

Annex to 20-I-Apparatus



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Annex (this document)

1. Installation
2. Piezoelectric pressure transducers
3. General Test Procedure
4. Cleaning the apparatus
5. Maintenance of outlet valve
6. Technics

Manual

1. Fundamentals
2. Software
3. Operation
4. Procedures for Dusts
5. Procedure for Hybrid Mixtures
6. Procedure for Gas (quiescent)
7. Utilities
8. Troubleshooting
9. Maintenance
10. References

Symbols



Please read this note!



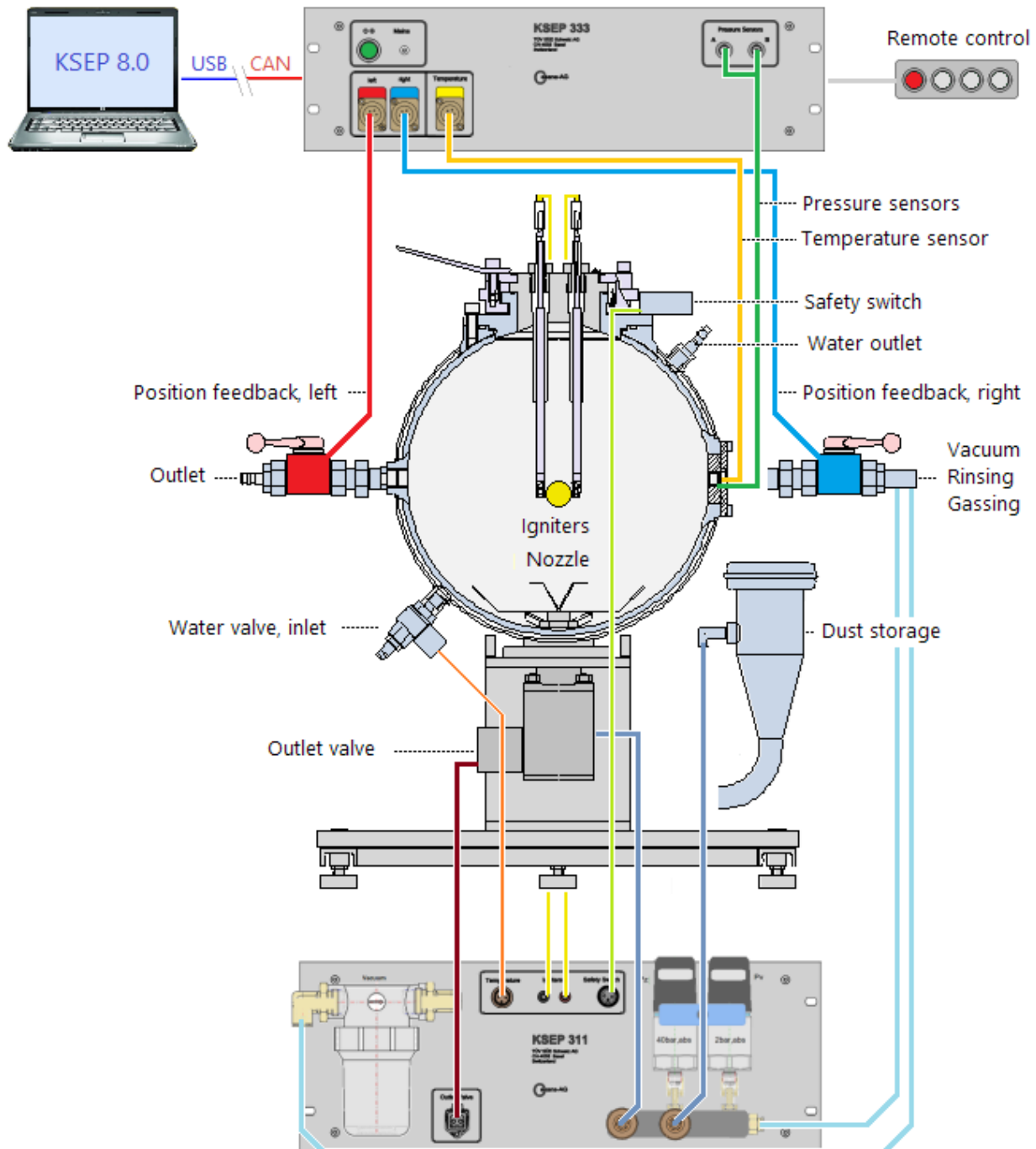
Question Answer



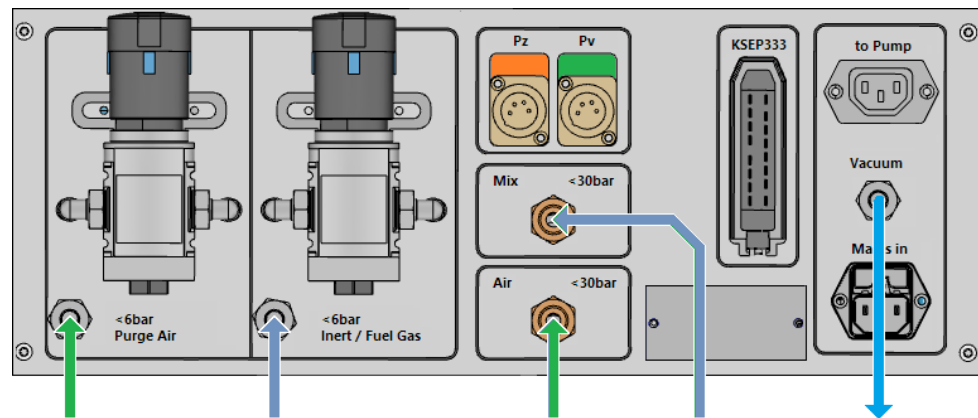
Attention: Please read this safety instruction carefully!

1. Installation

1.1 Apparatus



1.1.1 Pneumatic connections



Function:

Dust: Pmax, Kmax

Dust: LOC

Hybrid Mixture

Gas: Pmax, Kmax

maximum [bar]

Air 1

Air 1

Air 1

Air 1

6

Inert gas

Fuel gas

Fuel gas

6

Air 2

Air 2

Air 2

-

30

Inert gas

-

-

30

Vacuum

Vacuum

Vacuum

Vacuum

-

Compressed air 1:

This compressed air is used for cleaning.



Adjust to **1 bar** overpressure with the pressure regulator above (display = 1 bar).

Maximum 2 bar overpressure = 3 bar, absolute!

Inert gas, Fuel gas:

This connection is used only with LOC, Hybrid mixture and Gas.



Adjust to **1 bar** overpressure with the pressure regulator above (display = 1 bar).

Maximum 2 bar overpressure = 3 bar, absolute!

Compressed air 2:

This compressed air is used on the one hand as control air for the outlet valve and on the other hand for filling the dust reservoir. The precise dispersion pressure of 21 bar, absolute is controlled by the system. Therefore, the reduced pressure from the bottle must be slightly higher:

Nominal value = **21 bar overpressure** = 22 bar, absolute.



Only normal compressor compressed air from pressure cylinders may be used. With synthetic compressed air, strongly deviating explosion characteristics are measured.

Inert gas:

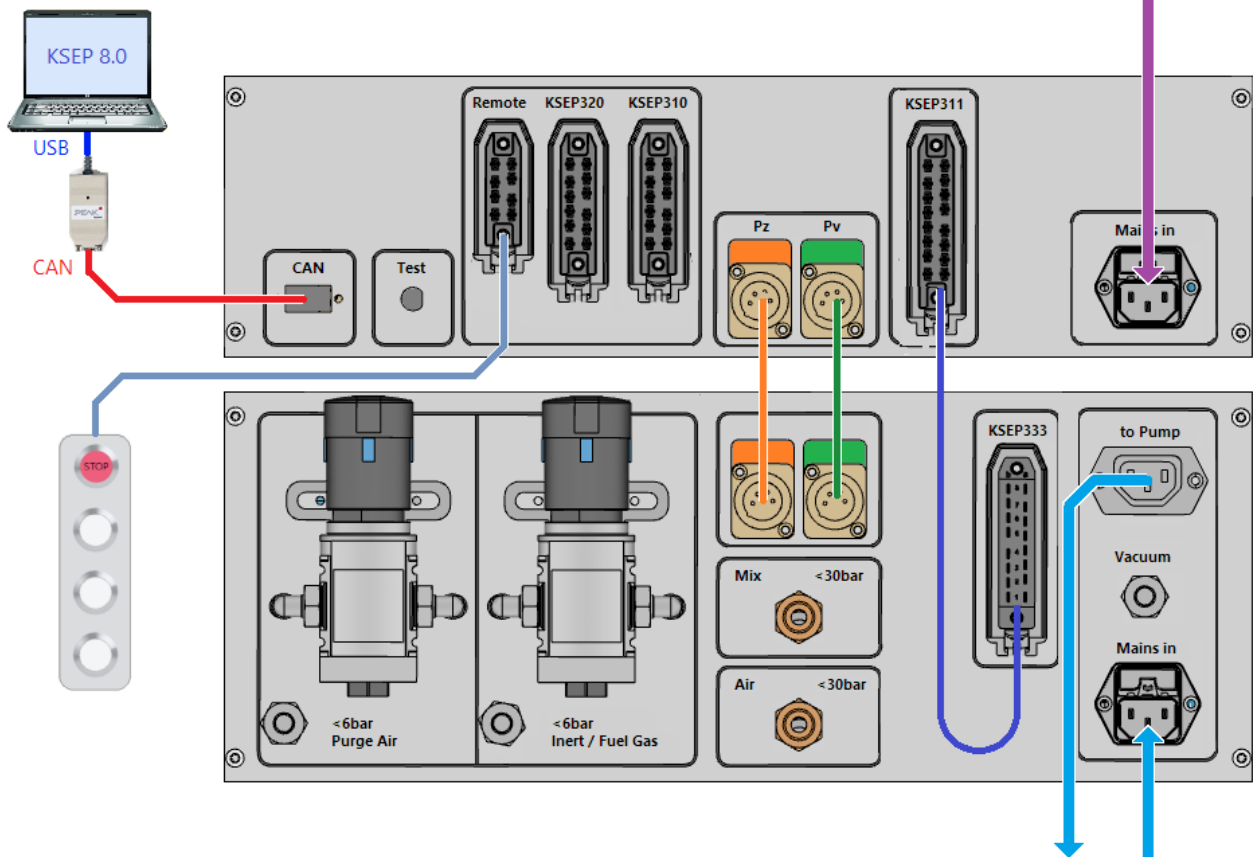
This inert gas is used to fill the dust supply container. The precise dispersion pressure of 21 bar, absolute is controlled by the system. Therefore, the reduced pressure from the bottle must be slightly higher: Nominal value = **21 bar overpressure** = 21 bar, absolute.

