

Annex to 20-l-Apparatus



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Please read this note!



Question Answer



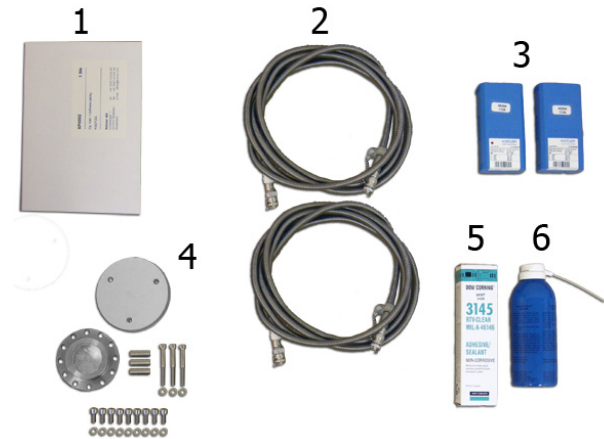
Attention: Please read this safety instruction carefully!

1. Installation of 20-L-Apparatus

1.1 Accessories

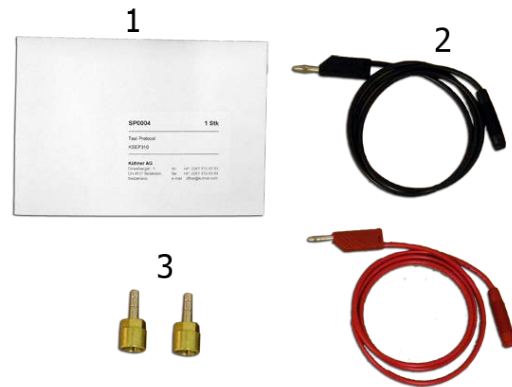
Accessories for SP3020

- Pos.1 SP0002 Software package.
- Pos.2 SP8807 Transducer cable.
- Pos.3 SP8801 Pressure sensors.
- Pos.4 SP8021 Sight glass.
- Pos.5 SP8808 Silicone Rubber.
- Pos.6 SP8809 Cleaning spray.



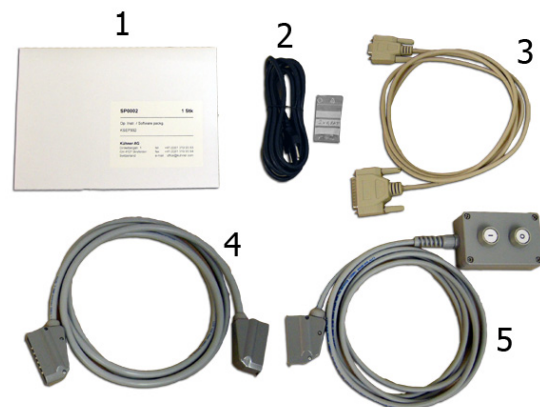
Accessories for KSEP 310

- Pos1. SP0004 Test protocol.
- Pos2. SP8010 Ignitors leads.
- Pos3. 2 connectors.



Accessories for KSEP 332

- Pos.1 SP0002 Software package
- Pos.2 Cord cable/Fuses.
- Pos.3 SP8817 Connection cable.
- Pos.4 SP8816 Connection cable.
- Pos.5 SP8818 Remote control.
- Pos.6 SP8825 Adapter RS232/USB





The following components are necessary for the function of the apparatus but are **not** supplied and must be provided by the user:

1.1.2 Personal Computer

Any standard personal computer running the operating system Microsoft-Windows 7 ... 11 (32 or 64Bit)

Graphics, monitor: resolution minimum 1024 x 768, colors minimum 16 bit
 Interface: USB (adapter USB - RS232 delivered with the 20-I-apparatus)
 or RS232 (COMx)

1.1.3 Chemical Igniters

For each test you need:

for the determination of explosion indices (P_{max}, K_{max}):

2 chemical igniters of **5000 J** each, with a total energy of **E = 10'000 J**

for the determination of lower explosible limit LEL and the limiting oxygen concentration LOC:

EN 14034-3, 4: 2 igniters with **1000 J** each and a total energy of **E = 2000 J**

ASTM E1515, E2931: 1 igniter with **E = 2500 J** or with **E = 5000 J**

Manufacturer:

Fr. Sobbe GmbH
 Beylingstr 59
D-44329 Dortmund
 Germany
 Tel: +49 231 230 560
 info@sobbe-zuender.de
www.sobbe-zuender.de

Manufacturer:

Simex Control s.r.o.
 Ul. 4. května 175
Vsetín 755 01 CZ
 Czech republic
 Tel: +42 0571 498 711
 sale@simexcontrol.cz

Distributor for USA and Canada:

Cesana Corporation
 P.O. Box 182
Verona, NY 13478
 U.S.A.
 Tel: +1 315 337 9181
 office@cesanacorp.com

1.1.4 Compressed air

Compressed air is used for the dust dispersion process and also to power the valve connected to the dust storage chamber. Therefore you need:



Compressed air in cylinders with pressure reducer adjustable to **20bar** (over pressure)
 It must be normal compressed air, **not synthetic air!**

The 20 bar compressed air connection should have an adequate cross section. It must be possible to pressurize the storage chamber (V = 0.6 l) within 5 seconds.

1.1.5 Exhaust air

The apparatus is usually set up in a ventilated laboratory hood. If the exhaust air (outlet) is fed directly into the ventilation system, glowing particles must be taken into account.

Air flow of ventilation approx. 1225 m³/h

1.1.6 Vacuum

Prior to dispersing the dust, the sphere is evacuated to such a degree, that the remaining pressure, together with the air contained in the storage chamber, result in the desired starting pressure for the explosion test.



Evacuation time of the sphere should be less than 12 seconds.

You need therefore a pump with at least 6m³ / hour (1.7 liter / second).

1.1.7 Water cooling

A high test frequency will necessitate keeping the operating temperature of the sphere at approx. 20°C by means of water cooling, i.e. the operating temperature should correspond to room temperature. Thermostatic control of the cooling water is not necessary, but care should be taken that there is always some flow of water and that the outlet temperature of the cooling medium never exceeds 25°C.

Minimum flow of cooling water: 0.5 liter / minute

1.1.8 Mains supply

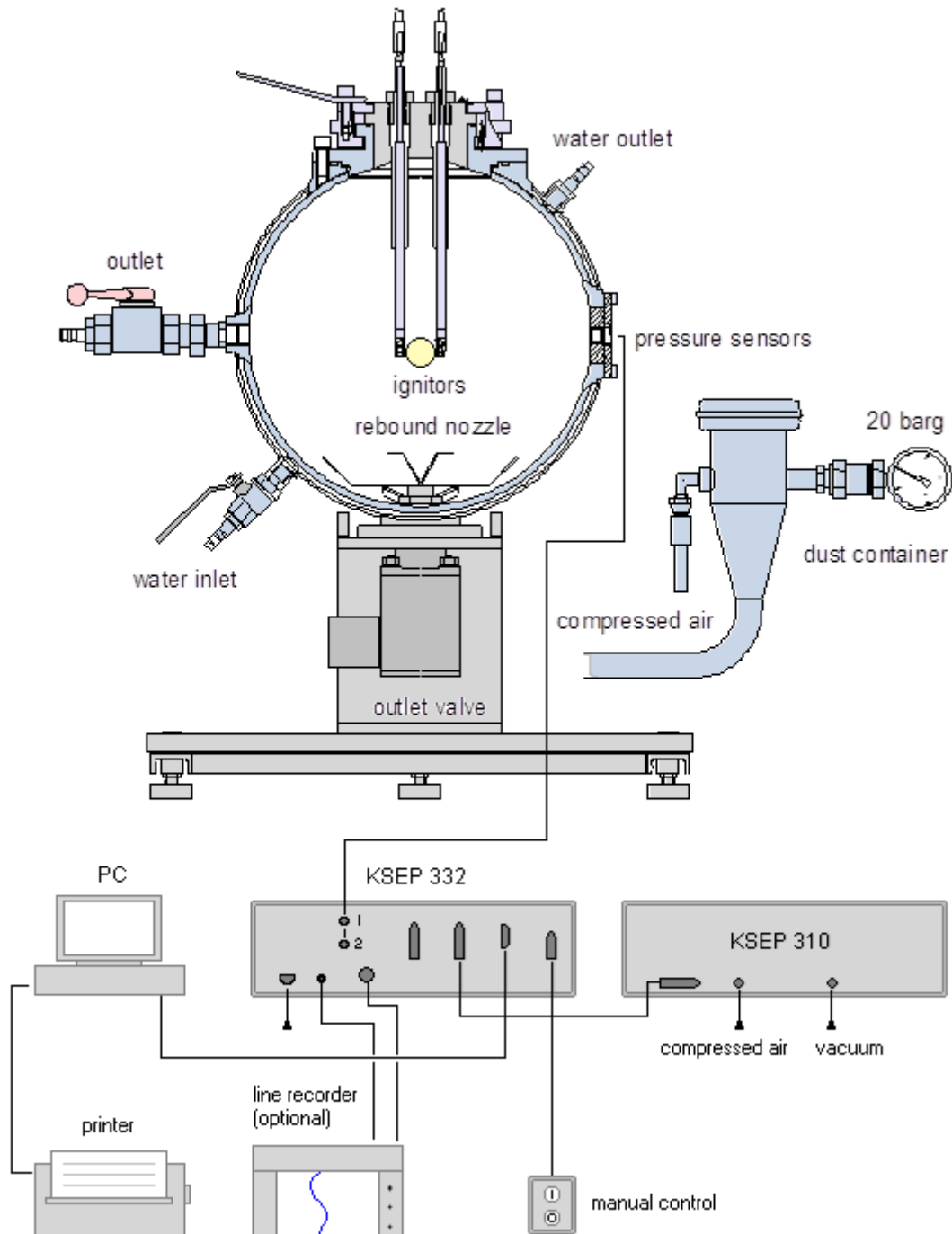
Control and measuring equipment KSEP 332: 230/115V, 50/60 Hz, 110W

1.1.9 Industrial vacuum cleaner

ATEX approved examples: <https://howatec.ch/industriesauger-atex.html>
<https://www.delfinindustriesauger.de>

1.2 Installation

1.2.1 Overview



1.2.2 Connections

1. Connect cable SP8816
to KSEP 310



and to KSEP 332

Both inputs can be used.

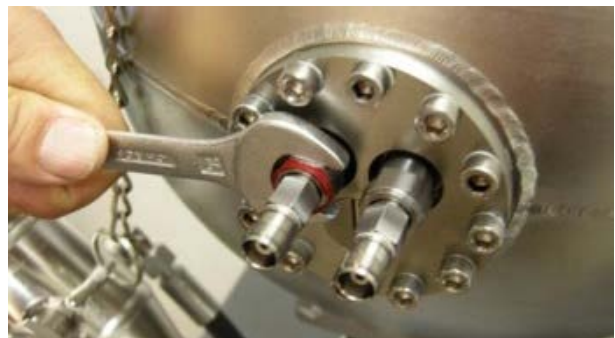


2. Install pressure sensors

The membrane of the pressure sensor has to be protected against the flame front of the explosion by a layer of silicone rubber.

See section: [2. Pressure transducers](#)

Remove first screws with a large screwdriver and fix the sensors with a wrench 16mm



3. Fit transducer cables

Please note the color coding



4. Manual control SP8818**5. Communication Cable SP8817**

Use the RS232 / USB adapter
for PCs without an RS232 input.

**6. Vacuum and compressed air**

Use the adapters delivered with the sphere
or screw directly on 1/4" cylindrical connection

**7. Water supply**

below inlet, above outlet

**8. Safety switch, Outlet valve
as shown ...**

1.2.3 Software

Install the KSEP-Software and start it.

See: [Manual for the 20-I-Apparatus](#)



1.2.4 Charge amplifiers

The different sensitivity of each sensor requires adjustment of the amplifier. The sensitivity of the sensors can be read from the calibration sheet: **K** pC. The measuring range of the system is 20 bar. From this, the adjustment of the amplifier is calculated as follows:

Amplification:	$A \cdot 10^N$ [pC]	$= 20 [\text{bar}] \cdot K [\text{pC/bar}]$
Example for 701A:	K	$= 79,8 \text{ pC/bar}$
	$20 \text{ bar} \cdot 79,8 \text{ pC/bar}$	$= 1596 \text{ pC}$
	1596 pC	$= 160 \cdot 10^1$
	setting	$= 160 / 1$

see KSEP-software: [System / Pressure Sensors](#)

charge amplifier

calibration data (range 25 bar): pC / bar pC

Sensor type 701

(no longer manufactured by Kistler)
use range 25bar from calibration sheet.
typical sensitivity = 80 pC/bar: 160/1

Sensor type 601

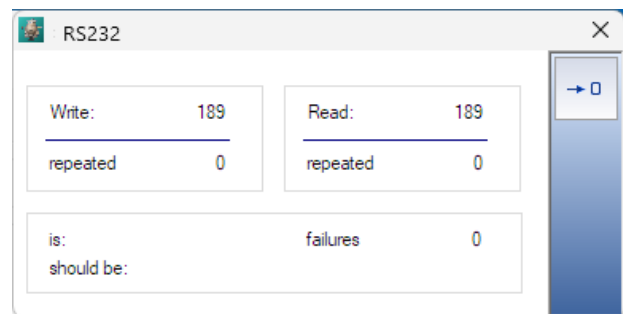
use range 2.5bar from calibration sheet.
typical sensitivity = 37 pC/bar: 740/0



1.3 Test of Installation

1.3.1 Communication KSEP - PC

1. Turn on KSEP332
2. Test Communication
Tools / Check interface



Problem with communication ?

