47.0</td>
<td>57.5</td>
<td>65.0</td>
</tr>
<tr>
<td>h1</td>
<td>*</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>h2</td>
<td>**</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.6</td>
<td>0.9</td>
<td>1.1</td>
<td>1.6</td>
<td>1.7</td>
<td>2.2</td>
<td>2.5</td>
<td>2.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Orifice letter</th>
<th>Dim. in mm</th>
<th>P</th>
<th>Q</th>
<th>R</th>
<th>T</th>
<th>T1</th>
<th>U</th>
<th>V</th>
<th>W</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>d0</td>
<td>H11</td>
<td>79.0</td>
<td>104.0</td>
<td>125.0</td>
<td>140.0</td>
<td>185.9</td>
<td>206.0</td>
<td>230.0</td>
<td>270.0</td>
<td>323.0</td>
<td>376.0</td>
<td>438.0</td>
</tr>
<tr>
<td>d1</td>
<td>0,1</td>
<td>82.2</td>
<td>108.2</td>
<td>130.0</td>
<td>166.5</td>
<td>192.4</td>
<td>214.2</td>
<td>239.2</td>
<td>280.8</td>
<td>335.9</td>
<td>391.0</td>
<td>465.5</td>
</tr>
<tr>
<td>d2</td>
<td>0,1</td>
<td>85.0</td>
<td>111.0</td>
<td>133.0</td>
<td>169.5</td>
<td>196.0</td>
<td>217.2</td>
<td>242.2</td>
<td>283.8</td>
<td>338.9</td>
<td>394.0</td>
<td>459.5</td>
</tr>
<tr>
<td>h1</td>
<td>*</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>h2</td>
<td>**</td>
<td>3.5</td>
<td>4.9</td>
<td>5.8</td>
<td>7.5</td>
<td>7.5</td>
<td>7.5</td>
<td>7.5</td>
<td>7.5</td>
<td>7.5</td>
<td>7.5</td>
<td>7.5</td>
</tr>
</tbody>
</table>

* Replace nozzle (2) if h1 is smaller than the value in the table.
** Replace disc (3) if h2 is smaller than the value in the table.
5.2 Disassembling indications
Observe disassembling sequence to preserve the valve set pressure.

ATTENTION
Loosen bonnet nuts (14) only if the spring (15) is locked or released as otherwise the bonnet studs (13) cannot absorb the compression way of the spring (15).

For working at nuts (18, 22) or adjusting screw (17), secure the spindle (11) [or (7.2) (at orifice T1-Z), SOH] against rotating as otherwise the valve seat (2.1) or the bellows (8) can be damaged.

5.3 Tools
• Torque wrench 17 - 55
• Fixed spanner 16 - 95
• Socket wrench 13 - 30
• Pin spanners in different sizes
• Safety ring pliers for outer rings
• Flatnose pliers, side cutting pliers
• Seal wire, lead seal, lead-sealing pliers
• Screwdriver for slotted-head screws long 5,5
• Screwdriver for fillister socket head screws 5 - 14
• Hammer, punch
• Vernier caliper, depth gauge
• Lapping wheel according to valve seat

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).

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.

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 A - Greases for lubricating the removable valve components

<table>
<thead>
<tr>
<th>Design temperature of the valve $T_b$</th>
<th>Grease</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_b$ &lt; 400°C</td>
<td>Molykote® BR 2 Plus[1]</td>
</tr>
<tr>
<td>400°C $\leq T_b$ &lt; 700°C</td>
<td>Molykote® P 37[1]</td>
</tr>
</tbody>
</table>

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:

Molykote® BR 2 Plus - Dow Corning GmbH Wiesbaden, Rheingaustr. 34, 65201 Wiesbaden
Molykote® P 37 - Dow Corning GmbH Wiesbaden, Rheingaustr. 34, 65201 Wiesbaden

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

<table>
<thead>
<tr>
<th>Lapping abrasive</th>
<th>Manufacturer / Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>TETRABOR® Boron carbide (F 100 - F 1200)</td>
<td>ESK Ceramics GmbH &amp; Co. KG Max - Schaidhauf-Str. 35, 87437 Kempten - Germany</td>
</tr>
</tbody>
</table>

TABLE C - Further operating materials

<table>
<thead>
<tr>
<th>Usage</th>
<th>Type</th>
<th>Manufacturer / Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degreasing agent</td>
<td>Isopropylalkohol [2-Propanol]</td>
<td></td>
</tr>
<tr>
<td>Assembly lubricant [colloidal graphite] for parts in contact with the medium</td>
<td>DAG® 156</td>
<td>Acheson Industries, Dornstadt</td>
</tr>
</tbody>
</table>

ATTENTION
For oxygen application all parts in contact with the medium must be free from oil and grease. Danger of explosion.
5.6 Dismantling of the safety valve
Removal or disassembly of the possibly mounted pneumatic drive A 160 see operating instruction SEMSH-0067.
Remove lead seal. Take off cap [19, 20, 21].
Remove dowel [40] and spindle nut [22].
Measure distance from upper edge spindle (11) (or [7.2] (at orifice T1-Z), SOH) to upper edge adjusting screw (17) and register it. Loosen adjusting screw nut [18] and release the spring (15) by means of an adjusting screw (17).
Loosen bonnet nuts [14] and lift off bonnet (12). For valves from size ‘T’ equipped with a tightening nut [46] completely release spring (15) by turning up tightening nut [46].