Vacuum:

Before the start of each test, the 20-liter apparatus is evacuated in order to obtain normal pressure (1.0 bar abs.) for the dust explosion after the subsequent expansion of the dust reservoir air.

1.1.2 Electrical connections

Mains connection to KSEP333: 100-240VAC, 50-60Hz, 180W

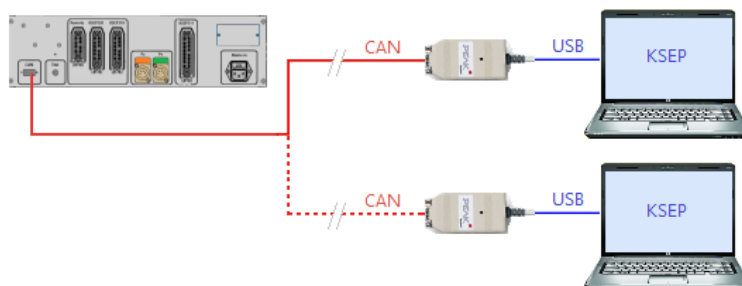


switched mains connection to the vacuum pump (max. 10A)



The **CAN bus** (Controller Area Network) is a serial bus system. The CAN bus was developed in 1983 by Bosch for the automobile, is internationally standardized and nowadays also widely used in industry as a field bus under various designations and data protocols. This bus is characterized by its robustness. Even cable lengths of up to 100m between KSEP333 and CAN-USB adapter are possible.

Connection of one KSEP333 to one or more PC's:



1.1.3 Position feedback

The position of the two ball valves is monitored:

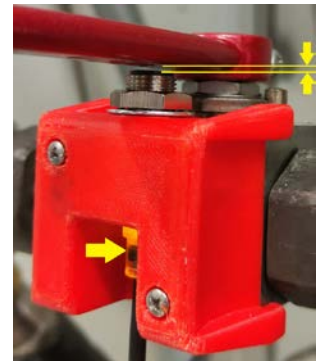
Left = outlet = red

Right = vacuum, rinsing, gassing = blue

The sensors hold themselves magnetically on the valve body.

The distance of the contactless proximity switches to the handle must be set once to a maximum of 1mm.

When the ball valve is closed, the LED display lights up.



1.2 Accessories

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

1.2.1 Laboratory hood

Usually, the 20 l sphere and its control units KSEP333 / 311 are installed in a ventilated laboratory hood.

1.2.2 Exhaust air



After a test, the sphere is relieved via the left ball valve. Glowing particles must be expected. If discharged directly into the ventilation of the hood, a fire hazard may occur.

Air flow of ventilation approx. 1225 m³/h

1.2.3 Vacuum



Before the start of each test, the 20-liter apparatus is evacuated to a vacuum of 0.4 bar abs. in order to return to normal pressure (1.0 bar abs.) as the initial pressure for the dust explosion after the subsequent expansion of the dust reservoir air.

To ensure that the evacuation time is not too long, we recommend a vacuum pump with at least 6m³ / hour (1.7 liters / second)

1.2.4 Water cooling



Due to the high test frequency, the explosion sphere must be kept at the operating temperature of 20°C ± 5°C by means of water cooling. Optionally, the temperature is controlled by a water valve. This saves cooling water.

Minimum flow of cooling water: 0.5 liters / minute

1.2.5 Industrial vacuum cleaner

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

1.2.6 Personal Computer (PC)

Operating system "Microsoft-Windows" 7...11 (32/64-bit)

USB port (USB 1.1, USB 2.0 or USB 3.0) on computer

Monitor resolution at least 1200 x 800

1.2.7 Chemical Igniters

For each test you need:

Determination of explosion indices (Pmax, Kmax):

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

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:

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Manufacturer:

Simex Control s.r.o.

Ul. 4. května 175

Vsetín 755 01 CZ

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Tel: +42 0571 498 711

sale@simexcontrol.cz

Distributor for USA and Canada:

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Verona, NY 13478

U.S.A.

Tel: +1 315 337 9181

office@cesanacorp.com

2. Piezoelectric pressure transducers

2.1 Pressure measuring equipment

The KSEP 333 unit uses piezoelectric pressure transducers to measure the pressure curve as a function of time, and controls the valves and the ignition system of the 20-liter apparatus. The measured values are digitized with high resolution and sent to the higher-level personal computer for further processing. As a safeguard against faulty measurements and for self-testing, the system operates with **two fully independent measuring channels**.

Pressure transducer

The pressure transducers (Kistler) work according to the piezoelectric principle: a quartz crystal is deformed by the pressure. This creates an electrical charge on its surface proportional to the pressure difference.

unit: "Coulomb" **C** ($10\text{E-}12\text{ C} = 1\text{pC}$)

Piezoelectric pressure sensing only allows the measurement of pressure differences. Unavoidable insulation resistances of the lead wires and plug connections lead to a slow change of the charge signal. This means that the electrical signal will change even if static pressure is applied to the transducer. For the short recording duration of an explosion, this drift is negligible.

2.2 Mounting the pressure transducer type 701A

1. All parts



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 ...



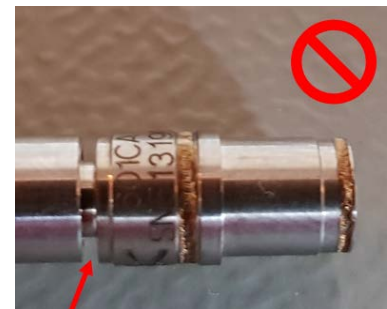
It is recommended to rinse the connectors with a cleaning spray (Kistler Type No. 1001A) before connecting them.

2.3 Mounting the pressure transducers Type 601CAB

1. All parts



2. Screw by hand SP8801 and SP8802 together



No gap should be visible

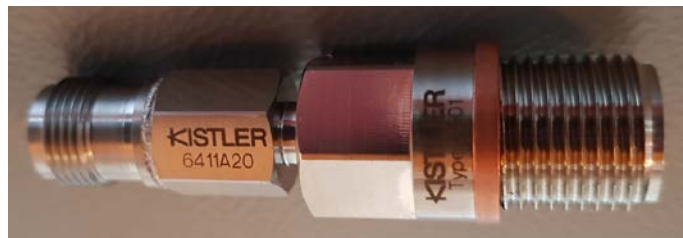
3. Bring the copper seal in Position.



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 rinse the connectors with a cleaning spray (Kistler Type No. 1001A) before connecting them.

2.4 Protect diaphragm of pressure transducers



The diaphragm of the pressure transducer must be protected from the flame front of the explosion by a layer of silicone rubber maximum **2 mm** thick. Protective layers that are too hard and too thick cause a force shunt on the diaphragm and thus lead to incorrect measurements, especially in the negative pressure range. The silicone protective layer must be renewed periodically.



3. General Test Procedure

3.1 Preparation

When handling the chemical igniters, protective goggles must be worn and care must be taken to protect against electrostatic discharges.



1. Preparation of the igniters:

Sobbe igniters (left) are electrically connected in parallel. Therefore, strip the wires and twist the two red and white wires together.

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

The current **Sobbe** igniters are protected from electrostatics by a metal cup.

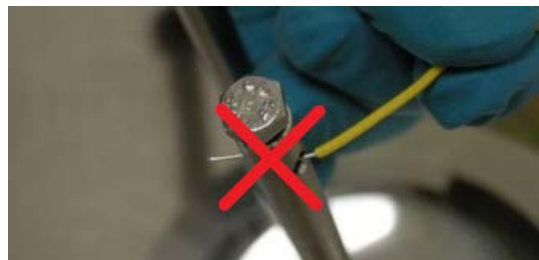


2. Attach the igniter to the electrode rods:
To do this, wrap the connecting wires around the screw and clamp them with the screw.

The contact surfaces must be clean.
If necessary, clean them first with a steel brush.



The holes are intended to accommodate electrodes for the continuous spark and are not suitable for the electrical connection of the igniters.



Note:

The two igniters are firing horizontal and in opposite directions.



3. Carefully weigh out the dust and pour it into the storage container.



4. Make sure that the dust is as far down as possible. If necessary, tap the reservoir with your hand.



3.2 After the test

Open the sphere.

Remove burnt igniters and
clean ignition rods.

Clean the rebound nozzle.
All bores must be free.



Remove the residues in the sphere and in
the dust storage container with a vacuum
cleaner.



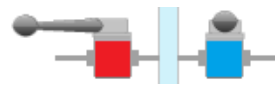
4. Cleaning the apparatus

4.1 Disassembly and cleaning

1. Close compressed air on the cylinder.



2. Open left ball valve and close right ball valve.



3. Press the "OUT" key on the remote control several times until the compressed air is completely drained.



4. Unscrew the pressure transducers with wrench 16 mm.



5. Unscrew the bayonet ring with an Allen key.



6. Remove the top flange.

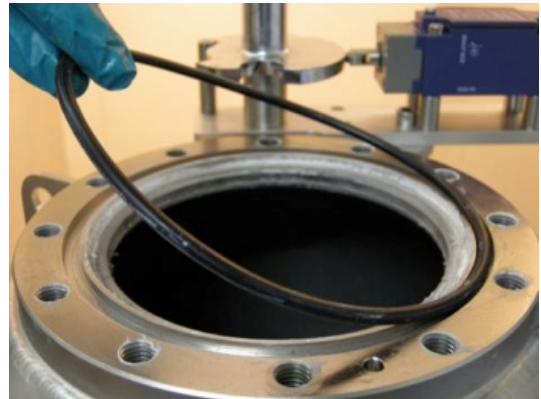


7. Clean the top flange:
Depending on the dust, use a suitable solvent.

For the CaRo test dust, water can be used.



8. Remove the O-ring SP8012.



9. Use a vacuum cleaner to remove the remaining dust from the outside.



10. Unscrew the SP8200 rebound nozzle and clean it in a water or solvent bath.



11. Unscrew the dust storage with wrench 24 and 43mm



12. Remove the safety chain of the dust storage.



13. Unscrew the left ball valve and clean in a water or solvent bath



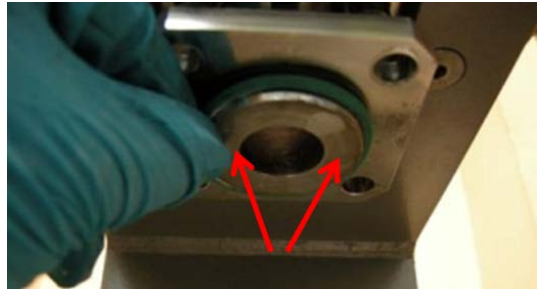
14. Unscrew the outlet valve with wrench 17mm



15. Remove the O-ring SP8014.



16. Clean the flange carefully with water or solvent.
When cleaning mechanically, it is essential to avoid scratches, because this is a sealing surface!