Check cable and connectors

Check in "Settings" Com-Port correct?

Check in "Settings" simulation mode?

1.3.2 Test Inlet / Outlet valves

1. Press Inlet button.
The valve should make a "clicking" sound
2. Press Outlet button.
The valve should make a „clicking" sound



1.3.3 Dispersion pressure

1. Check that the cover from the storage container is closed.



2. Close both ball-valves on left and right side of sphere



3. Dispersion pressure
Adjust to exactly **20bar** (overpressure)



4. Fill up storage container with Inlet button
The pressure gauge must show 20bar
If necessary, adjust with the regulator on the compressed air supply.



5. Relieve the pressure from the storage container into the sphere.



6. Relieve the air pressure from the sphere through the outlet ball-valve (left side).



7. Residual air pressure?



8. Press the Outlet button several times until the air pressure shows 0 Bar.



1.3.4 Vacuum

1. Close the outlet ball-valve (on left side).



2. Open the vacuum ball-valve (on right side)



3. Start the vacuum pump and evacuate the sphere to 0.4 bars absolute. Indication of the vacuum manometer = **-0.6 bar**. It must be accurate!



4. When the value of **-0.6 bar** is reached, close the vacuum ball-valve (on right side).

At this moment, the manometer will go further down. This is normal. The manometer shows the pressure of the external vacuum instead of the sphere.

Switch off the vacuum pump.



1.3.5 Check adjustments

1. Fill up the storage container with the inlet button until **20 bar**



2. Relieve the pressure from the storage container into the sphere.



3. Open outlet ball-valve **slowly**.
Just a little air should flow in or out.
i.e. there should be **ambient pressure** within the sphere !



2. Pressure transducers

2.1 Installation of Pressure transducer type 701A

1. Complete set



2. Screw by hand SP8804 and SP8805 together



No gap should be visible

3. Bring the copper seal in Position.



4. Screw the SP8806 onto it and tighten it with two open-ended wrenches.



In the end, it should look like this



It is recommended to flush the connectors with a cleaning spray (Kistler no. 1001) before plugging them together.

2.2 Installation of Pressure transducer type 601CAB

1. Complete set



2. Screw by hand SP8801 and SP8802 together



No gap should be visible

3. Bring the copper seal in Position.



4. Screw the SP8810 onto SP8802 and tighten it with two open-ended wrenches.



In the end, it should look like this



It is recommended to flush the connectors with a cleaning spray (Kistler no. 1001) before plugging them together.

2.3 Protection of the pressure transducer membrane

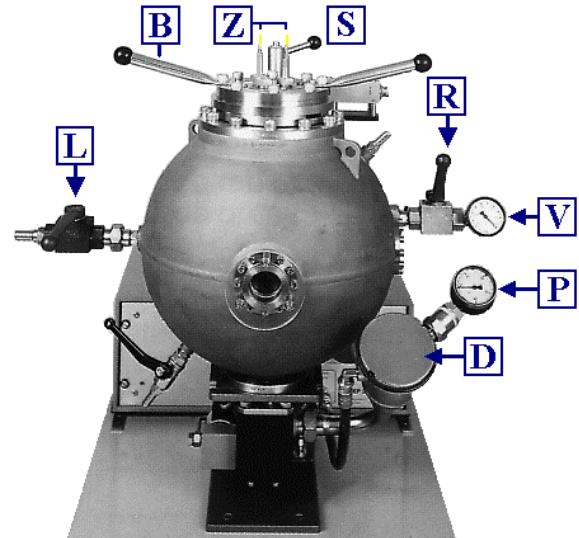


The membrane of the pressure sensor must be protected against the flame front of the explosion by a layer of silicone rubber of **maximum 2 mm thickness**. Too hard or too thick protective layers will have a "shunting" effect on the membrane and cause faulty measurements especially in the vacuum range. The protective silicone layer must be renewed periodically.



3. General Test Procedure

- B** - Bayonet ring
- D** - Storage container
- L** - Outlet Ball valve
- P** - Pressure manometer
- R** - Vacuum Ball valve
- S** - Safety switch
- V** - Vacuum manometer
- Z** - Ignition lines



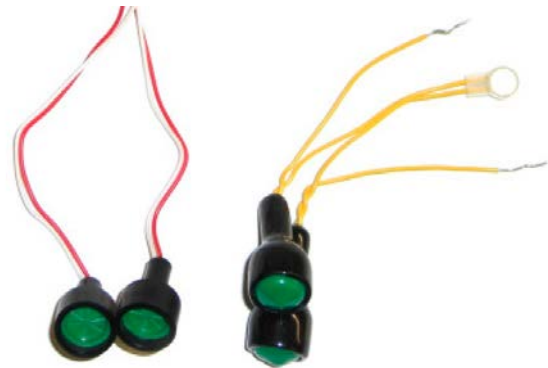
Protective goggles are required to handle the chemical igniters and ESD protection must be observed.



1. preparing the igniter

Sobbe-igniters (left) are connected in parallel. Therefore strip the wires. Twist the two red ones together and twist the two white ones together as well.

Simex-igniters (right) are already pre-wired (serial connection).



The current **Sobbe** igniters are additionally protected against electrostatics with a metal housing.



When manipulating the chemical-igniters, they should never be pointing towards your body !



2. Attach the igniters to the electrode rods.
To do this, wrap the connecting wires around the screw and clamp them with the screw.

Make sure the surfaces are clean. Otherwise clean beforehand with a steel brush.



This hole is intended for the attachment of electrodes for the continuous spark gap and is not suitable for connecting the igniter.



Note:

The two igniters are firing horizontal and in opposite directions.



3. Turn the bayonet-ring (B) on the sphere until final position.



4. Connect the ignition leads and close the safety switch (S).



5. Weigh the dust carefully.



6. Fill dust into the storage container (D)



7. Try to put the dust as deep as possible into the storage container (D).



8. Close cover of Storage container (D).

Make sure it is well closed!



9. Close ball-valve (L) on left side of sphere



10. Open the vacuum ball-valve (on right side)



11. Start the vacuum pump and evacuate the sphere to 0.4 bars absolute. Indication of the vacuum manometer = **-0.6 bar**. It must be accurate!



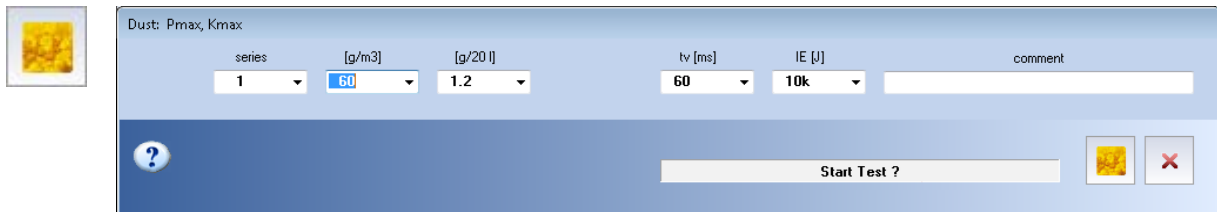
12. When the value of **-0.6 bar** is reached, close the vacuum ball-valve (on right side).

At this moment, the manometer will go further down. This is normal. The manometer shows the pressure of the external vacuum instead of the sphere.

Switch off the vacuum pump.



13. Start the automatic test run



Dust: Pmax, Kmax

series	[g/m3]	[g/20 l]	tv [ms]	IE [J]	comment
1	60	1.2	60	10k	

Start Test ?

14. Relieve the air pressure from the sphere through the outlet ball-valve (left side).



15. Rinse the apparatus with compressed air by alternately pushing the buttons (I) and (O) on the manual control (approx. 3 times)



16. Open safety switch. Open the sphere. Open the storage container (D) Remove residues with a vacuum cleaner.



4. Cleaning the 20-I-Apparatus

4.1 Dismantling and cleaning

Required tools:

- Wrenches: 14 / 17 / 19 / 24 / 43mm
- Adjustable wrench
- Hex keys 5, 10mm
- Screwdriver
- Metal brush
- Scourer strip
- Grease paste



Cleaning kit:

- Safety glasses
- Mask
- Gloves
- Apron
- Stainless steel cleaner
- Solvent cleaner
- Vacuum cleaner
- Paper roll
- Big bucket



1. Remove the air pressure

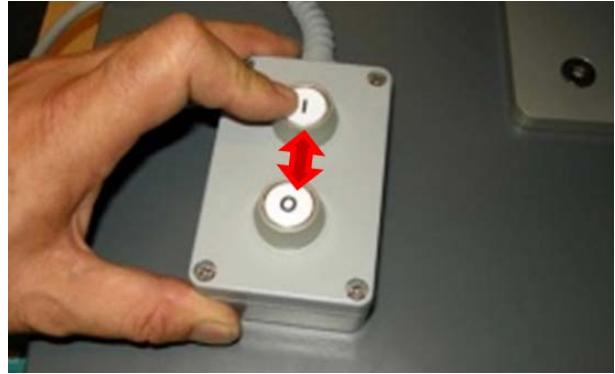


2. Make sure everything is pressure less:

Open the ball valve (**Left**) – venting



With the manual control, depressurize the apparatus by alternately pushing the buttons (I) and (O) approx. 3 times



3. Remove the pressure sensors with a wrench 16 mm.



4. Remove the Bayonet-ring



5. Unscrew the screws with hex key



6. Remove the upper flange



7. Clean the upper flange

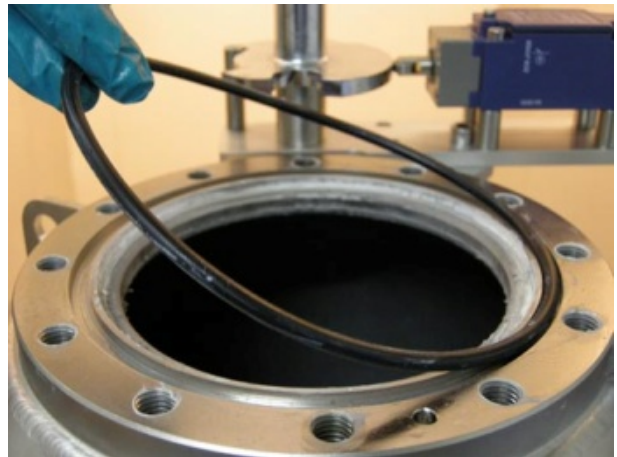


Depending on the dust, use
a special cleaning agent.

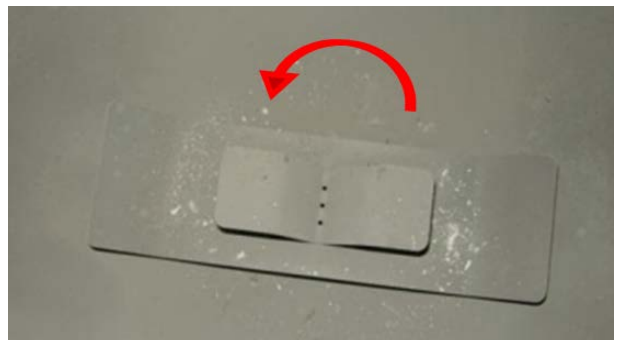
Water can be used for the
CaRo test dust.