For orifice D - T
Remove retainer [31] or lower bearing plate [32] which protects the pin [30] against being lost. Press out pin [30] and remove spindle (11) with spring (15) and accessory.

For orifice T1 - Z, SOH
Remove spring [15], spring plate [16] and accessory from spindle (7.2). By means of lifting gears draw spindle (7.2) upwards against the stroke stop and with complete internal parts carefully draw out vertically upwards.

ATTENTION
Disc (3) must not fall out of disc holder (7.1) in any case. Danger of damage! Possibly secure disc (3) by means of adhesive tape against falling out.

If required, further dismantle spindle assembly. For T1-Z and SOH, the spindle assembly can not be further dismantled. Dismount gaskets [24], guide [10] and, if available, intermediate flange. Remove disc holder (7.1) and disc (3).

ATTENTION
At valves with adjusting ring mark the locked groove at adjusting ring (5). Measure and record the distance between upper edge adjusting ring (5) and valve seat (2.1).

Unscrew adjusting ring pin (6) and adjusting ring (5). Dismantle nozzle (2) only if required. Dismantle cap [19, 20, 21] with lifting lever only if required.

5.7 Disassembly and installation of disc
Use lifting gears for big valves

6.2 Assembling of the dismantled safety valve

At valves with screwed nozzle
Screw in nozzle (2) with new gasket [23] into the body (1) and tighten up to the metallic stop.

At valves with adjusting ring
Turn adjusting ring (5) on the nozzle (2). Adjust it to the height measured during disassembly and secure it within the marked groove by means of the adjusting ring pin (6) turned into the body (1).

NOTE
If this information is no longer available, the following adjustment is recommended at the assembled valve. Turn adjusting ring (5) to the disc holder (7) up to the stop. Shift adjusting ring (5) downwards by the following numbers of notches:

<table>
<thead>
<tr>
<th>SKB</th>
<th>D/E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>P</th>
<th>Q</th>
<th>R</th>
<th>T</th>
<th>T1</th>
<th>U</th>
<th>V</th>
<th>W</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>15</td>
<td>18</td>
<td>23</td>
<td>26</td>
<td>28</td>
<td>23</td>
<td>30</td>
<td>35</td>
<td>72</td>
<td>81</td>
<td>60</td>
<td>70</td>
<td>84</td>
<td>98</td>
<td>114</td>
</tr>
</tbody>
</table>

6 ASSEMBLY

6.1 Mounting of the valve bonnet
Assemble valve bonnet again. Screw the bonnet nuts [14] onto the bonnet studs (13) and tighten them by tightening torques according to table. Loosen spindle nut (22). Check recorded measure from upper edge spindle (11) (or [7.2] (at orifice T1-Z), SOH) to upper edge adjusting screw (17).

In case of differences adjust adjusting screw (17). In doing so, the set pressure remains the same. Check adjusting screw (17) with adjusting screw nut (18). Secure spindle nut (22) with dowel (40). Put on cap parts (19) and (20) and tightly connect them with the bonnet (12) by means of cap bolts (21).
SEMPELL SERIES S, TYPES SO, SC, SB, SOH FULL-LIFT SAFETY VALVES
OPERATING INSTRUCTIONS

Insert disc (3) with disc retainer (4) into the disc holder (7) (see section 5.6). Put the assembly on the nozzle (2) into the body (1). Move guide (10) on the disc holder (7) and center it in the body (1). Take care that new gaskets (24) will be inserted.

**Only at orifice D - T**
Put spindle (11) on the disc holder (7) and connect both parts with the pin (30). Secure pin (30) with retainer (31) or lower bearing plate (32). In doing so, take care that the retainer (31) is fixed in the groove.

**Only at SOH**
Mount spindle assembly. Secure allen bolts (7.3, 10.4) by bordering or secure hexagonal nuts (10.5) by locking plate (10.6). Carefully insert spindle assembly [spindle and cover (10.1)] vertically upwards into the body (1) until the cover (10.1) rests into the pertaining centring of the body (1). Slowly lower spindle until the disc (3) rests on the body seat.

Mount washer (16), spring (15), washer (16), lower bearing plate (32) and bearing (33) on the spindle (11) (or (7.2) (at orifice T1-Z), SOH).