17. Clean the inner wall of the sphere:
a) with wire brush or spatula.



- b) with cleaning strip



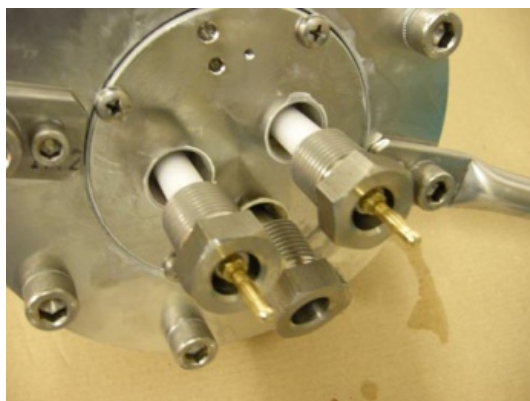
- c) with water or solvent



This is how the sphere should look after cleaning!



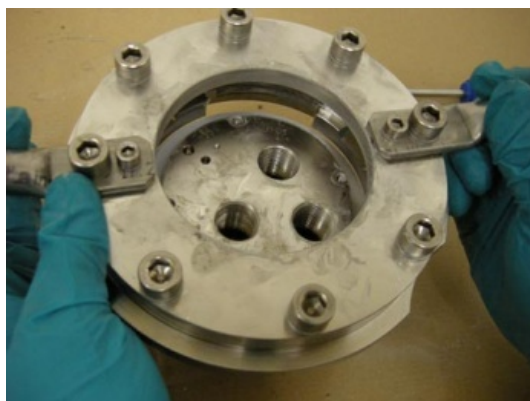
- 18.** Disassemble the bayonet ring:
The electrodes with wrench 24mm.



- 19.** Remove the 4 holding screws.



- 20.** Separate the bayonet ring.



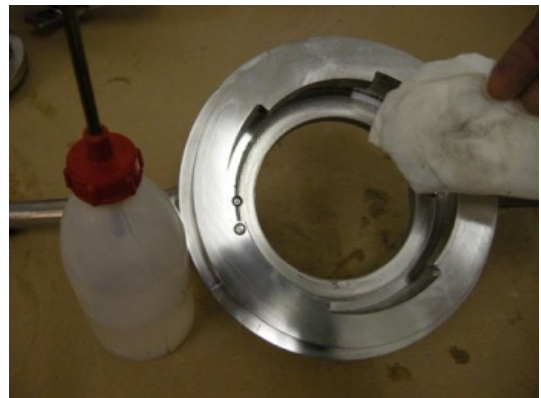
- 21.** Remove the SP8042 slide ring.



- 22.** The block is now placed in the bucket with the cleaning bath.



- 23.** Clean the bayonet ring with water or solvent.



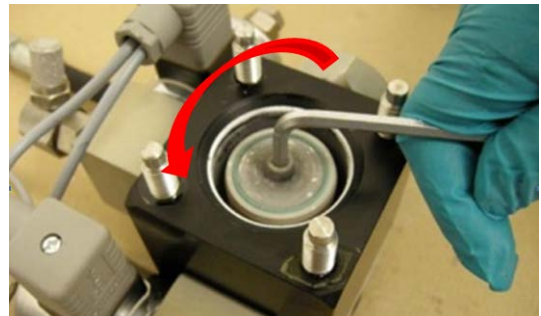
- 24.** Clean the dust storage.



25. Overview of all the cleaned parts:



26. **Outlet valve:**
Unscrew screw SP8067 with Allen key 5mm



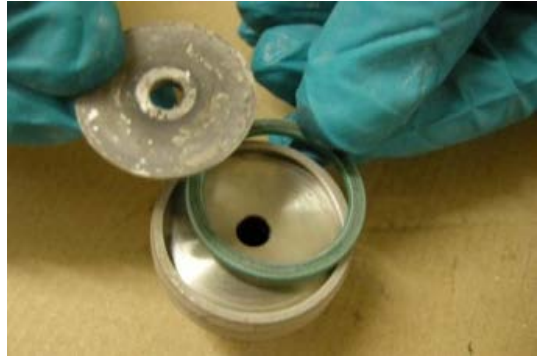
27. Turn the outlet valve and remove the disc SP8085 from the valve body.



28. Remove the O-ring SP8064.



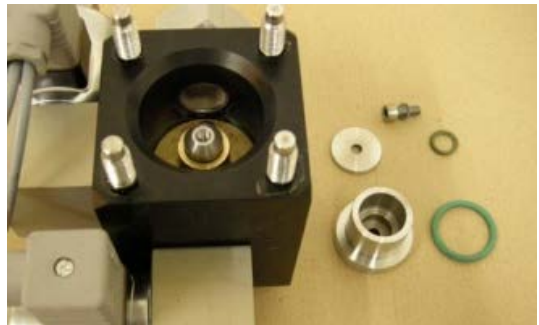
- 29.** Disassemble into 3 parts:
SP8085, SP8086 and SP8060.



- 30.** Clean the inside of the outlet valve.



- 31.** Overview of the cleaned parts:



4.2 Assembly



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

Generally: Tighten screws only slightly. Tightness is achieved via O-rings!

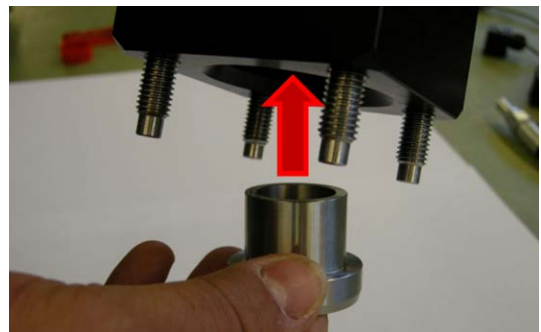
The screws must be loosened again for the next cleaning.



1. Grease the O-ring SP8064 and install it in the disc SP8085.

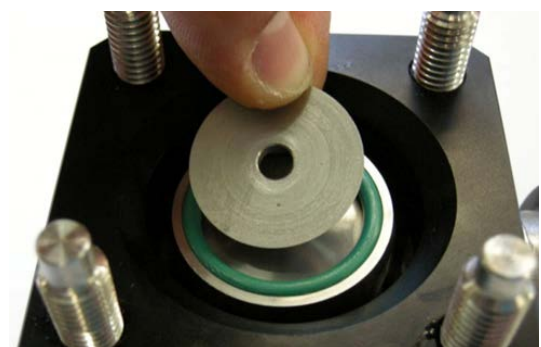


2. Hold the valve body in this position and insert the SP8085 disc.

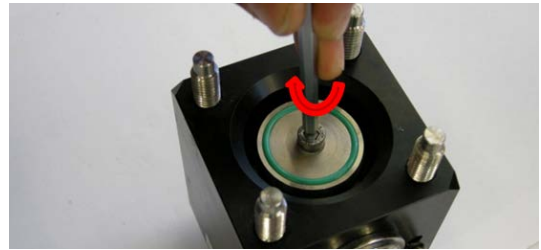


3. Grease and insert the O-ring SP8060 into the plate SP8085.

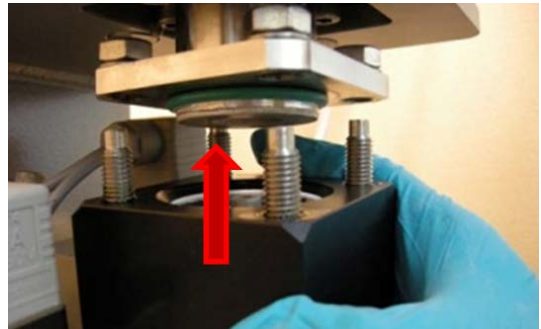
Insert the washer SP8086 into the plate SP8085.



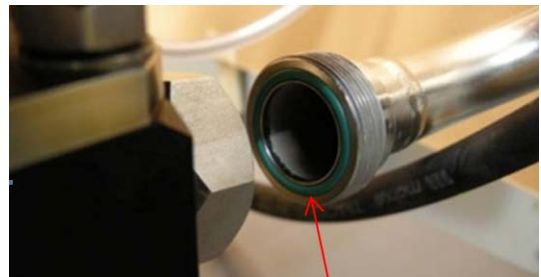
4. Grease screw SP8067 (M6x16 BN610) and the washers.
Fasten with screw SP8067.
(Allen key 5mm)



5. Fasten the outlet valve with the 4 nuts.
Key 17mm.



6. Fasten the dust storage:
 - a) Safety chain.
 - b) Do not forget the O-ring SP8054



- c) Tighten the coupling nut by hand.



- d) and tighten with keys 24, 42mm



7. Insert rebound nozzle and turn clockwise.



8. Grease and insert the O-ring SP8012.



9. Insert the top flange.
Only one position is possible!



10. Screw on the top flange.
Tighten the screws crosswise,
but only lightly and please do not use force.



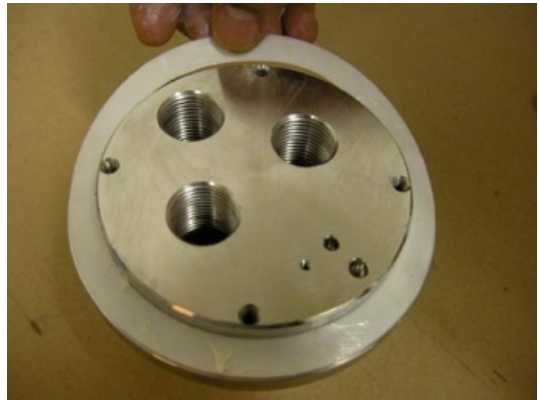
11. Fasten the left ball valve.
Do not forget the O-ring SP8037



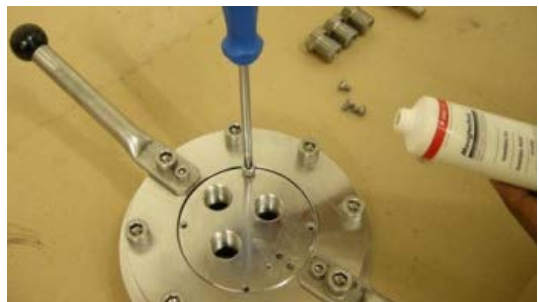
12. With wrench 22mm hold the ball valve
and with wrench 36mm
tighten the union nut.