8. Remove the SP8012 O-ring



9. Unscrew the rebound nozzle SP8200



10. Remove the rebound nozzle and clean it in the water basin.



11. Unscrew the storage container with wrenches 24 / 43mm



12. Remove the safety chain of the storage container



13. Unscrew the ball valve venting (Left) and put it in the water basin.



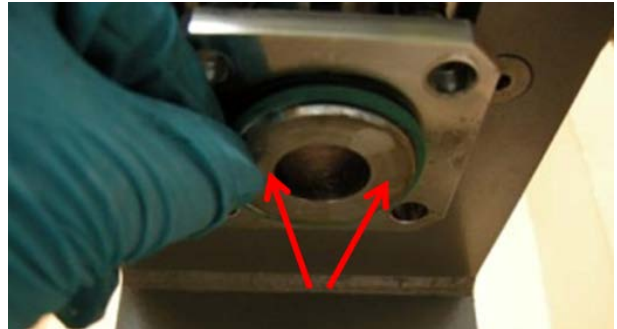
14. Remove outlet valve with wrench 17mm



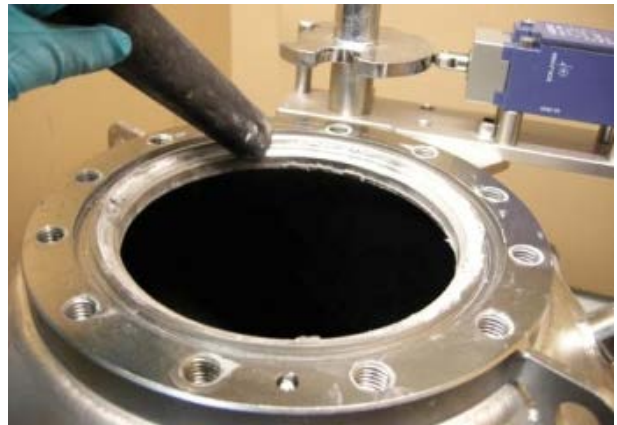
15. Remove the SP8014 O-ring



16. Clean the flange with water or solvent.
Avoid scratching the surface when
cleaning mechanically.



17. Remove with a vacuum cleaner
the remaining dust from the sphere.



18. Remove with a vacuum cleaner the
remaining dust from inside the sphere.

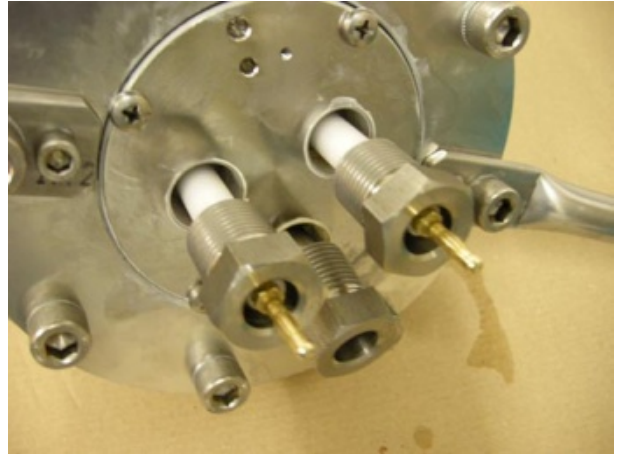


19. Clean the inside of the sphere:**a) with metal brush.****b) with scrub strip****c) with water or solvent**

This is what the sphere should look like after cleaning.



- 20.** Disassemble the bayonet-ring:
Remove the electrodes with wrench 24mm.



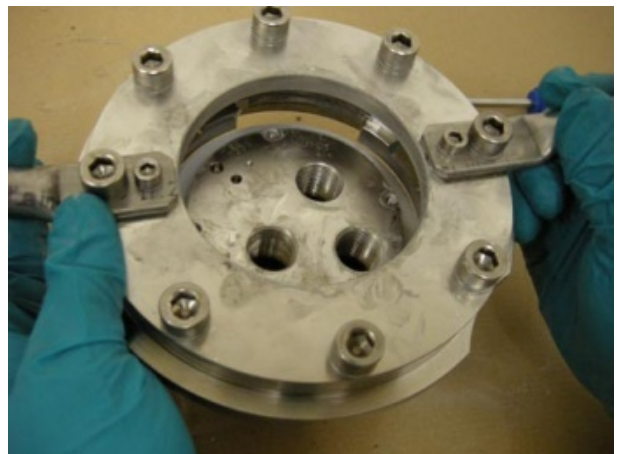
Overview of the dismantled parts.



- 21.** Unscrew the four screws



- 22.** Disassemble the bayonet-ring in two parts.



23. Remove the guide ring SP8042.



24. Put block into the bucket filled with the specific cleaning liquid.



25. Clean bayonet-ring with water or solvent.



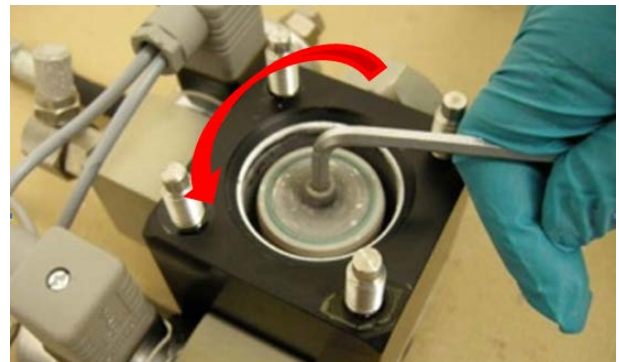
26. Clean the dust storage container



Overview all parts cleaned



- 27. Outlet valve:**
Unscrew the insert with hex key 5mm.



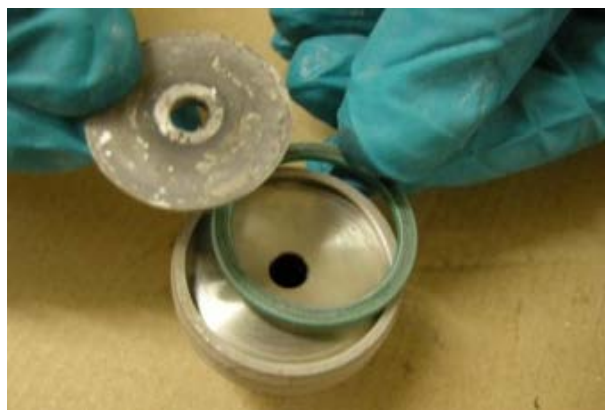
- 28. Turn the outlet valve, the insert SP8085 can now be removed.**



- 29. Remove O-ring SP8064**



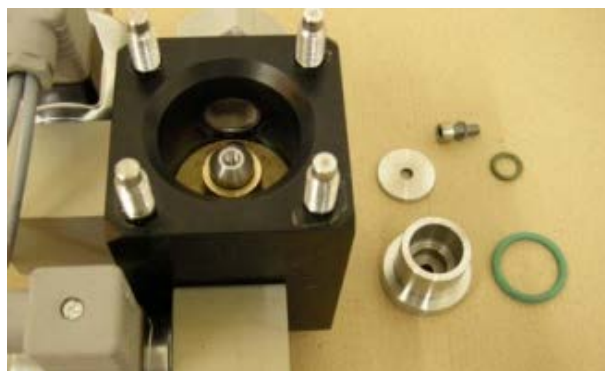
- 30.** Disassemble into 3 parts
SP8085, SP8086 and SP8060.



- 31.** Clean inside of outlet valve



Overview of all parts cleaned.



4.2 Assembly



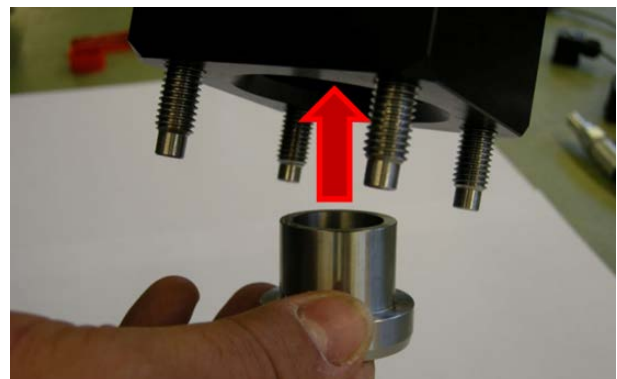
Important: Always **grease** all **O-rings** and all **threads** before assembly.



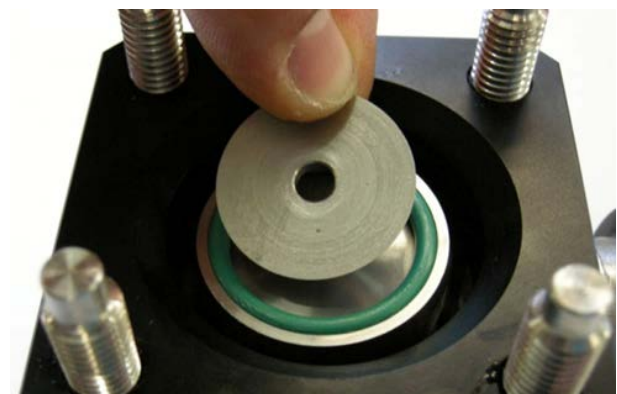
1. Grease and place the O-ring SP8064 into the valve insert SP8085.



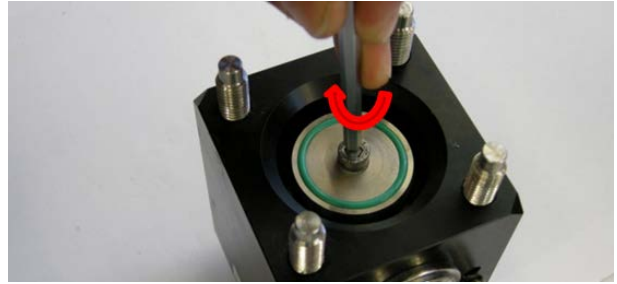
2. Keep the valve body in this position and put the valve insert SP8085 inside as shown.



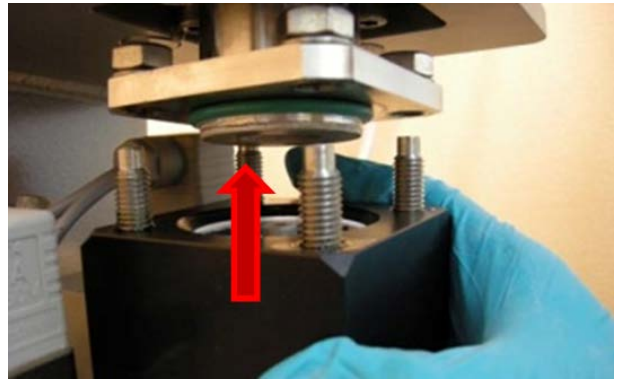
3. Grease the O-ring SP8060. Place it onto valve insert SP8085.
4. Place the cover SP8086 onto the valve insert SP8085.



5. Grease hex screw SP8067 (M6x16 BN610) and the washer SP80106.
Fix screw SP8067 with the hex key 5mm.



6. Fit outlet valve and screw the 4 nuts with wrench 17mm



7. Fix the dust storage container:
- a) Fit safety chain.
 - b) Don't forget the O-ring SP8054.



- c) Hand tighten the nut



- d) Tighten with wrenches 24 and 42mm



8. Install the rebound nozzle
(turning clockwise)



9. Grease and insert the O-ring SP8012



10. Place the upper flange on the sphere.
There is only one position possible.



11. Fix the upper flange.
Tighten the screws crosswise!



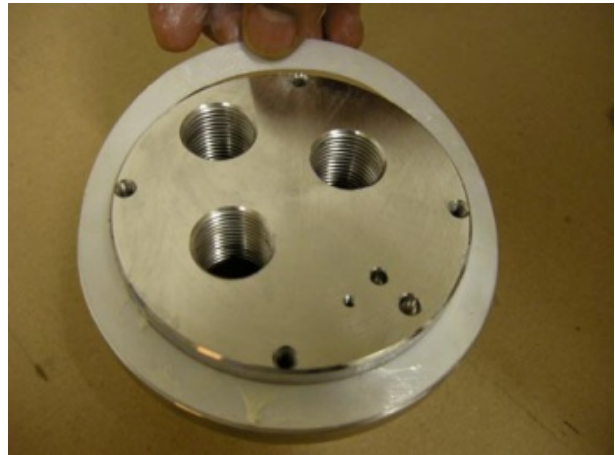
12. Fit the left ball valve to the sphere.
Don't forget the O-ring SP8037.



13. With wrench 22mm fix the position of the ball valve, and with wrench 36mm tighten the nut.



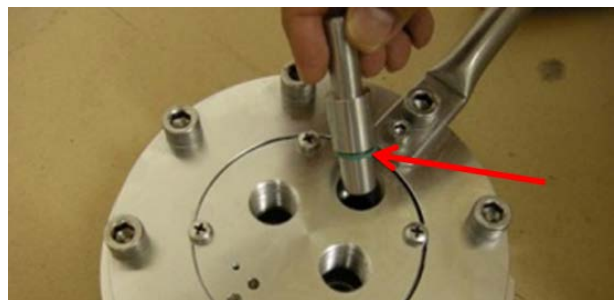
14. Generously grease the guide ring and place it onto the block.



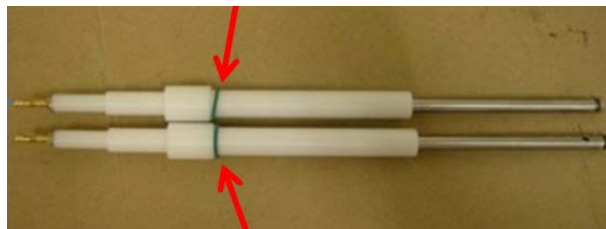
15. Place the bayonet-ring onto the block and fix it with 4 screws.



16. Insert the cylindrical part, as shown.
Don't forget the O-Ring SP8045.



17. Place the O-rings SP8045 on the electrodes.



18. Fix the 3 screw caps with wrench 24mm



5. Troubleshooting



P_{ex} and dP/dt are dependent on the dust concentration. The steps in the dust concentration are quite large e.g. 125, 250, 500, 750 g / m³. The optimal dust concentration is often in between. However, dust distribution and concentration are subject to fluctuations. We take this into account by forming the mean from 3 series. Repetitions with the same dust concentration for testing the apparatus are therefore not very useful.