For some valves of the size 'T' to 'Z' the spring (15) must be precompressed before assembling the bonnet (12). Therefore screw the tightening nut (46) downwards up to the step of the spindle (11) (or (7.2) (at orifice T1-Z), SOH).

Place bonnet (12) into position. In doing so, insert spindle (11) (or (7.2) (at orifice T1-Z), SOH) into the adjusting screw (17). Fix bonnet (12) by means of bonnet studs (13) and bonnet nuts (14) by the tightening torques $M_A$ according to table. Prestress spring (15) with adjusting screw (17) to the dimension measured before disassembly. Therefore secure spindle (11) (or (7.2) (at orifice T1-Z), SOH) at dual-cornered shaft against torsion, as otherwise valve seat (2.1) or bellows (8) can be damaged. Fix spindle nut (22) with dowel (40) at the spindle end. In case of orifice D - S put on cap (19) and cap top (20) or in case of orifice T - Z cap (19) with new gaskets (25) and attach them on the bonnet (12) by means of cap bolts (21).

**Only at orifice K - T**
In case of a closed bonnet do not forget the gaskets (43) below the cap bolts (21).

<table>
<thead>
<tr>
<th>Nut material</th>
<th>Tightening torques $M_A$ [Nm] of bonnet nuts (14)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M10</td>
</tr>
<tr>
<td>Ferritic</td>
<td>30</td>
</tr>
<tr>
<td>Austenitic</td>
<td>20</td>
</tr>
</tbody>
</table>

After assembly check set pressure.
7 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.

7.1 Lapping area production

7.1.1 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.

7.1.2 Valve seat (2.1)
The preferred method is hand operated machine lapping in case the valve seat is fixed 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.

7.2 Lapping area site
As a rule, there is no lapping machine available so only a manual method or the method described in section 7.1.2 can be used.

7.2.1 Disc (3)
Depending upon the 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 about 200 mm diameter lap the discs with a mobile manual lapping machine according to section 7.1.2.

7.2.2 Valve seat (2.1)
Procedure see section 7.1.2.

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.

8 SPARE PARTS
- Disc (3)
- Disc holder (7)
- Bellows (8)
- Guide (10)
- Gaskets (23 - 26)
- Piston ring, slide ring (38)
- Gaskets (43) (47)

Please specify valve type and job no. (see nameplate) in your order.

9 DECLARATION TO EC-DIRECTIVE
The declaration of conformity can be found in the documentation.
SEMPELL SERIES S, TYPES SO, SC, SB, SOH FULL-LIFT SAFETY VALVES
OPERATING INSTRUCTIONS

10 ASSEMBLY DRAWINGS

Valve orifice D to J and below the pressure rates 09 (160)K and 03 (040)L.