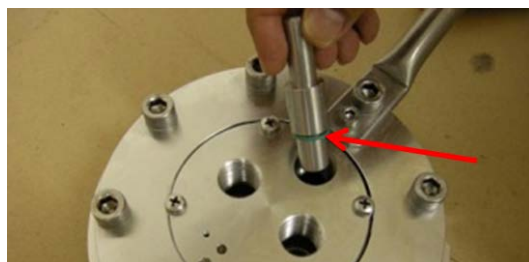
13. Generously grease the sliding ring
and place it on the block.



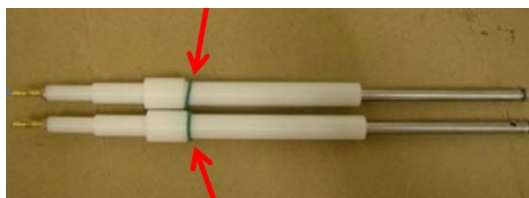
14. Place the bayonet ring on the block
and fix it with 4 screws.



15. Insert the cylindrical filling piece.
Do not forget the O-ring SP8045.



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



17. Fix the 3 screw caps with wrench 24mm



5. Maintenance of outlet valve

5.1 Normal cleaning

before you start with a new dust

5.2 Extended cleaning

after heavy pollution

5.3 Full Service (only for experts)



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



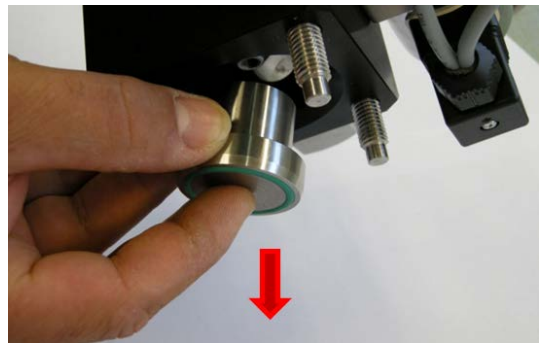
5.1 Normal cleaning

5.1.1 Disassembly

1. Remove screw SP8067 with Allen key 5mm.



2. Remove the SP8085 disc from the valve body.



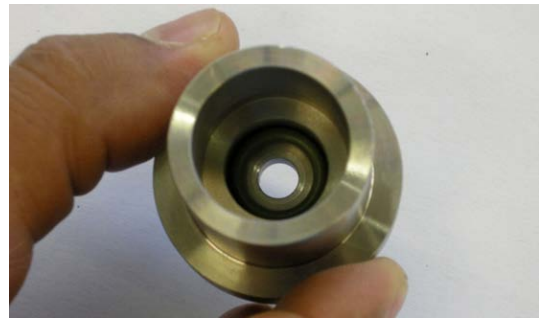
Parts (from left to right):

- a) SP8064 (O-ring)
- b) SP8085 (plate)
- c) SP8060 (O-ring)
- d) SP8086 (Washer)
- e) SP80106 (washer M6)
- f) SP8067 (screw M6x16 BN610)

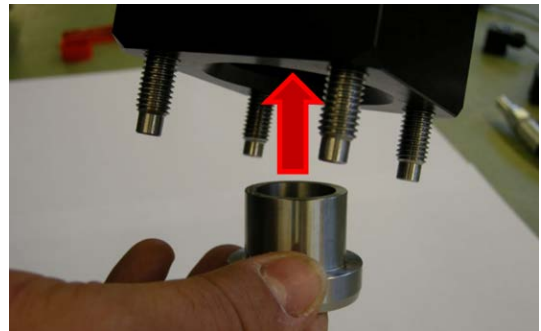


5.1.2 Assembly

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

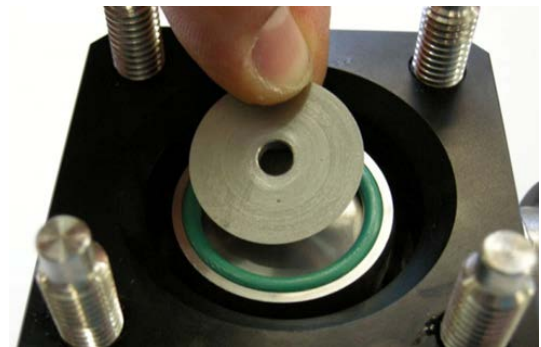


2. Hold the valve body in this position and insert the SP8085 disc.

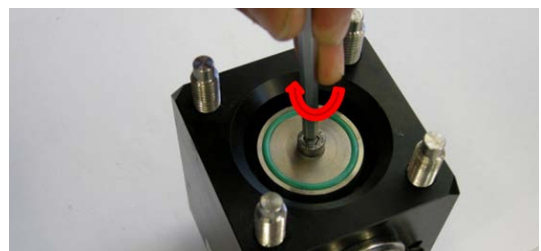


3. Grease and insert the O-ring SP8060 into the plate SP8085.

Insert the washer SP8086 into the plate SP8085.



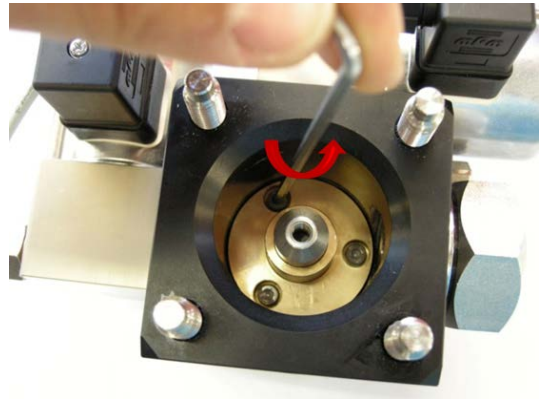
4. Grease screw SP8067 (M6x16 BN610) and the washers.
Fasten with screw SP8067.
(Allen key 5mm)



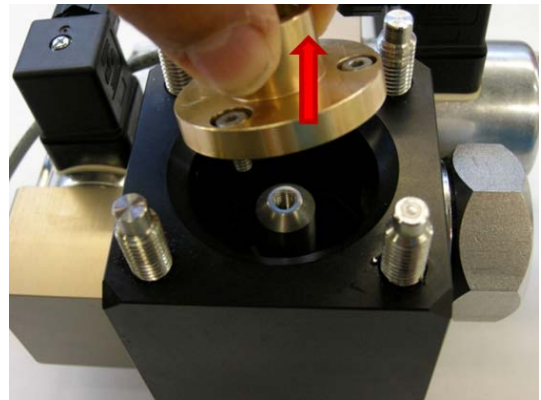
5.2 Extended cleaning

5.2.1 Disassembly

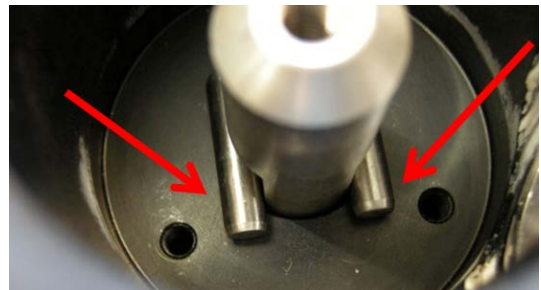
1. Remove 3 screws SP8078 (M4x8mm BN610) from guide SP8081 with Allen key 3mm.



2. Lift the guide SP8081 from the valve body.



3. Take out the SP8082 guide rollers.



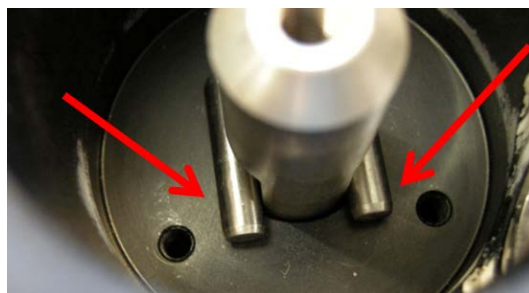
Overview of the parts:

4.
 - a) 2 x guide rollers SP8082
 - b) 1 x guide SP8081
 - c) 3 x screw SP8078 (M4x8 BN610).

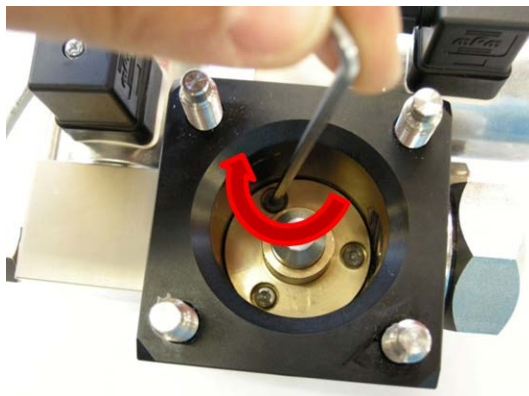


5.2.2 Assembly

1. Insert the guide rollers SP8082.



2. Fasten the guide with 3 screws SP8078 and Allen key 3mm.

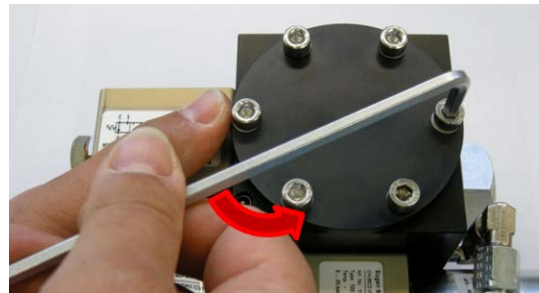


3. Continue with 5.1.2 Normal cleaning: Assembly

5.3 Full Service (only for experts)

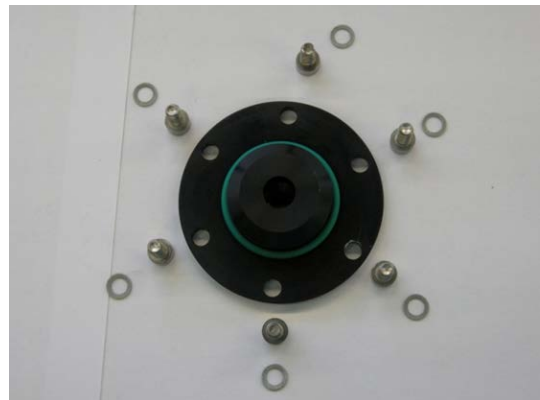
5.3.1 Disassembly

1. Unscrew 6 screws SP80104 (M6x14 BN610).



Overview of parts:

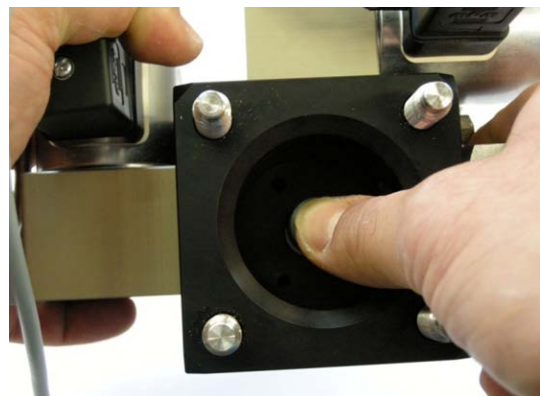
- a) 1 x base plate SP8087
- b) 1 x O-ring SP8063
- c) 6 x M6x14 SP80104
- d) 6 x M6 washers SP80106



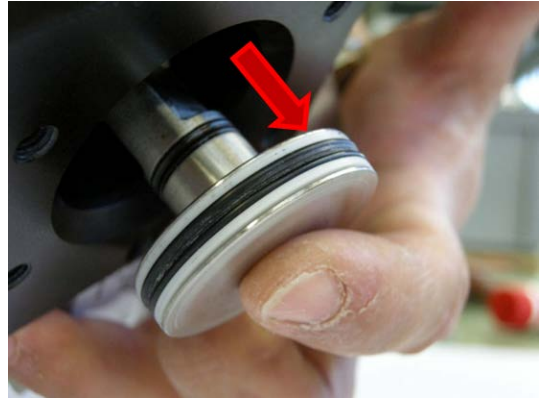
2. Unscrewing:
screw SP80105 (M6 x 12)
with Allen key 5mm



3. Push the SP8083 plunger out from the other side.



4. Hold the SP8084 piston..
See picture.



Overview of parts.

- a) SP8083 Plunger.
- b) SP8084 Piston.
- c) SP8064 O-ring.
- d) SP80105 (M6x12) screw.
- e) SP80106 M6 washer



5. Remove the support rings SP8066.1 from piston SP8084



6. Take out the SP8066 quad ring.

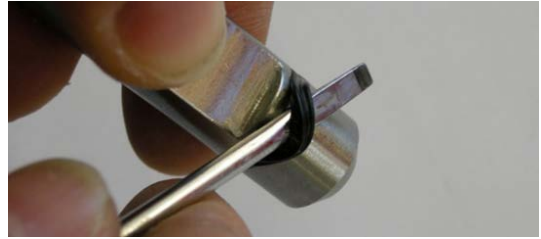


Overview of parts:

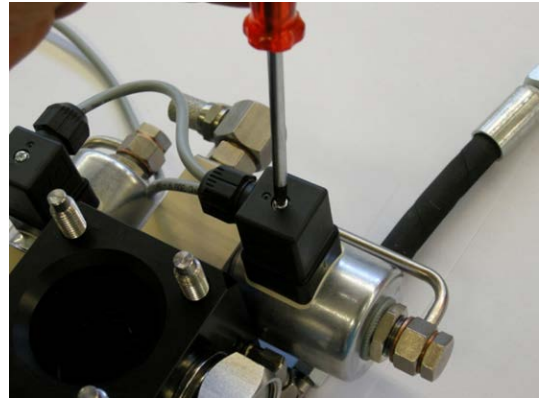
- a) SP8084 Piston
- b) SP8066.1 Support ring
- c) SP8066 Quad ring
- d) SP8066.1 Support ring



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.

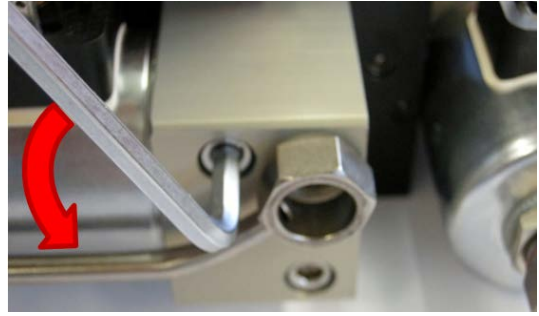


Overview of removed parts:

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

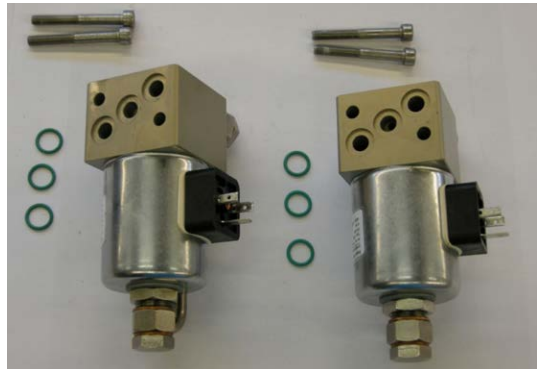


11. Remove hex screws SP80107 (M6x50 BN611) from the valve body

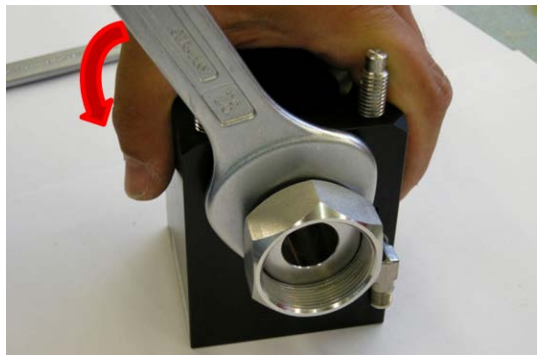


Overview of removed parts

- a) 2x 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



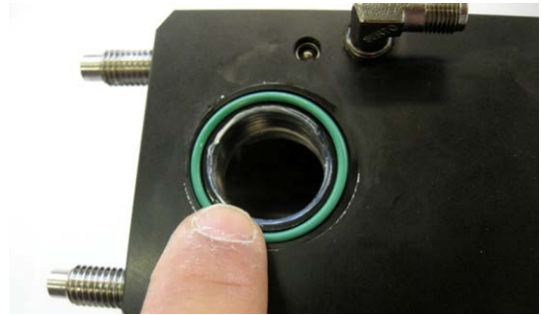
Overview of removed parts:

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

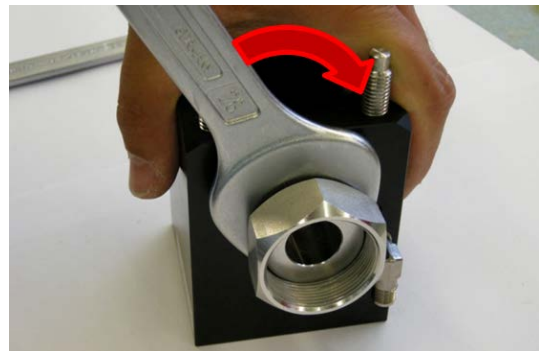


5.3.2 Assembly

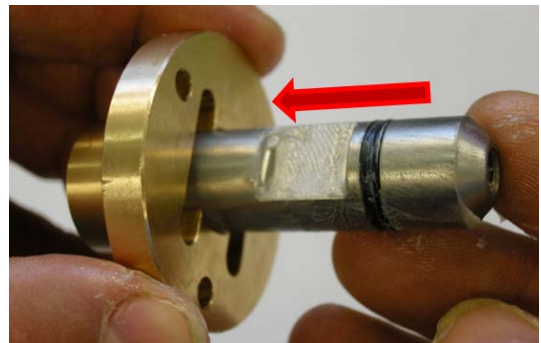
1. Place the O-ring SP8062 into the valve body.



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



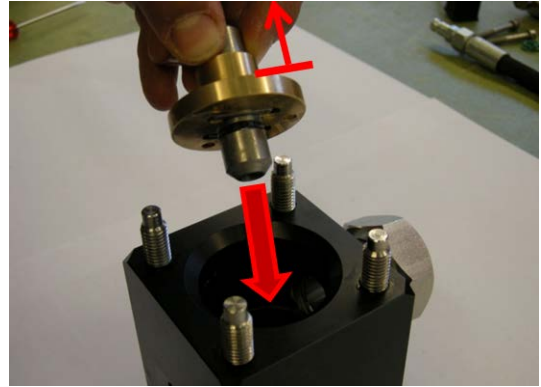
3. Place the Quad-ring SP8065 into the pilot valve SP8083.
Always use a new spare part (SP8065)
Fit piston rod into the guide ring SP8081



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



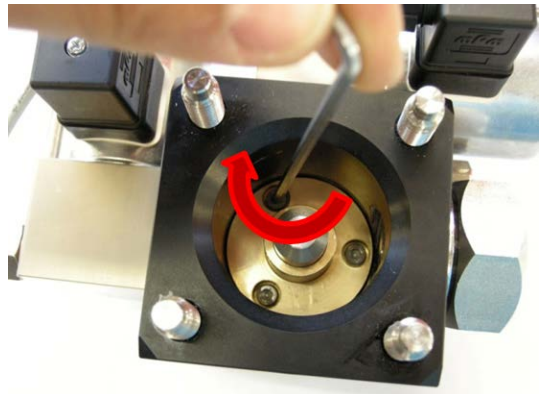
5. Fit piston rod as shown, make sure that the guide rollers do not fall out.



6. Push piston rod SP8083 right to the end.

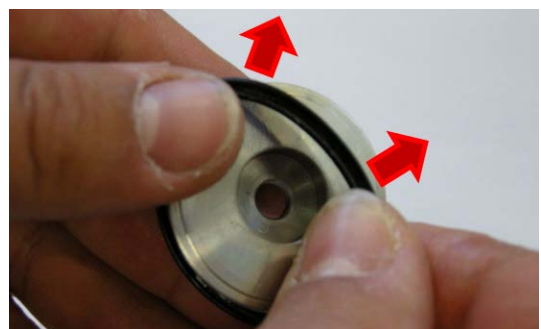


7. Fasten with 3 screws.
Allen key 3mm.



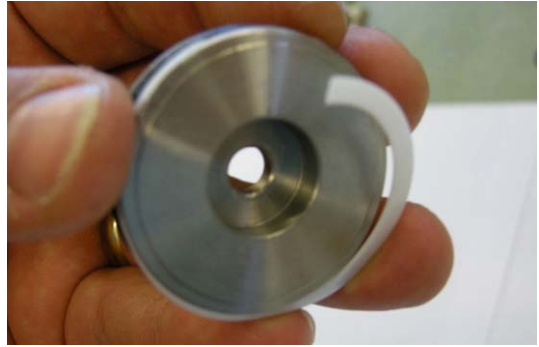
8. Place the Quad ring SP8066 into the piston SP8084 as shown.