5.1 Igniter not activated during normal test sequence

- a) No electrical contact between the electrode rod and the igniter connection wires.
See: **3. General Test Procedure: step 1 and 2**
- b) No pressure increase on pressure measuring channel 1.
The measurement of the ignition delay time t_v begins with the first increase in pressure in the sphere. Only the pressure signal from channel 1 is used for this. The following applies:
No pressure raise in channel 1 = no ignition.



5.2 P_{max} too high or too low

The maximum explosion overpressure P_{max} is the result of the combustion of the fuel with the oxygen in the air and is largely independent of the turbulence. If there is a deviation from the expected value, the causes can be:

- a) At the time of ignition there is not atmospheric pressure (1013 mbar) in the sphere.
 P_{max} is directly proportional to the initial pressure P_i = pressure at the time of ignition.
KSEP-Software: **Tools / Calculator / P_{max} : influence of initial pressure P_i**
Check: **1.3 Test of Installation (1.3.4 ... 1.3.5)**
or see: **Manual: 4.1 Test check**

Possible error causes:

- Settings for dispersion pressure (20 bar) and vacuum (-0.6 bar)
- Loss of vacuum due to a leak in the sphere?
- Vacuum pressure gauge blocked or defective?
- Defective pressure gauge on the storage chamber?

A comparison with the ambient pressure is only permissible if it does not deviate significantly from 1013 mbar. Otherwise, an absolute pressure gauge must be connected to the outlet ball valve for this test.

- b) Influence of temperature: P_{max} decreases practically linearly with increasing temperature.
The cause is the reduced oxygen content.
KSEP-Software: **Tools / Calculator / P_{max} : influence of temperature T**

Due to the high frequency of tests, the explosion sphere must be kept at an operating temperature of approx. 20°C by means of water cooling. Make sure that the water flows with at least 0.5 L/min.



5.3 Kmax too high or too low

- a) Pmax is also too high or too low:

At the time of ignition there is not atmospheric pressure (1013 mbar) in the sphere.

Kmax is directly proportional to the initial pressure P_i = pressure at the time of ignition.

KSEP-Software: [Tools / Calculator / Kmax: influence of initial pressure \$P_i\$](#)

Check: [1.3 Test of Installation \(1.3.4 ... 1.3.5\)](#)

or see: [Manual: 4.1 Test check](#)

Possible error causes:

- Settings for dispersion pressure (20 bar) and vacuum (-0.6 bar)
- Loss of vacuum due to a leak in the sphere?
- Is the vacuum manometer blocked or defective?
- Manometer on storage chamber defective?

A comparison with the ambient pressure is only permissible if it does not deviate significantly from 1013 mbar. Otherwise, an absolute pressure gauge must be connected to the outlet ball valve for this test.

- b) Pmax is correct, Kmax too low:

The turbulence during dust dispersion has a decisive influence on the Kmax value.

Lowering the turbulence usually results in a weakening of the severity of the explosion.

Possible causes:

- Bore holes in the rebound nozzle blocked?
- Deposits on the inner wall of the sphere?
- Pressure drop in storage chamber, leak?
- Ignition delay time $t_v > 60\text{ms}$
- Is the outlet valve dirty?

- c) Pmax is correct, Kmax too high:

The turbulence during dust dispersion has a decisive influence on the Kmax value.

An increase in turbulence usually leads to an increase in the severity of the explosion.

Possible causes:

- Influence of igniter: Superimposed oscillations when the pressure rises?
- Ignition delay time $t_v < 60\text{ms}$



5.4 Differences between the two pressure channels

The different sensitivities of the pressure transducers require an adaptation of the charge amplifier. Have the pressure transducers been mistakenly mixed up?

Do the settings on the charge amplifier match the calibration sheet?

See: [1.2.4 Charge amplifiers](#)

Has the silicone protective layer on the pressure transducers hardened or even broken?

See: [2.3 Protection of pressure transducer membrane](#)

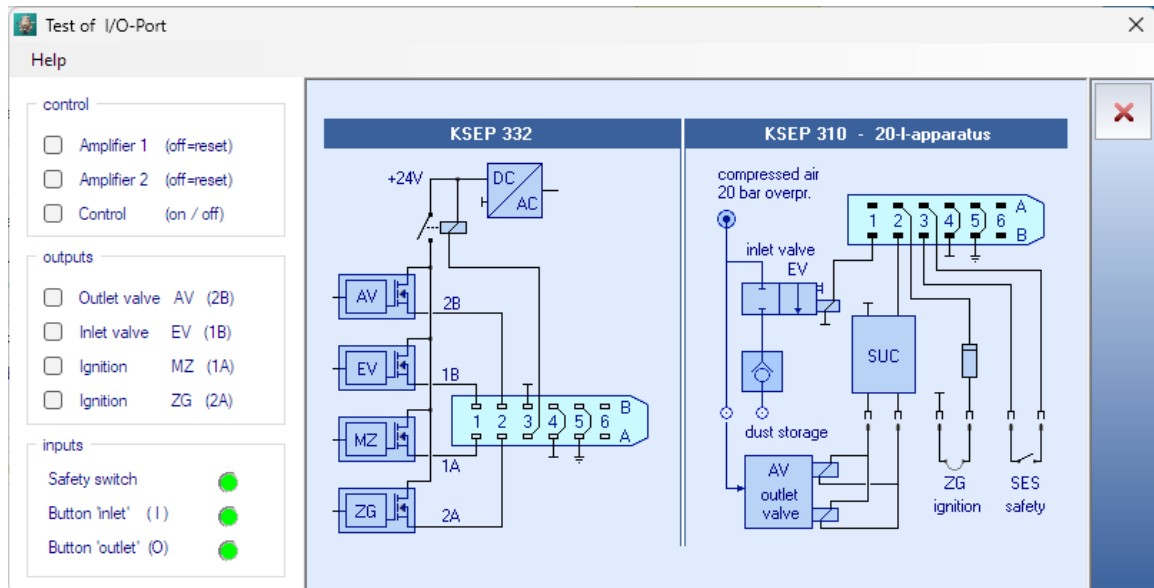
Dirty insulators at the connections cause the charge signal to drift.

See: [6.2 Check of pressure measuring system](#)

6. Check

6.1 Check of input / output port

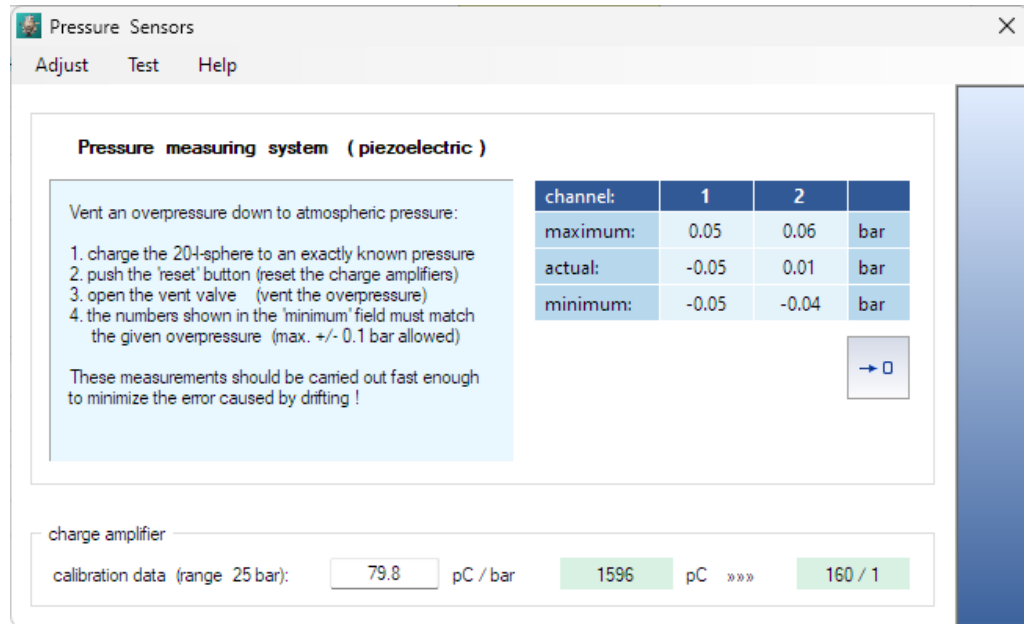
This tool gives you direct access to the power outputs of the KSEP 332. These outputs can be switched on and off independently.



To activate the outputs, the safety switch on the sphere must be switched on.

6.2 Check of Pressure Measuring System

This test program displays the actual pressure reading of both channels. The maximum and minimum values are displayed separately. Please note that piezoelectric sensor's only allow measurement of "quasi-static" pressures or pressure changes. The preferred test method is to vent a given over pressure down to atmospheric pressure. Proceed as follows:



1. Charge the 20-I-sphere to an exactly known pressure.
2. Reset the display of "maximum, minimum" and the charge amplifier reading.
3. Compare the pressure deviations between the two channels when discharging the vessel (max. +/- 0.1 bar are allowed).



These measurements should be carried out fast enough to minimize the error caused by drifting. This test is not a calibration but a function check. Ageing effects of the sensors are negligible. As long as both channels show matching results, they are assumed to be OK.

7. Maintenance of outlet valve

7.1 Normal cleaning

before you start with a new dust

7.2 Extended cleaning

after heavy pollution

7.3 Full Service (only for experts)



Required tools:

- Wrenches 12 / 24 / 28mm
- Screwdrivers
- Hex keys 3 / 5mm
- Grease



Important: Always **grease** all **O-rings** and all **threads** before assembly.



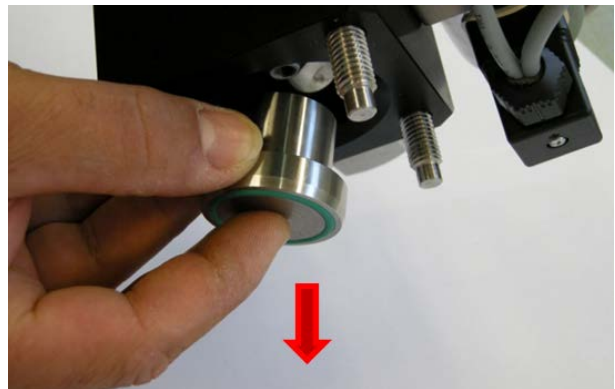
7.1 Normal cleaning

7.1.1 Dismantling

1. Loosen screw SP8067 with hex key 5mm



2. Remove valve insert SP8085 from the valve body.



Parts (from left to right):

- a. SP8064 (O-ring)
- b. SP8085 (valve insert)
- c. SP8060 (O-ring)
- d. SP8086 (cover)
- e. SP8067 (Screw M6x16 BN610)
- f. SP80106 (Rib washer M6)

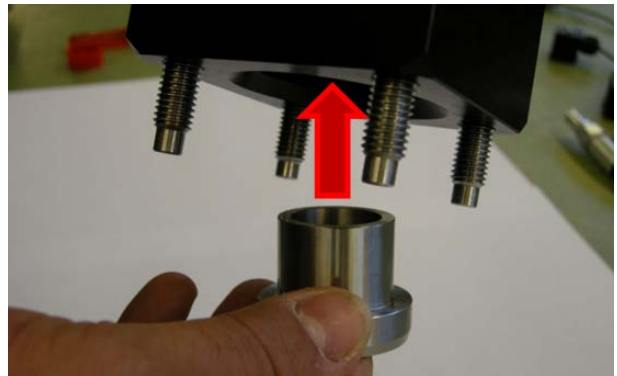


7.1.2 Assembly

1. Grease and place the O-ring SP8064 into the valve insert SP8085.

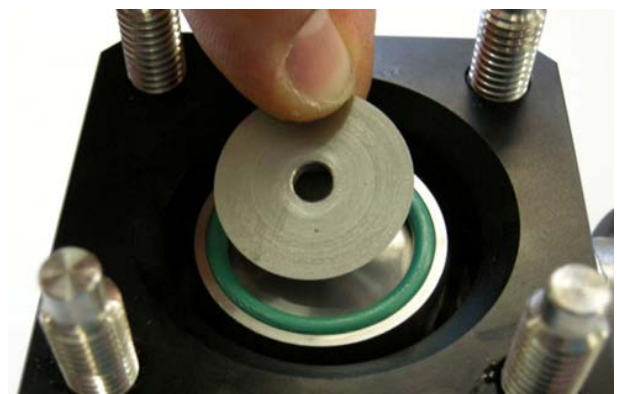


2. Keep the valve body in this position and put the valve insert SP8085 inside as shown.

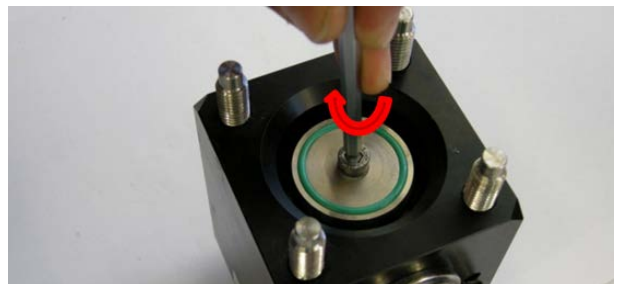


3. Grease the O-ring SP8060. Place it onto valve insert SP8085.

4. Place the cover SP8086 onto the valve insert SP8085.



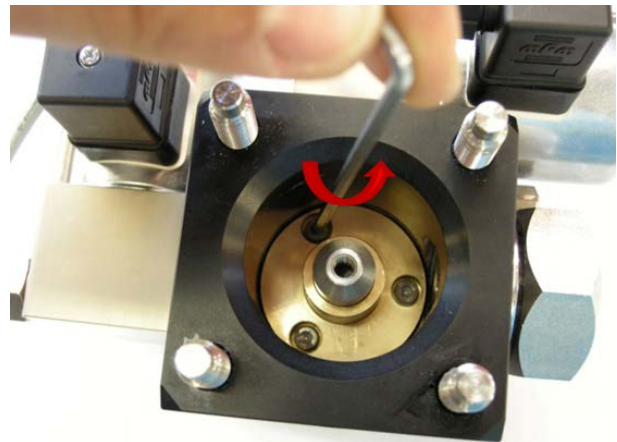
5. Grease hex screw SP8067 (M6x16 BN610) and the washer SP80106. Fix screw SP8067 with the hex key 5mm.