TYPE SC..
Safety valve with closed bonnet for vapours, gases and liquids

<table>
<thead>
<tr>
<th>Part</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Body</td>
</tr>
<tr>
<td>2</td>
<td>Nozzle</td>
</tr>
<tr>
<td>2.1</td>
<td>Valve seat</td>
</tr>
<tr>
<td>3</td>
<td>Disc</td>
</tr>
<tr>
<td>4</td>
<td>Disc retainer</td>
</tr>
<tr>
<td>5</td>
<td>Adjusting ring</td>
</tr>
<tr>
<td>6</td>
<td>Adjusting ring pin</td>
</tr>
<tr>
<td>7</td>
<td>Disc holder</td>
</tr>
<tr>
<td>7.1</td>
<td>Disc holder</td>
</tr>
<tr>
<td>7.2</td>
<td>Spindle</td>
</tr>
<tr>
<td>7.3</td>
<td>Allan bolt</td>
</tr>
<tr>
<td>7.4</td>
<td>Straight pin</td>
</tr>
<tr>
<td>8</td>
<td>Bellows</td>
</tr>
<tr>
<td>9</td>
<td>Bellows cover</td>
</tr>
<tr>
<td>10</td>
<td>Guide</td>
</tr>
<tr>
<td>10.1</td>
<td>Cover</td>
</tr>
<tr>
<td>10.2</td>
<td>Guide bush</td>
</tr>
<tr>
<td>10.3</td>
<td>Stroke stop</td>
</tr>
<tr>
<td>10.4</td>
<td>Stud, Allan bolt</td>
</tr>
<tr>
<td>10.5</td>
<td>Hexagonal nut</td>
</tr>
<tr>
<td>10.6</td>
<td>Locking plate</td>
</tr>
<tr>
<td>10.7</td>
<td>Slotted pin</td>
</tr>
<tr>
<td>11</td>
<td>Spindle</td>
</tr>
<tr>
<td>12</td>
<td>Bonnet</td>
</tr>
<tr>
<td>13</td>
<td>Bonnet stud</td>
</tr>
<tr>
<td>14</td>
<td>Bonnet nut</td>
</tr>
<tr>
<td>15</td>
<td>Spring</td>
</tr>
<tr>
<td>16</td>
<td>Washer</td>
</tr>
<tr>
<td>17</td>
<td>Adjusting screw</td>
</tr>
<tr>
<td>18</td>
<td>Adjusting screw nut</td>
</tr>
<tr>
<td>19</td>
<td>Cap</td>
</tr>
<tr>
<td>20</td>
<td>Cap top</td>
</tr>
<tr>
<td>21</td>
<td>Cap bolt</td>
</tr>
<tr>
<td>21.1</td>
<td>Hexagonal screw</td>
</tr>
<tr>
<td>22</td>
<td>Spindle nut</td>
</tr>
<tr>
<td>23</td>
<td>Gaskets</td>
</tr>
<tr>
<td>24</td>
<td>Gasket</td>
</tr>
<tr>
<td>25</td>
<td>Gasket</td>
</tr>
<tr>
<td>26</td>
<td>Drain plug</td>
</tr>
<tr>
<td>27</td>
<td>Dowel</td>
</tr>
<tr>
<td>28</td>
<td>Pin</td>
</tr>
<tr>
<td>29</td>
<td>Retainer</td>
</tr>
<tr>
<td>30</td>
<td>Lower bearing plate</td>
</tr>
<tr>
<td>31</td>
<td>Bearing</td>
</tr>
<tr>
<td>32</td>
<td>Upper bearing plate</td>
</tr>
<tr>
<td>33</td>
<td>Signal pin</td>
</tr>
<tr>
<td>34</td>
<td>Intermediate flange / guide</td>
</tr>
<tr>
<td>35</td>
<td>Pipe</td>
</tr>
<tr>
<td>36</td>
<td>Hexagonal screw, bolt</td>
</tr>
<tr>
<td>36.1</td>
<td>Hexagonal nut</td>
</tr>
<tr>
<td>36.2</td>
<td>Locking plate</td>
</tr>
<tr>
<td>36.3</td>
<td>Retaining ring</td>
</tr>
<tr>
<td>36.4</td>
<td>Piston ring / slide ring</td>
</tr>
<tr>
<td>37</td>
<td>Balanced piston</td>
</tr>
<tr>
<td>38</td>
<td>Dowel</td>
</tr>
<tr>
<td>39</td>
<td>Gasket</td>
</tr>
<tr>
<td>40</td>
<td>Screw</td>
</tr>
<tr>
<td>41, 42</td>
<td>Retaining ring</td>
</tr>
<tr>
<td>42</td>
<td>Bellows lower part</td>
</tr>
<tr>
<td>43</td>
<td>Tightening nut</td>
</tr>
<tr>
<td>44</td>
<td>Gasket</td>
</tr>
<tr>
<td>45</td>
<td>Holding ring</td>
</tr>
<tr>
<td>46</td>
<td>Guard ring</td>
</tr>
<tr>
<td>47</td>
<td>Baffle plate</td>
</tr>
</tbody>
</table>

• Recommended spare parts
SEMPPELL SERIES S, TYPES SO, SC, SB, SOH FULL-LIFT SAFETY VALVES
OPERATING INSTRUCTIONS

TYPE SO..
Safety valve with open bonnet for steam and inert gases

TYPE SB..
Safety valve with balancing bellows and vented bonnet for vapours, gases and liquids
**SEMPELL SERIES S, TYPES SO, SC, SB, SOH FULL-LIFT SAFETY VALVES**

**OPERATING INSTRUCTIONS**

**BODY AND ADJUSTING RING DESIGNS**

**FLANGE CONNECTION ACCORDING TO DIN**

- Without adjusting ring
  - Type SC
  - Type SO
  - Type SB

- With adjusting ring
  - Type SCR
  - Type SOR
  - Type SBR

**FLANGE CONNECTION ACCORDING TO ANSI**

- Without adjusting ring
  - Type SCL
  - Type SOL
  - Type SBL

- With adjusting ring
  - Type SC
  - Type SO
  - Type SB
DISC HOLDER AND SPINDLE DESIGN

M to T and above the pressure rates 09 (160) K and 03 (040) L

U to Z

BALANCED PISTON 144, TYPE SO

D to T

T1 to Z

BELLOWS DESIGN P TO Z

SPRING COMPRESSION FOR ORIFICE T TO Z
SEMPELL SERIES S, TYPES SO, SC, SB, SOH FULL-LIFT SAFETY VALVES
OPERATING INSTRUCTIONS

CAP DESIGN

K to T and above the pressure rates
08 [160]H and 06 [063]J

D to G and below the pressure rates
08 [160]H and 06 [063]J

U to Z

DESIGN TYPE SOH

J to T

T1 to Z

Detail X: screw locking by deformation