Always use a new spare part SP8066



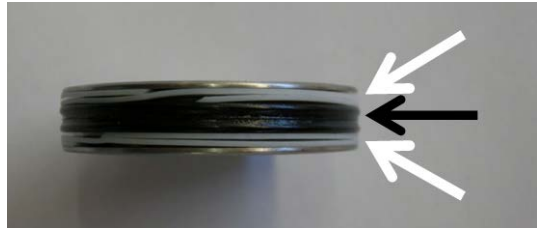
9. Place the two spiral-washers SP8066.1 in the piston SP8084.

Always use a new spare part SP8066.1

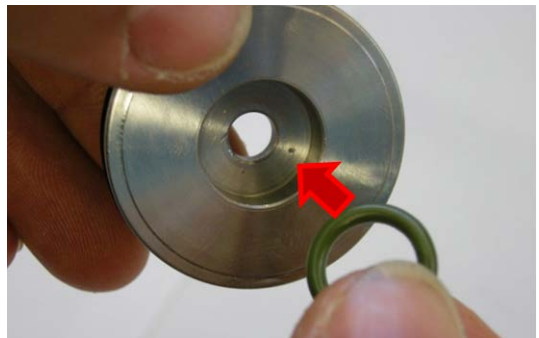


Overview of all the parts fitted:

- 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.



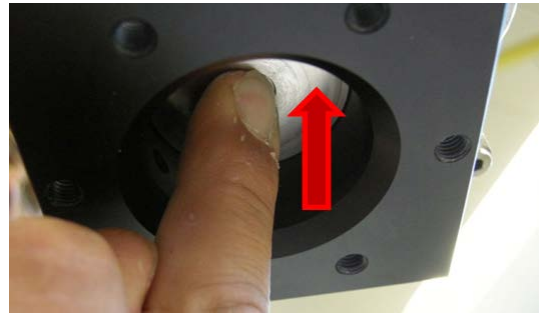
11. Hold the valve body as shown and fit piston SP8084.



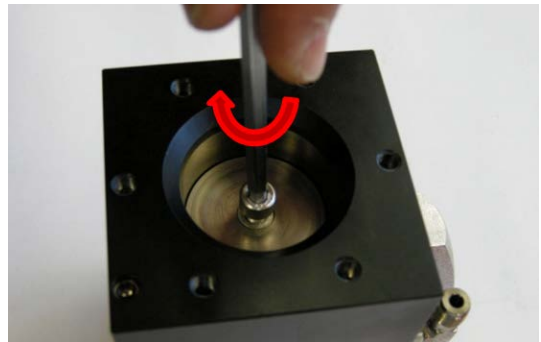
12. This way, the O-ring SP8064 cannot drop out.



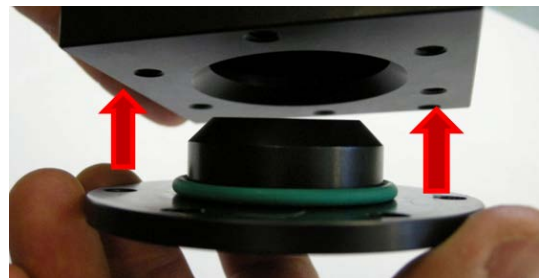
13. Push piston SP8084 until it stops.



14. Fasten with screw SP80105 (M6x12).
Allen key 5mm.



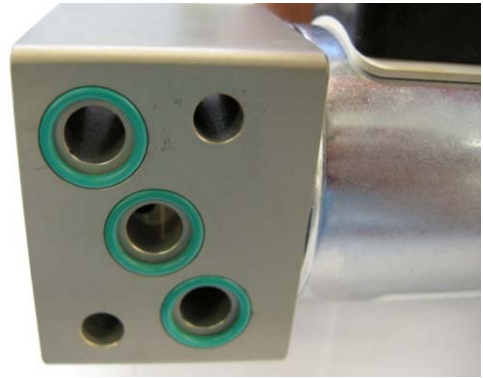
15. Grease the O-ring SP8063 und place it
onto the base plate SP8087.
Place base plate SP8087 on valve body



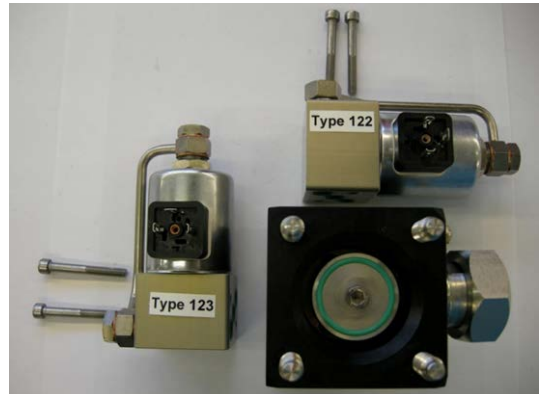
16. Grease the screws SP80104 (M6x14) and
tighten them with a 5mm Allen key.



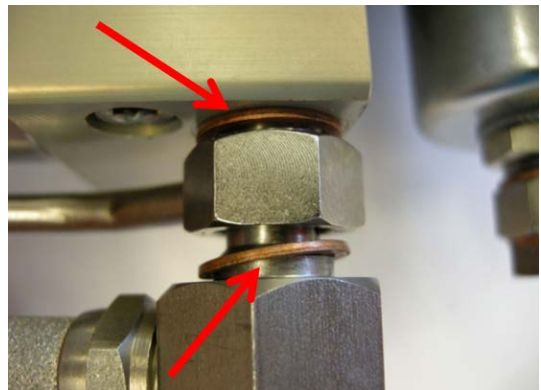
17. Grease and place the three O-rings SP8068 onto the valve SP8070.



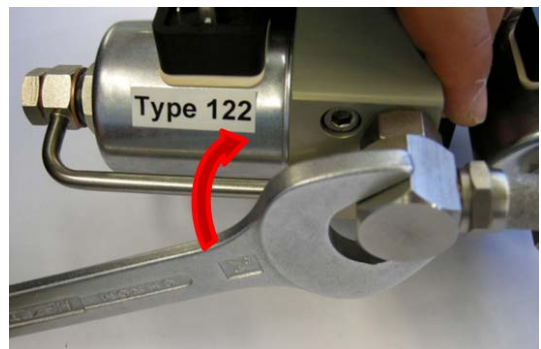
18. Fix the valves SP8070 (Type 122) and (Type 123) as shown.



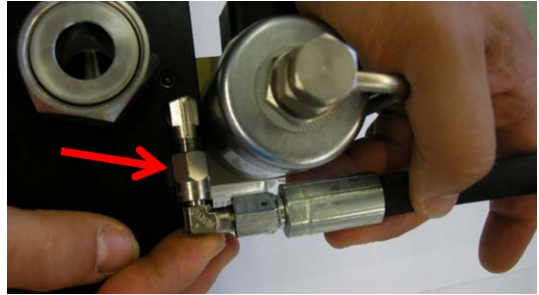
19. Put the cooper washers on the sound absorber SP8100 as shown.



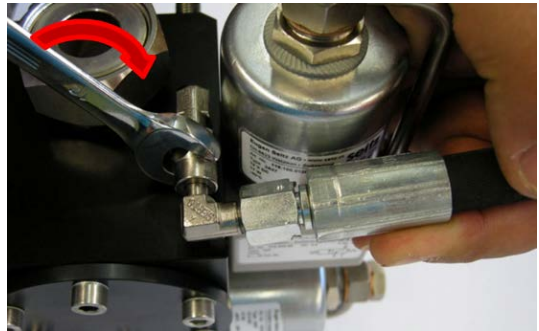
20. Fix the sound absorber with 24mm wrench.



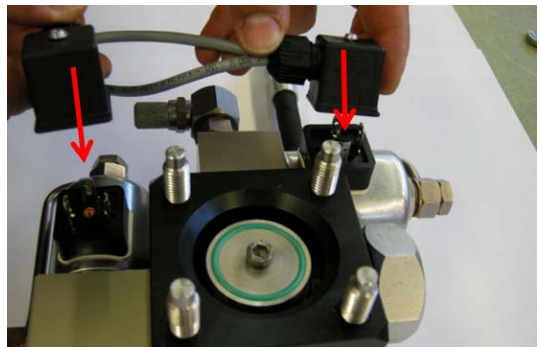
21. Place the pressure line SP8036 as shown.



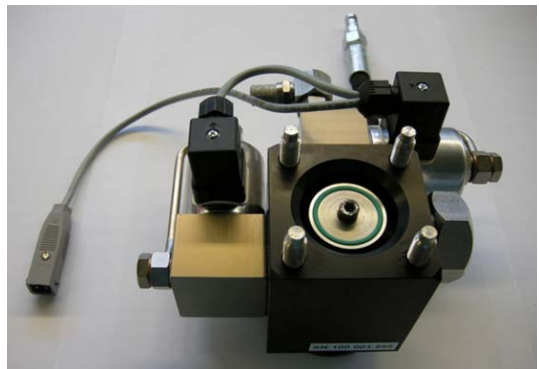
22. Fix the pressure line SP8036 with wrench 12mm.



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



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



6. Technics

Static pressure measurement:

Instead of the previous analog and relative pressure display for evacuation and dust dispersion, absolute and digital measurement is now used. It is thus possible to measure and check the initial pressure P_i absolutely by means of a blank test.

Resolution = 1mbar.

Pressure transducer: Endress+Hauser PTC31B with robust capacitive measuring cells. Their data is transmitted digitally to the KSEP333 via IO-Link.

Dynamic pressure measurement:

The pressure curves are measured relatively with the robust and proven Kistler piezo pressure transducers. However, the absolute initial pressure is known and can therefore be taken into account in the recording. The new charge amplifiers have a digital structure and are connected via IO-Link

The specifications of P_{ex} and P_m are given as overpressure as before. However, they can now be referred to a normal pressure of 1013mbar.

Temperature:

Measurement of the jacket temperature at the location of the pressure transducers. Connection for an external solenoid valve for simple on/off control of the cooling water flow and thus the jacket temperature. This significantly reduces the consumption of cooling water.