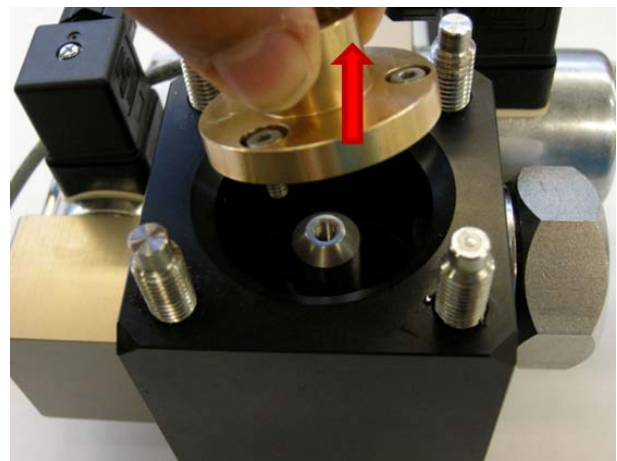
7.2 Extended cleaning

7.2.1 Dismantling

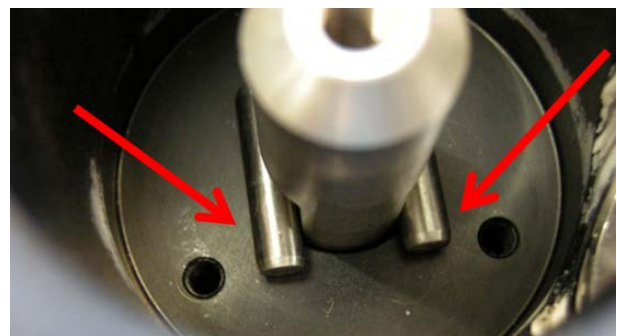
1. Remove 3 screws SP8078 (M4x8mm BN610) from the guide ring SP8081 with key 3mm.



2. Remove the guide ring SP8081 from the valve body.



3. Remove the guide rollers SP8082.



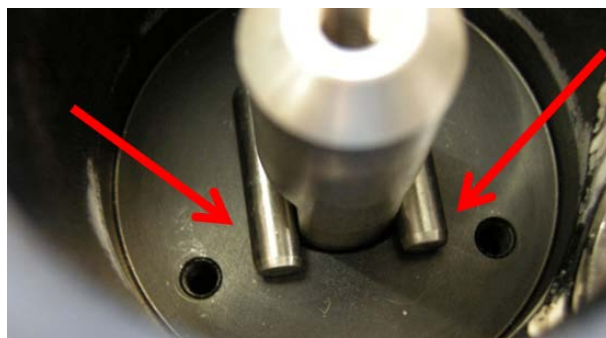
Overview of all removed parts.

- a) 2 x guide rollers SP8082
- b) 1 x guide ring SP8081
- c) 3 x screw SP8078 (M4x8 BN610).

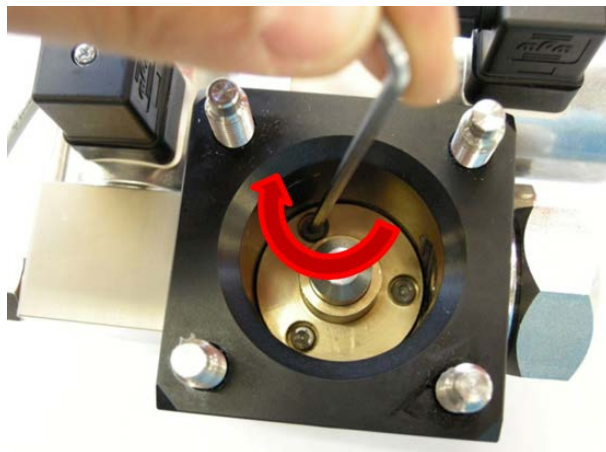


7.2.2 Assembly

1. Insert the guide rollers SP8082.



2. Fix the guide ring with 3 hex screws SP8078 using the hex key 3mm

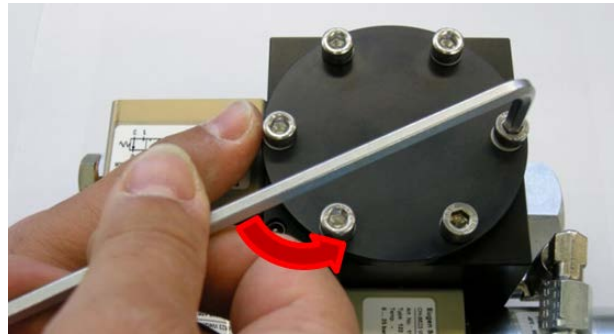


3. Proceed according to 7.1.2 Normal cleaning: assembly

7.3 Full Service (only for experts)

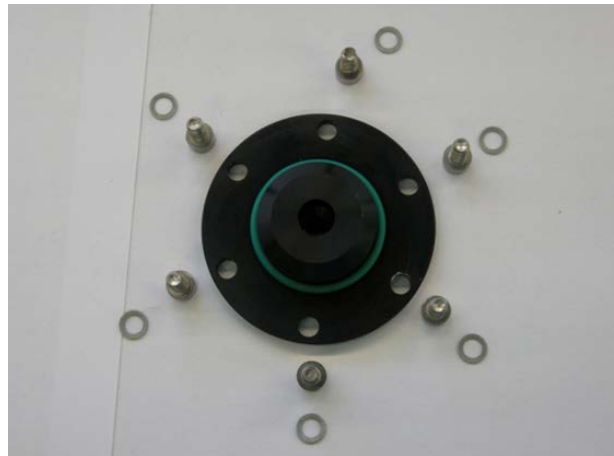
7.3.1 Dismantling

1. Remove the 6 Hex screws SP80104 (M6x14 BN610).



Overview of all removed parts.

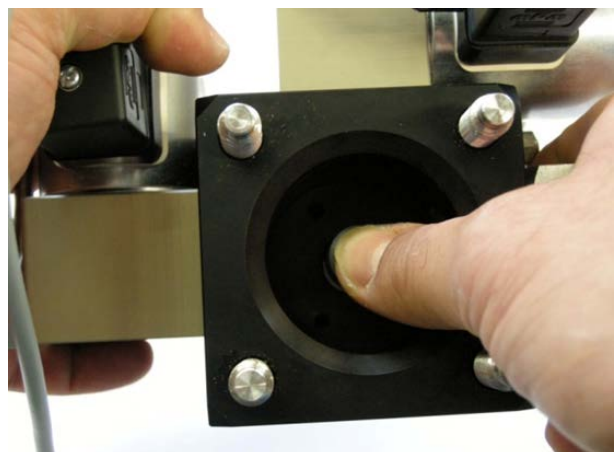
- a) 1 x Base plate SP8087
- b) 1 x O-ring SP8063
- c) 6 x M 6x14 SP80104
- d) 6 x M6 Washers SP80106



2. Remove screw SP80105 (M6 x 12 BN610) with hex key 5mm.



3. Remove piston rod SP8083 by pushing it from the other side.



4. At the same time hold piston SP8084 as shown on picture.



Overview of all removed parts.

- a) SP8083 Piston rod.
- b) SP8084 Piston.
- c) SP8064 O-ring.
- d) Screw SP80105 (M6x12 BN610).
- e) SP80106 M6 Washer.



5. Remove both spiral washers SP8066.1 from the piston SP8084.



6. Remove the Quad-ring SP8066 from the piston SP8084.

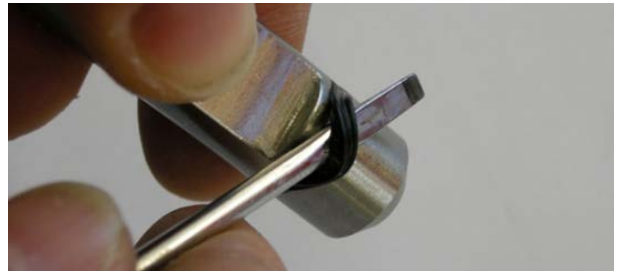


Overview of all removed parts:

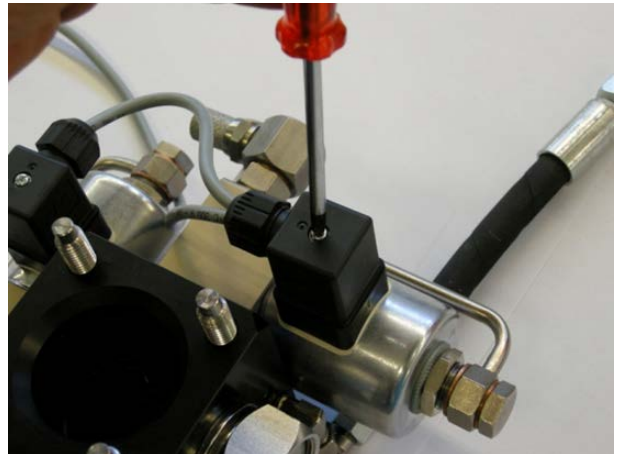
- a) Piston SP8084
- b) Spiral washer SP8066.1
- c) Quad-ring SP8066
- d) Spiral washer SP8066.1



7. Remove SP8065 Quad-ring from piston rod SP8083



8. Remove the connectors from the outlet valve with a screwdriver.



9. Remove the pressure line SP8036 with wrench 12mm



10. Remove the sound absorber with wrench 24 mm.

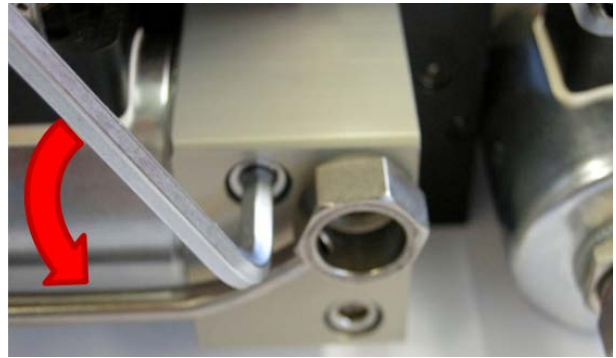


Overview of removed parts:

- a) 2 x copper washers
- b) sound absorber SP8100

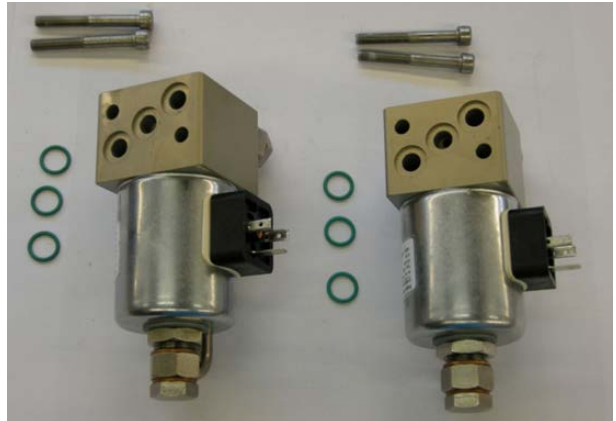


11. Remove hex screws SP80107 (M6x50 BN611) from the valve body



Overview of removed parts

- a) 2x Magnet Block valves SP8070.
- b) 6x O-ring SP8068.
- c) 4x Screws SP80107 (M6x50 BN611).