Protocol:

The digitally recorded pressure values P_z , P_v , P_i and the temperature are stored in the KSEP file for each test. The exact test conditions can thus be traced for each individual shot.

Comfort:

The pre-evacuation of the sphere, the adjustment of the gas mixture according to the partial pressure method and the pressure superposition of the pre-chamber are carried out fully automatically and with high precision.

Safety:

Monitoring the position of the two ball valves (outlet and vacuum)
Both must be closed to start a test.

Control:

Before each test, the electrical contact to the igniters is checked by a small test current. Avoidance of failed tests in case of insufficient cleaning of the electrode rods.

Dustproof:

The new KSEP333 is largely dust-tight and can be installed directly on the "gas box" KSEP310 (previously) or KSEP311 (new) behind the sphere.

Compatibility:

The new KSEP333 is 100% backwards compatible with the previous KSEP332. But offers additional advantages at no extra cost. The concept is very flexible and different expansion variants can be realized.

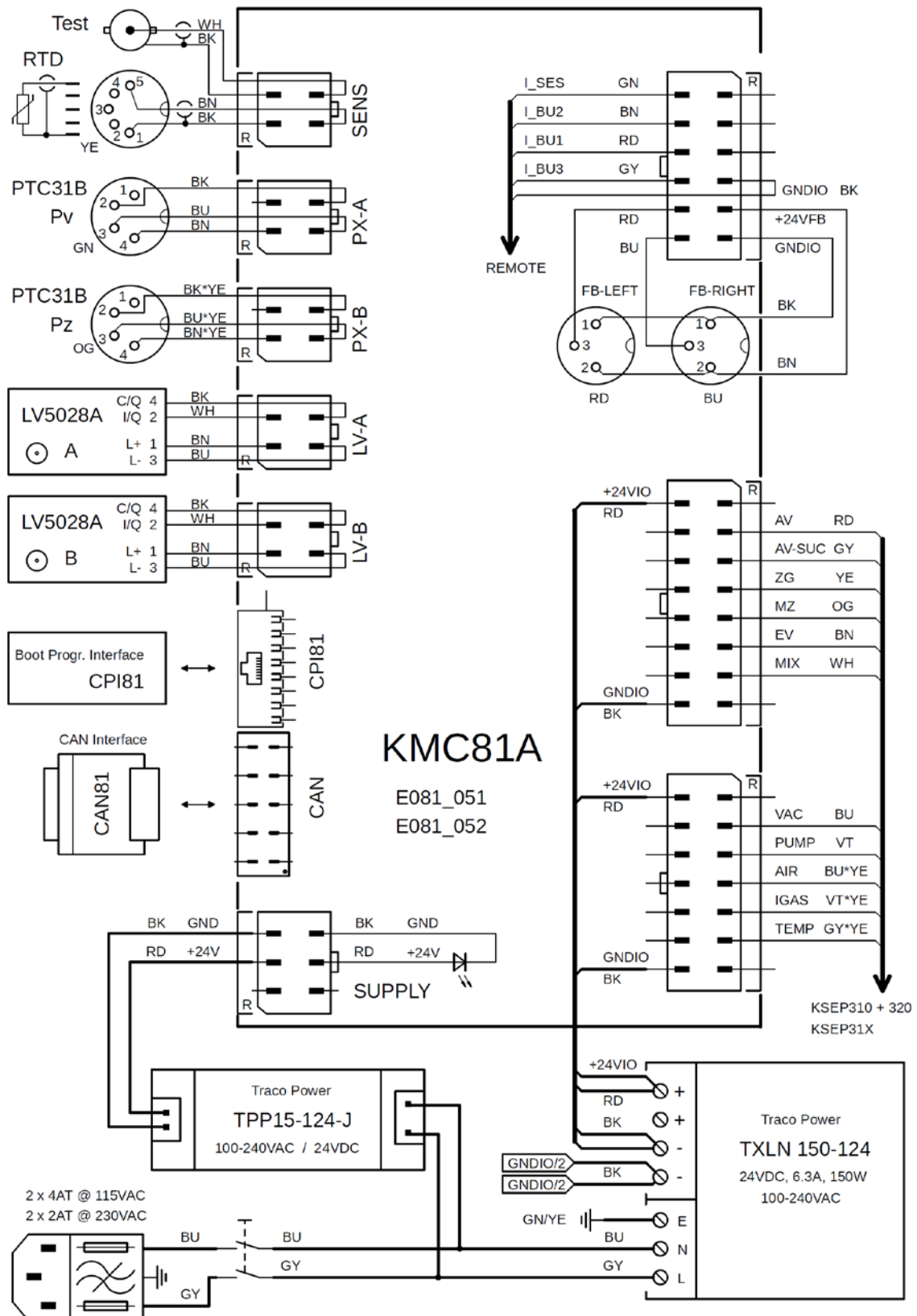
6.1 20-I-Sphere

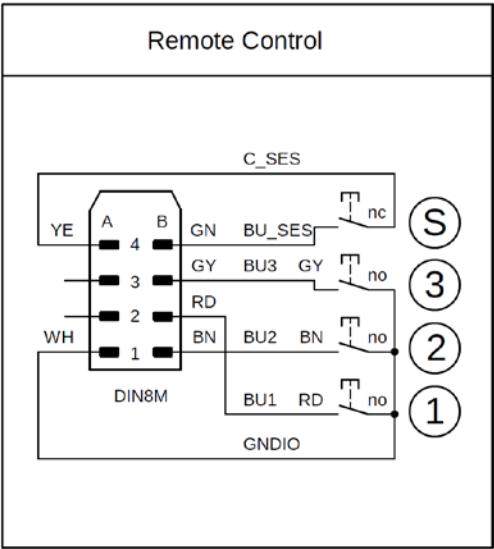
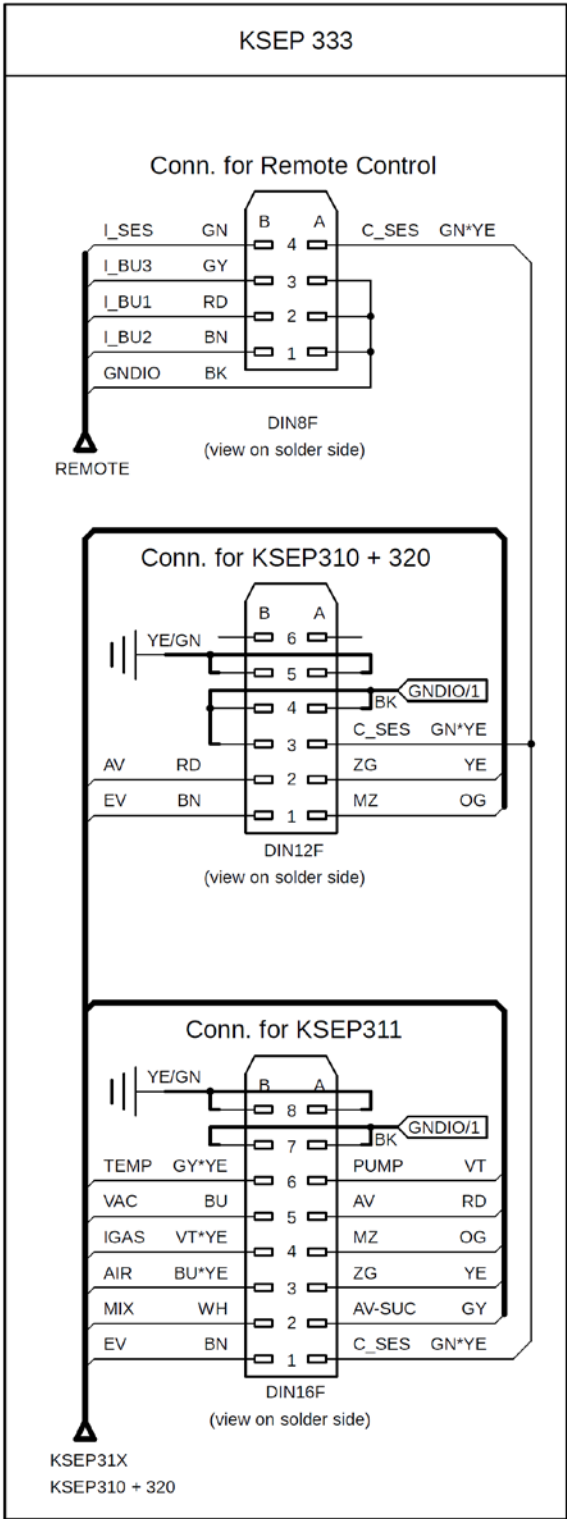
Material of construction No.:	1.4435
Volume of sphere:	20 liters
Volume of water jacket:	1,5 liters
Design pressure of sphere:	30 bar (60°C)
Design pressure of jacket:	10 bar (60°C)
Test pressure of sphere:	42.9 bar
Test pressure of jacket:	15.8 bar
Design temperature:	60 °C
Bayonet ring aperture Ø:	96 mm
Cleaning aperture Ø:	140 mm
Sight glass Ø:	30 mm