12. Remove the coupling-half G3/4 SP8059 from the valve body



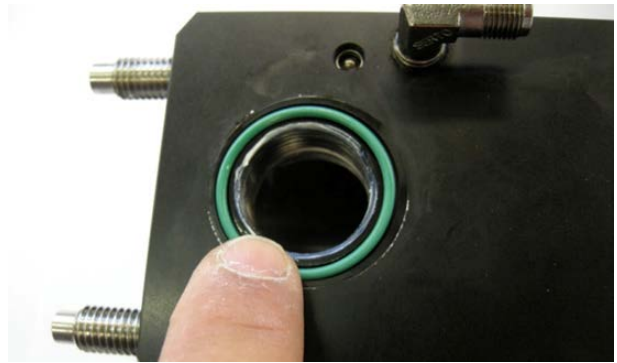
Overview of removed parts:

- a) valve body.
- b) O-ring SP8062.
- c) coupling-half SP8059.

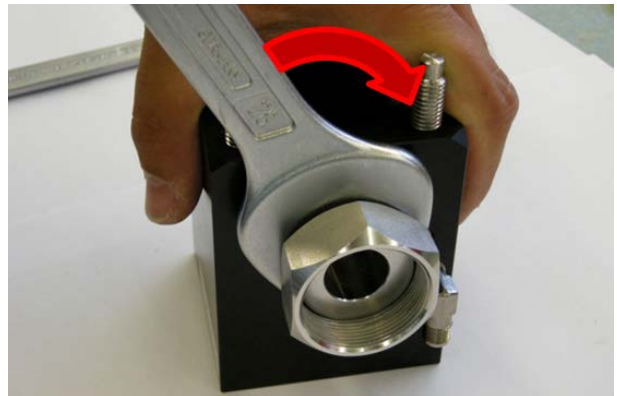


7.3.2 Assembly

1. Place the O-ring SP8062 into the valve body.



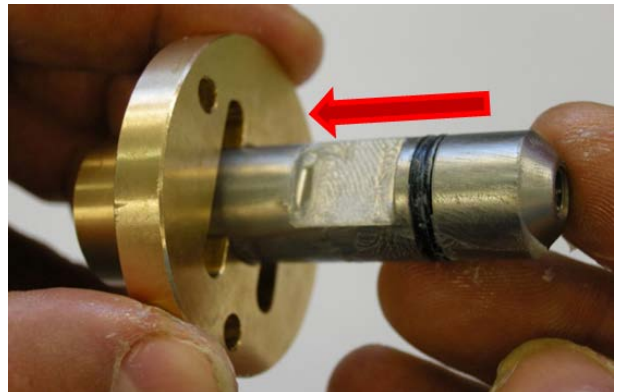
2. Fix the Coupling-half SP8059 on the valve body valve with wrench 24mm



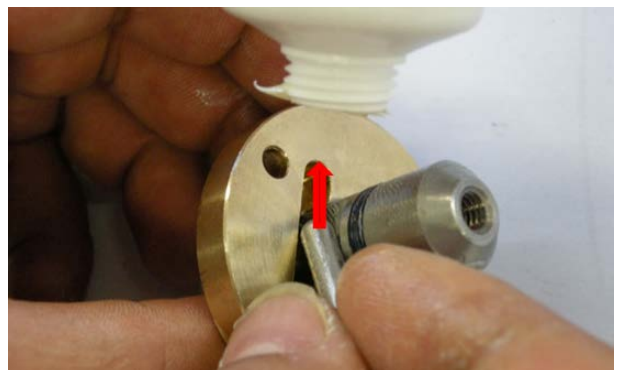
3. Place the Quad-ring SP8065 into the Pilot valve SP8083.

Always use a new spare part (SP8065)

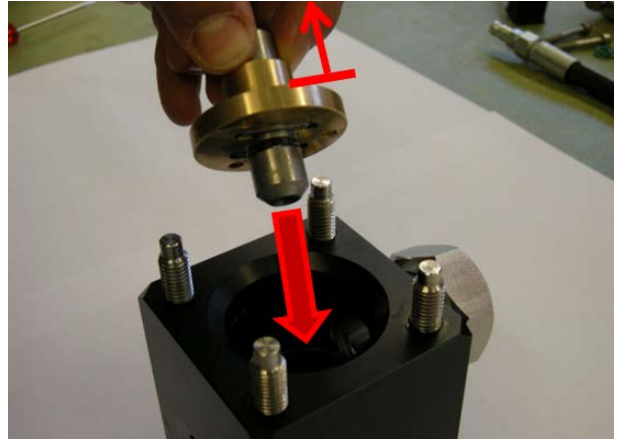
Fit piston rod into the guide ring SP8081



4. Grease und place the guide rollers SP8082 as shown.



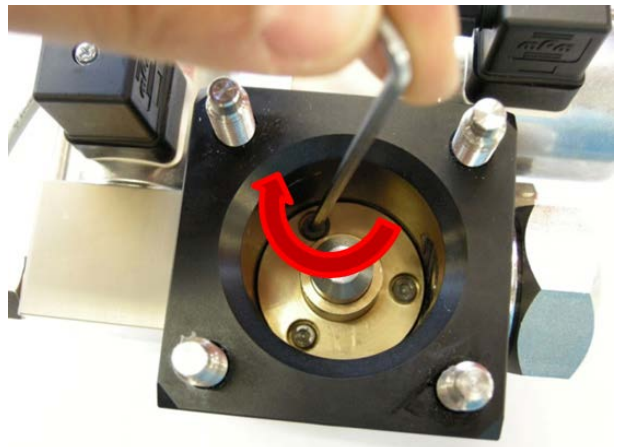
5. Fit piston rod as shown, make sure that the guide rollers do not fall out.



6. Push piston rod SP8083 right to the end.

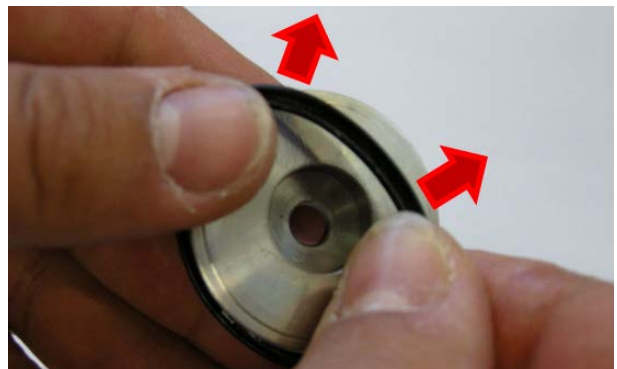


7. Fix the 3 hex screws SP8078 with hex key 3mm.



8. Place the Quad ring SP8066 into the piston SP8084 as shown.

Always use a new spare part SP8066



9. Place the two spiral-washers SP8066.1 in the piston SP8084.

Always use a new spare part SP8066.1

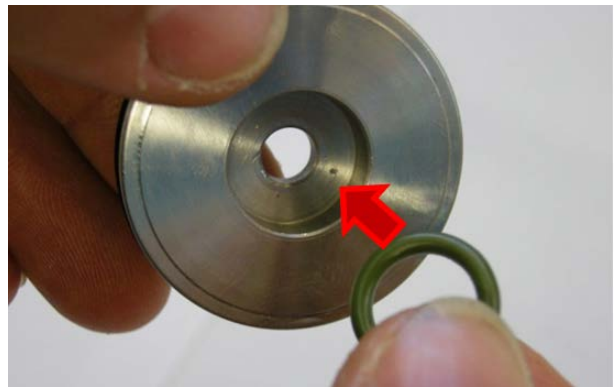
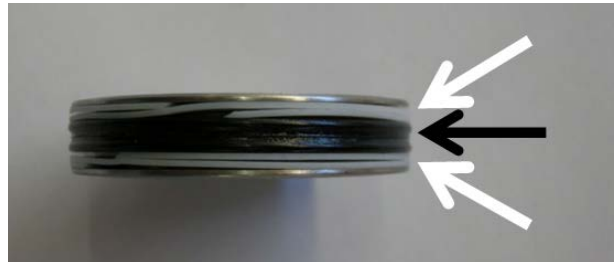
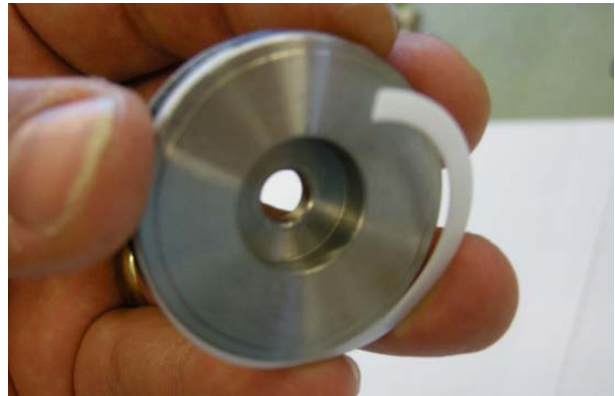
Overview of all the parts fitted:

- a) Spiral-ring SP8066.1
- b) Quad-ring SP8066
- c) Spiral-ring SP8066.1

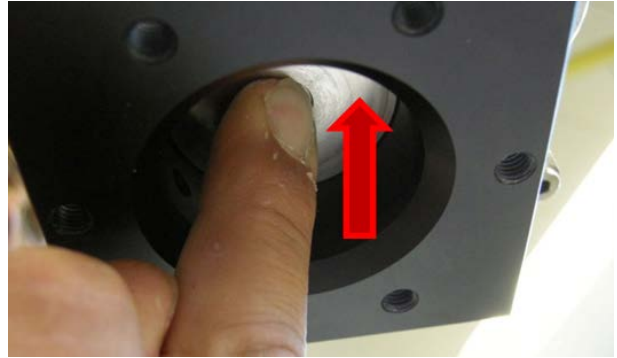
10. Grease and place the O-ring SP8064 into the piston SP8084.

11. Hold the valve body as shown and fit piston SP8084.

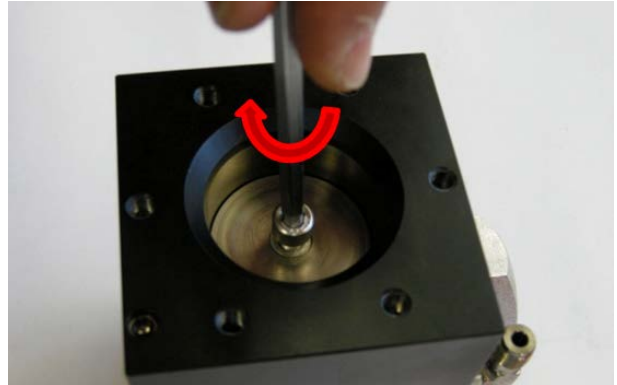
12. This way, the O-ring SP8064 cannot drop out.



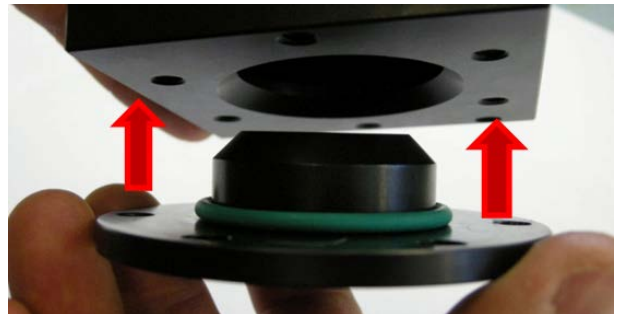
13. Push piston SP8084 until it stops.



14. Fix screw SP80105 (M6x12 BN610) with hex key 5mm.



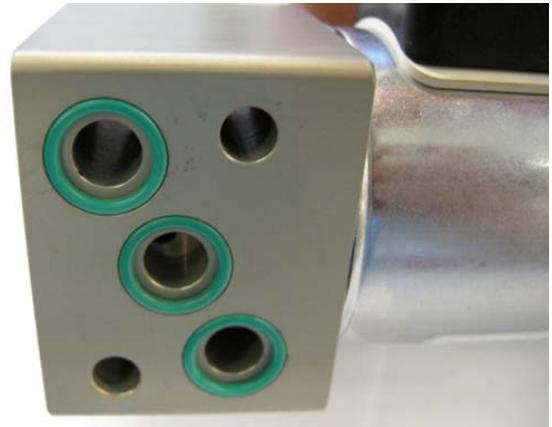
15. Grease the O-ring SP8063 und place it onto the Base plate SP8087.
Place base plate SP8087 on valve body



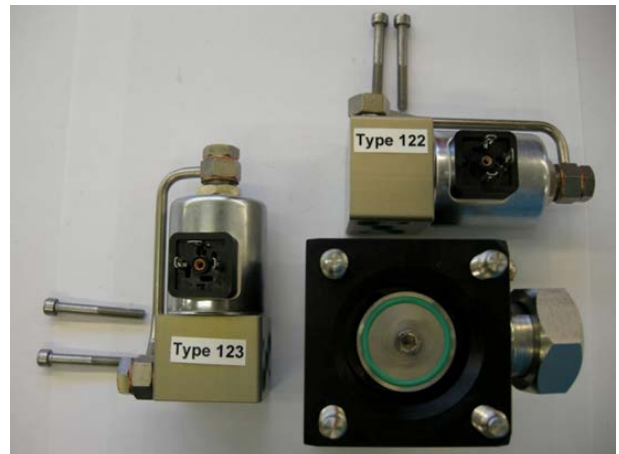
16. Grease hex screws SP80104 (M6x14 BN610). and fix with hex key 5mm.



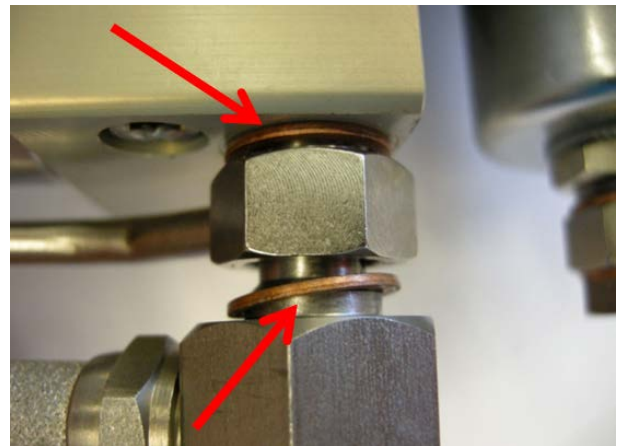
17. Grease and place the three O-rings SP8068 onto the valve SP8070.



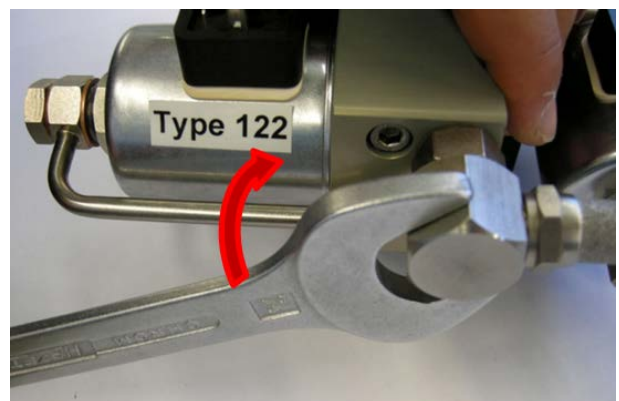
18. Fix the valves SP8070 (Type 122) and (Type 123) as shown.



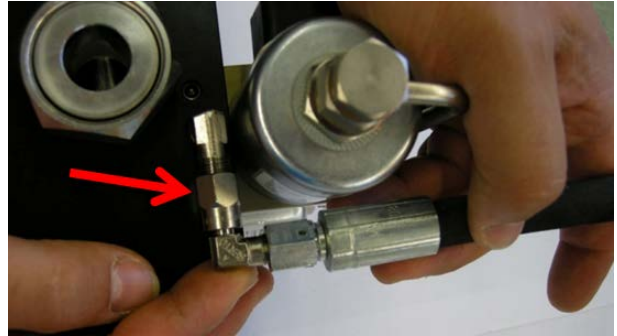
19. Put the cooper washers on the sound absorber SP8100 as shown.



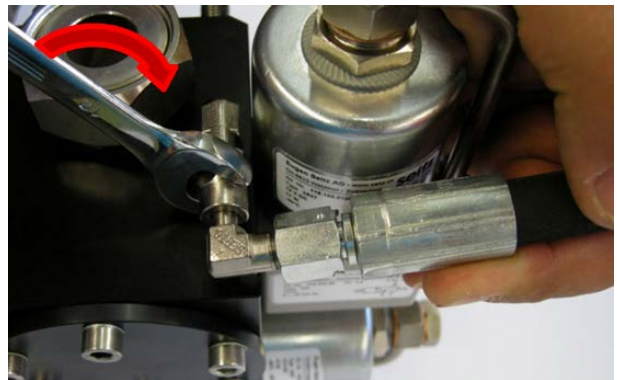
20. Fix the sound absorber with 24mm wrench.



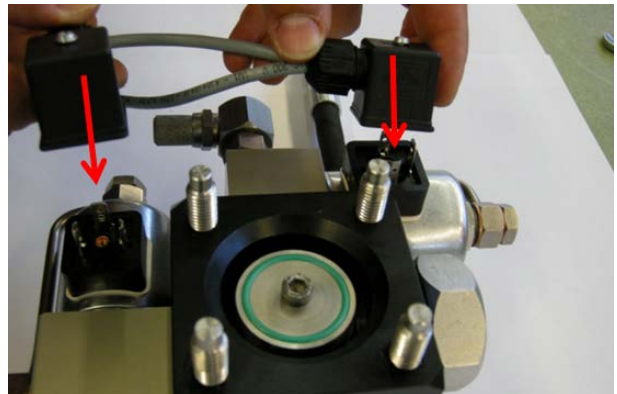
21. Place the pressure line SP8036 as shown.



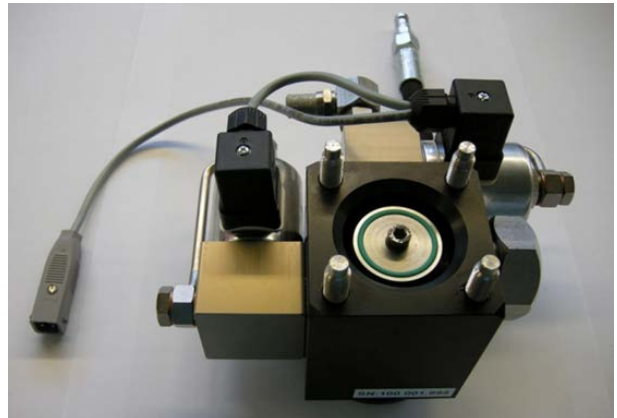
22. Fix the pressure line SP8036 with wrench 12mm.



23. Connect the connectors
There's only one position possible.



Overview of how it should look
when everything is in place !



8. Technology

8.1 Technical data

8.1.1 Technical data of 20-l-sphere

- Material of construction No.: 1.4435
- Wall thickness of inner jacket: min. 4 mm
- Wall thickness of outer jacket: min. 2 mm
- Volume of sphere: 20 l
- Volume of water jacket: 1.5 l
- Design pressure of sphere: 30 bar
- Design pressure of jacket: 10 bar
- Test pressure of sphere: 39 bar
- Test pressure of jacket: 14.3 bar
- Design temperature: 60 °C
- Bayonet ring aperture: 96 mm diameter
- Cleaning aperture: 140 mm diameter
- Sight glass: 30 mm diameter
- Measuring flange: 3 tapped bores M14 x 1.25
- Venting connection: hose ID. 12 mm
- Vacuum connection: Serto, 1/4" G
- Water connections: hose ID. 10 mm
- Overall dimensions (w,h,d): 650 x 875 x 820 mm
- Weight: 75 kg

8.1.2 Technical data of KSEP 310

- Compr. air connection on back: fitting: Serto 1/4" G
nominal pressure: 20 bar
max. pressure: 30 bar
- Vacuum connection on back: fitting: Serto 1/4" G
- Overall dimensions (w,h,d): 510 x 215 x 370 mm
- Weight: 13 kg

8.1.3 Technical data of KSEP 332

Control outputs (for KSEP 310 and ignition system)

Two 12-pole connectors according to DIN 41622 connected in parallel. The contacts are as follows:

- 5A, 5B: safety ground
- 4A, 4B: common and potential isolated ground return of 1A, 1B, 2A, 2B
- 3A,..3B: Safety switch (3A = plus / 3B = minus)
- 2B: Outlet valve 24V / 4A (current limited)
- 2A: Chemical igniters 24V / 4A (current limited)
- 1B: Inlet valve 24V / 0.6A (current limited)
- 1A: MIE system 24V / 0.6A (current limited)

Measuring unit

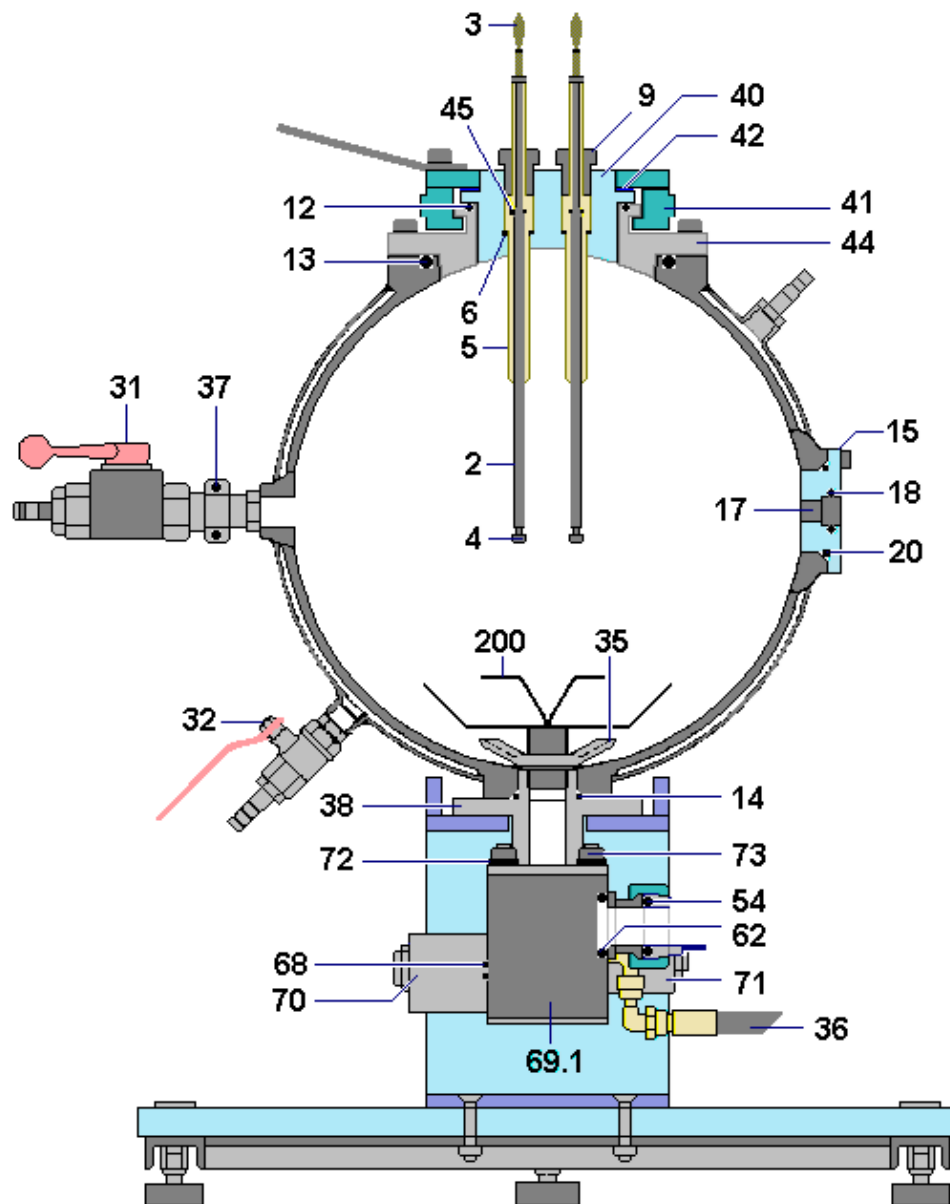
- Pressure range: +/- 20 bar
- Pressure resolution: 10 mbar
- Sampling time: 0.2 ms
- Recording time: 2.0 s
- Pressure transducer (2): Kistler Type 701A
- Charge amplifiers (2): Kistler Type 5041B
- Recorder output: 5.25V = +20 bar / 0V = -1 bar

Computer

- CMOS-Microprocessor: HD64180
- Program storage: EPROM 32 Kbytes
- Data storage: static CMOS RAM 32 Kbytes
- Data protection: Lithium Battery for CMOS RAM
- Interface: RS 232: 4800, N, 8, 2
- Mains supply: 230/115V, 50/60 Hz, 110W

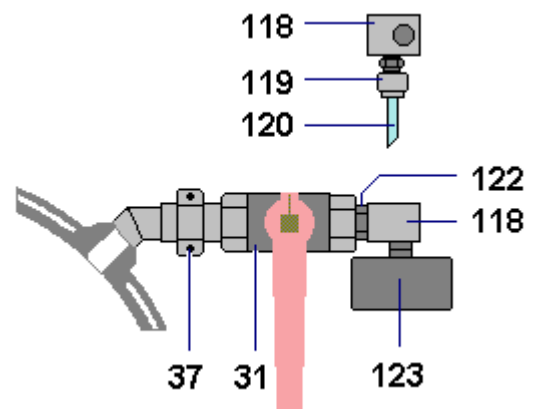
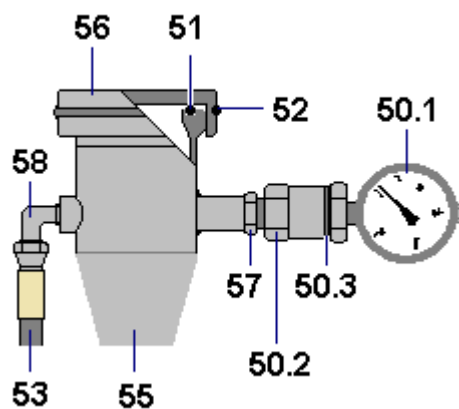
8.2 Spare parts

8.2.1 20-I-sphere



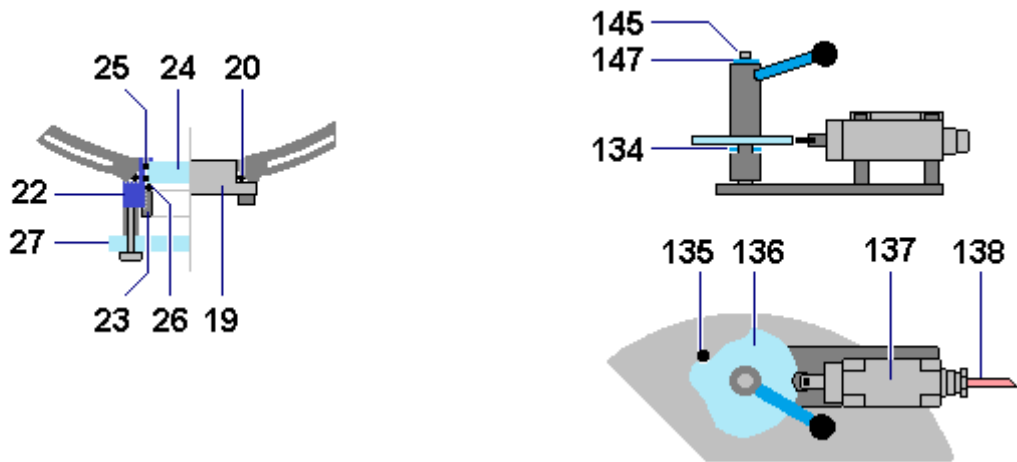
Dust storage container

Vacuum

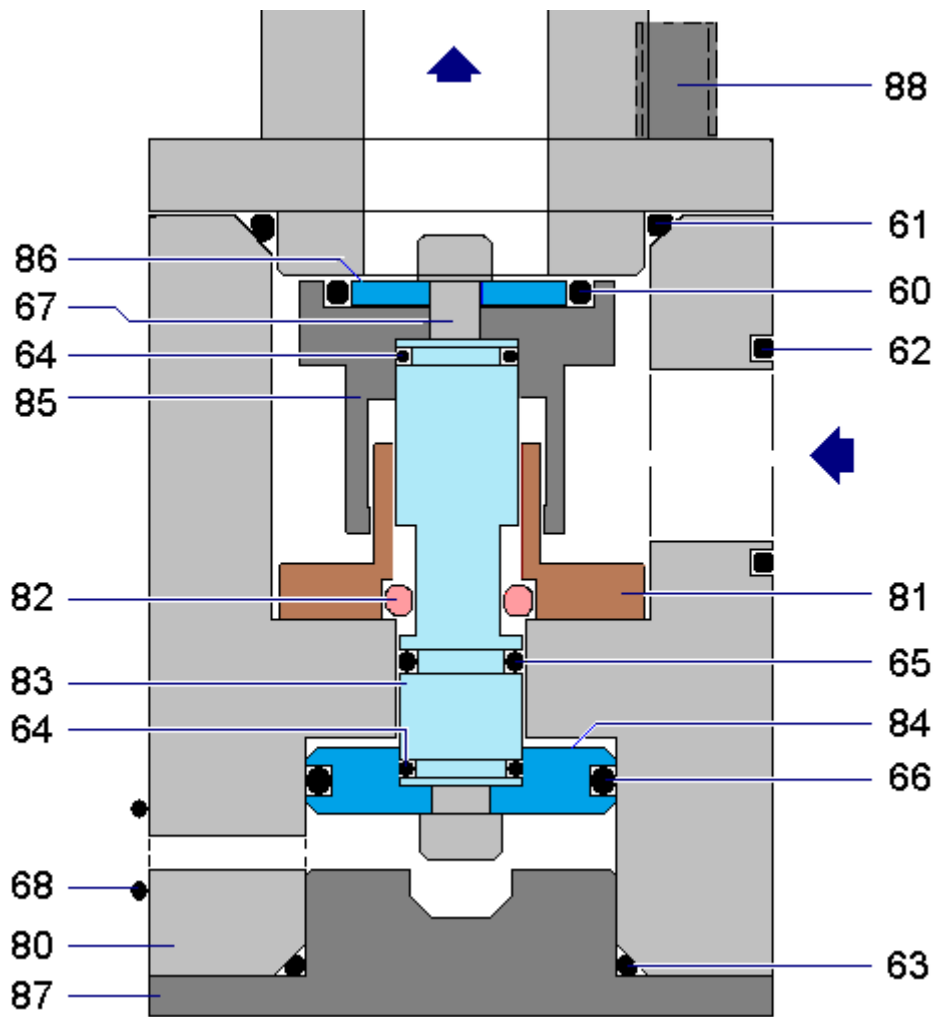


Sight glass / Flange

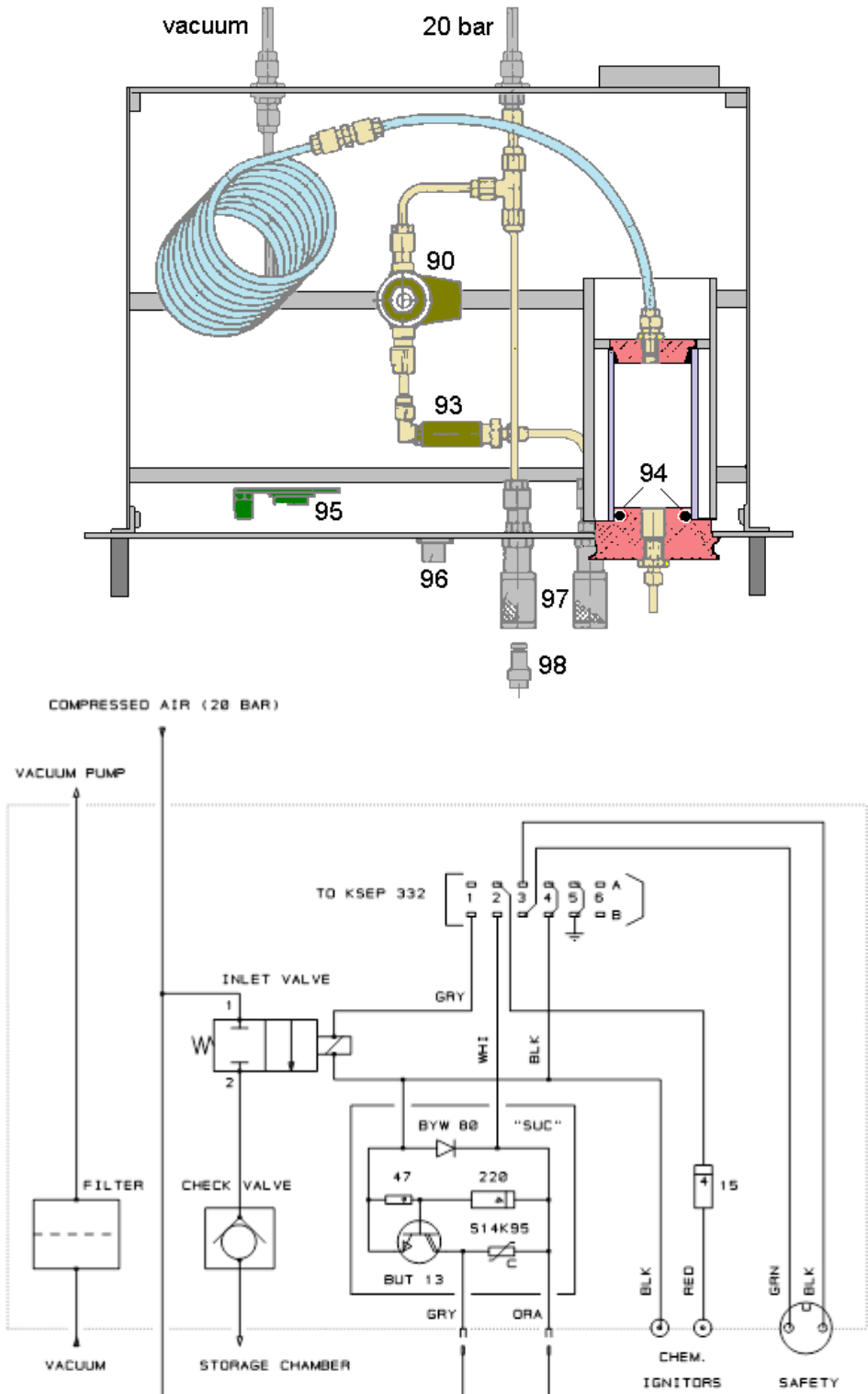
Safety



Outlet valve



8.2.2 Parts / Diagram of KSEP 310



8.2.3 Spare Parts SP8xxx (number „xxx“ on drawings)

SP8000	Recommended set of spare parts	SP8050	Gauge assembly (40 bar)
SP8001	Electrode assembly	SP8050.1	Gauge with pressure transfer unit
SP8002	Rod	SP8050.2	Reducer with seal R 3/4" - 1/4"
SP8003	Contact	SP8050.3	Seal 26.5 x 33
SP8004	Clamping screw	SP8051	O-ring 66.27 x 3.53 - 231
SP8005	Insulator	SP8052	O-ring 88.27 x 5.33 - 341
SP8006	O-ring 14.00 x 1.78 - 015	SP8053	Pressure line 1/4" - 1/4" 450 mm
SP8007	Electrode tips (100pcs)	SP8054	O-ring 26.64 x 2.62 - 121
SP8008	Plug	SP8055	Dust storage chamber assembly
SP8009	Pressure seal	SP8057	Screw-in nipple
SP8010	Ignition lead for chem. igniters	SP8058	Elbow fitting
SP8012	O-ring 101.19 x 3.53 - 242	SP8059	Connector-half G 3/4"
SP8013	O-ring 158.12 x 5.33 - 363	SP8060	O-ring 28.17 x 3.53 - 216
SP8014	O-ring 40 x 3	SP8061	O-ring 47.22 x 3.53 - 225
SP8016	Measuring flange	SP8062	O-ring 30 x 2
SP8017	Sealing screw for flange	SP8063	O-ring 40 x 3
SP8018	O-ring 15.54 x 2,62 - 114	SP8064	O-ring 11 x 2.5
SP8019	Solid flange	SP8065	Quad ring 4111 - 366Y
SP8020	O-ring 55.25 x 2.62 139	SP8066	Quad ring 4219 - 366Y
SP8021	Sight glass assembly	SP8067	Hex socket screw M6 x 16
SP8022	Sight glass support	SP8068	O-ring 10.82 x 1.78 - 013
SP8023	Threaded bushing	SP8069.1	Outlet valve assembly
SP8024	Sight glass	SP8070	Solenoid valve type 123
SP8025	O-ring 44.12 x 2.62 - 132	SP8071	Solenoid valve type 122
SP8026	Seal	SP8072	Washer
SP8027	Protective plate assembly	SP8073	Hex nut M10
SP8031	Ball valve (vent / vacuum)	SP8074	Hex socket screw M6 x 53
SP8031.1	Repair seal set for ball valve	SP8075	Hex socket screw M6 x 48
SP8032	Ball valve (water jacket)	SP8076	Adjustable fitting
SP8033	Ring nozzle assembly	SP8077	Elbow fitting
SP8034	End cap for pos. 8033	SP8081	Guide (Pos.81)
SP8035	Positioning unit for pos. 8033	SP8082	Round wedge (Pos.82)
SP8036	Pressure line 1/8" - 1/4" 190 mm	SP8083	Plunger (Pos.83)
SP8037	O-ring 21.95 x 1.78 - 020	SP8085	Plate (Pos.85)
SP8037.1	Coupling with threaded nipple	SP8086	Disc (Pos.86)
SP8038	Lower flange	SP8090	Inlet valve
SP8040	Filler block	SP8093	Check valve 1/8"
SP8041	Sealing ring	SP8094	O-ring 44.04 x 3.53 - 224
SP8042	Guide ring	SP8095	Speed up circuit
SP8044	Upper flange	SP8096	Chassis socket for outlet valve
SP8045	O-ring 4.47 x 1.78 - 008	SP8097	Quick connector female

SP8098	Quick connector male	SP8804	Pressure transducer Type 701A
SP8118	Manifold assembly	SP8805	Plug nipple Type 7411
SP8123	Vacuum gauge	SP8806	Adapter Type Z11784
SP8123.1	Vacuum gauge assembly	SP8807	Measuring cable Type Z4368sp
SP8134	Slide plate	SP8808	Silicone rubber Type 1043
SP8137	Safety switch	SP8809	Cleaning spray Type 1001A
SP8148	Safety assembly	SP8818	Remote control for KSEP 332
SP8200	Rebound nozzle	SP8819	Print K332A Microprocessor
SP8803	Charge amplifier Type 5041B	SP8820	Print K331B Control print