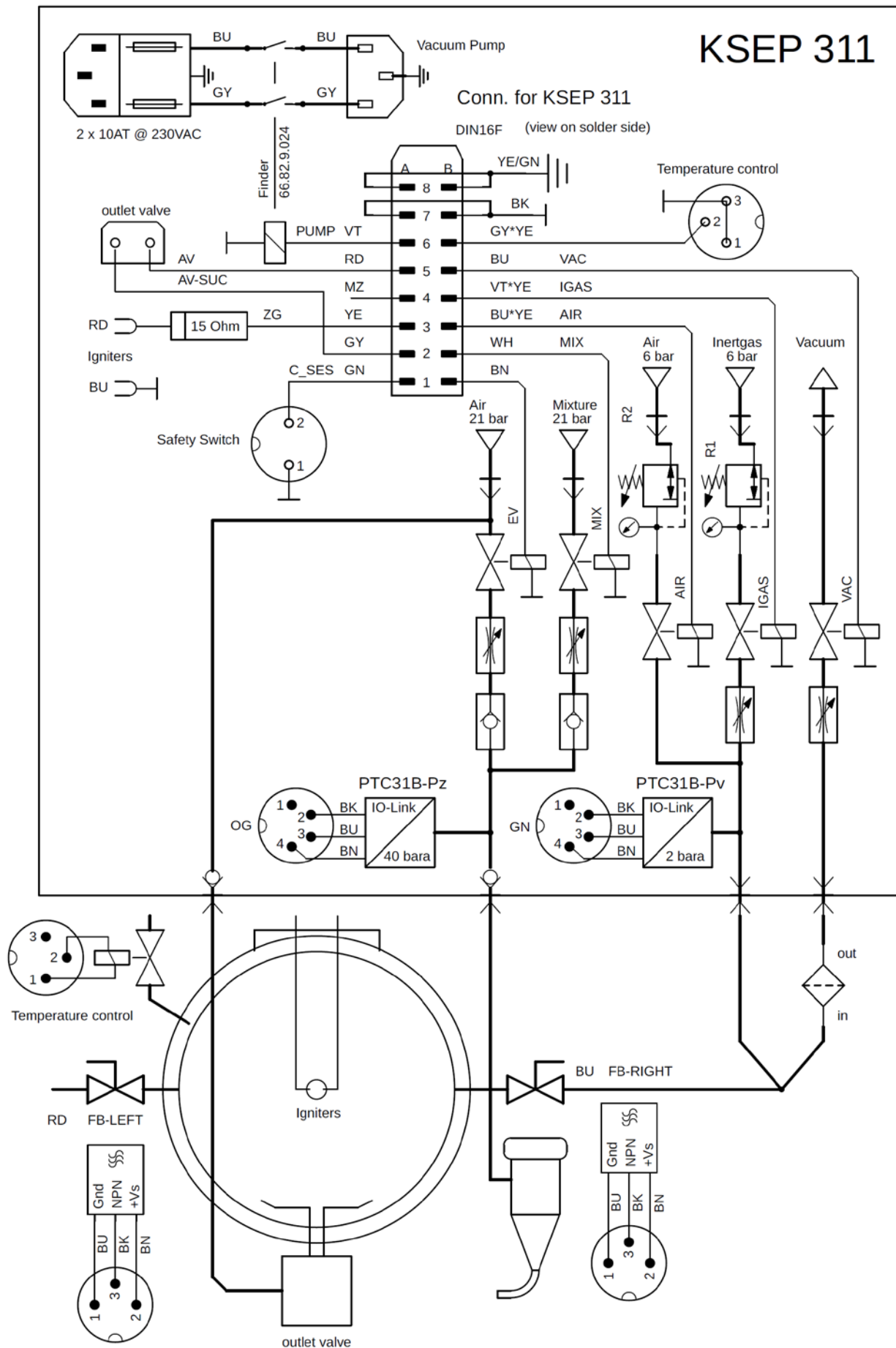
6.2 Control units KSEP333/311

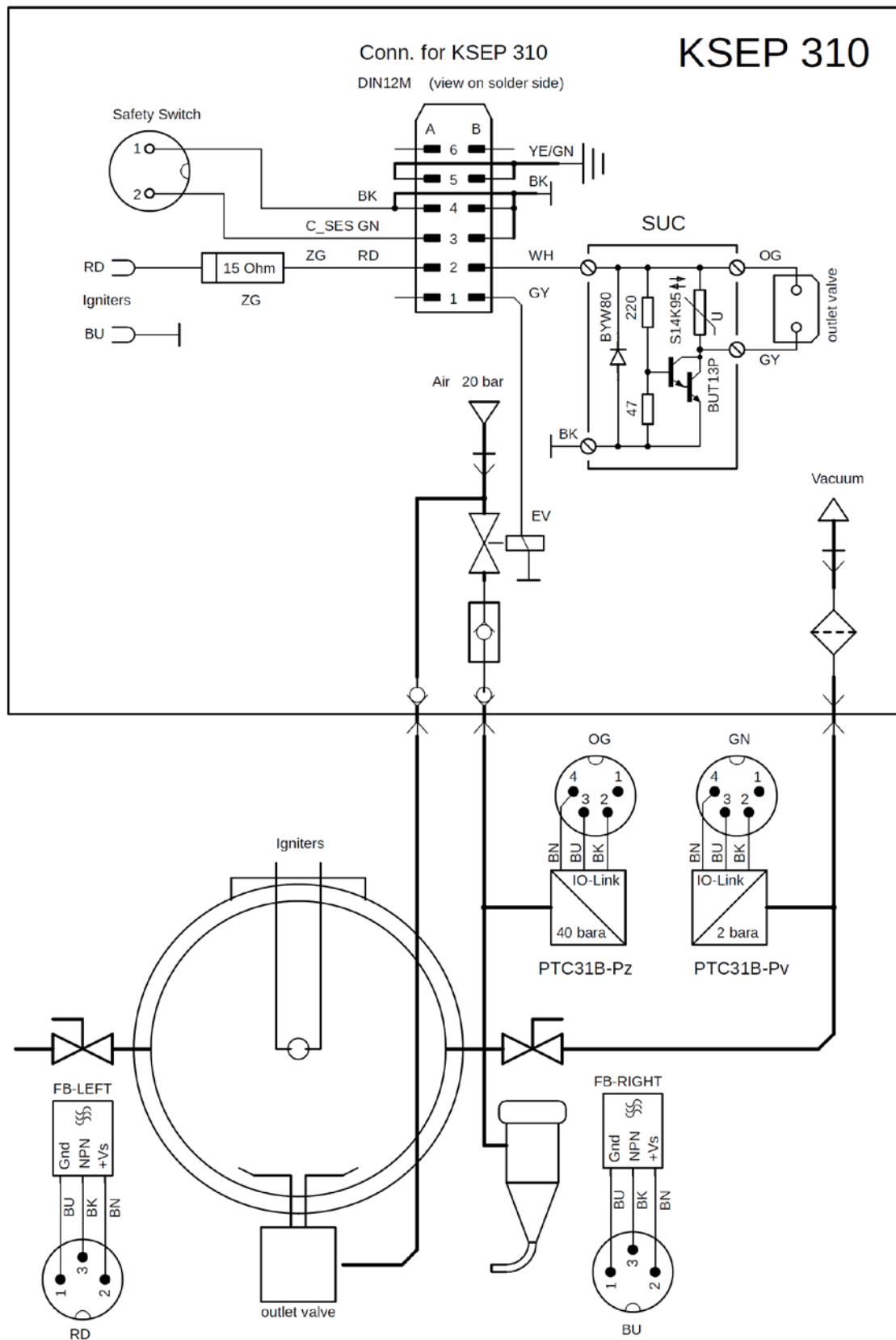
PC-Software	KSEP 8.0
Measurement initial pressure (Pi)	absolute, digital
Dispersion pressure measurement (Pz)	absolute, digital
Measurement evacuation (Pv)	absolute, digital
Measurement pressure curve	relative
Temperature measurement jacket	yes, digital
Wide range power supply	yes
Self-diagnosis	yes
Charge amplifier	Kistler 5028A
Processor	Renesas RX62T
Interface to PC	CAN - USB
Bitrate	125K CAN-Bus
Mains connection	100 ... 240VAC

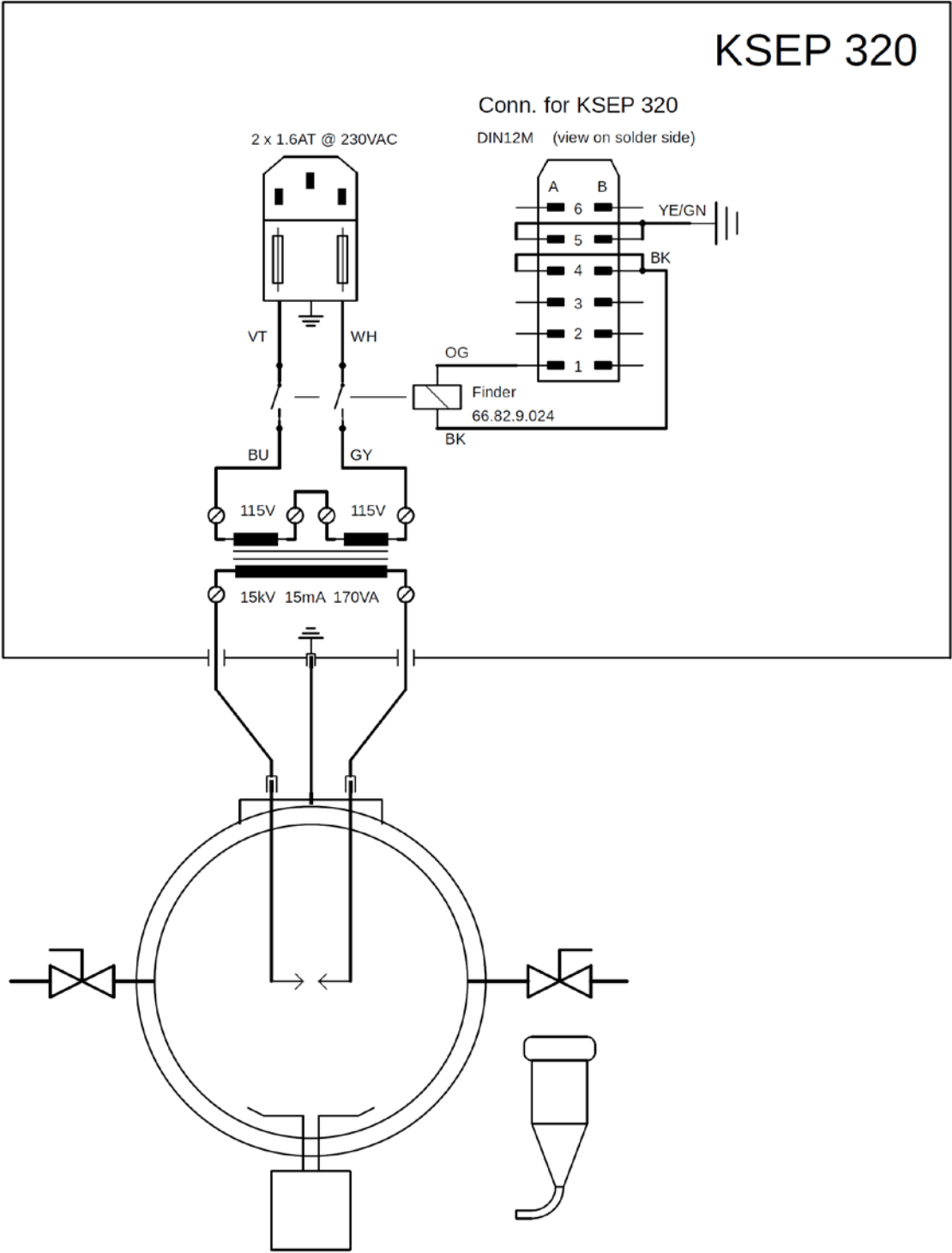
6.3 Schemata





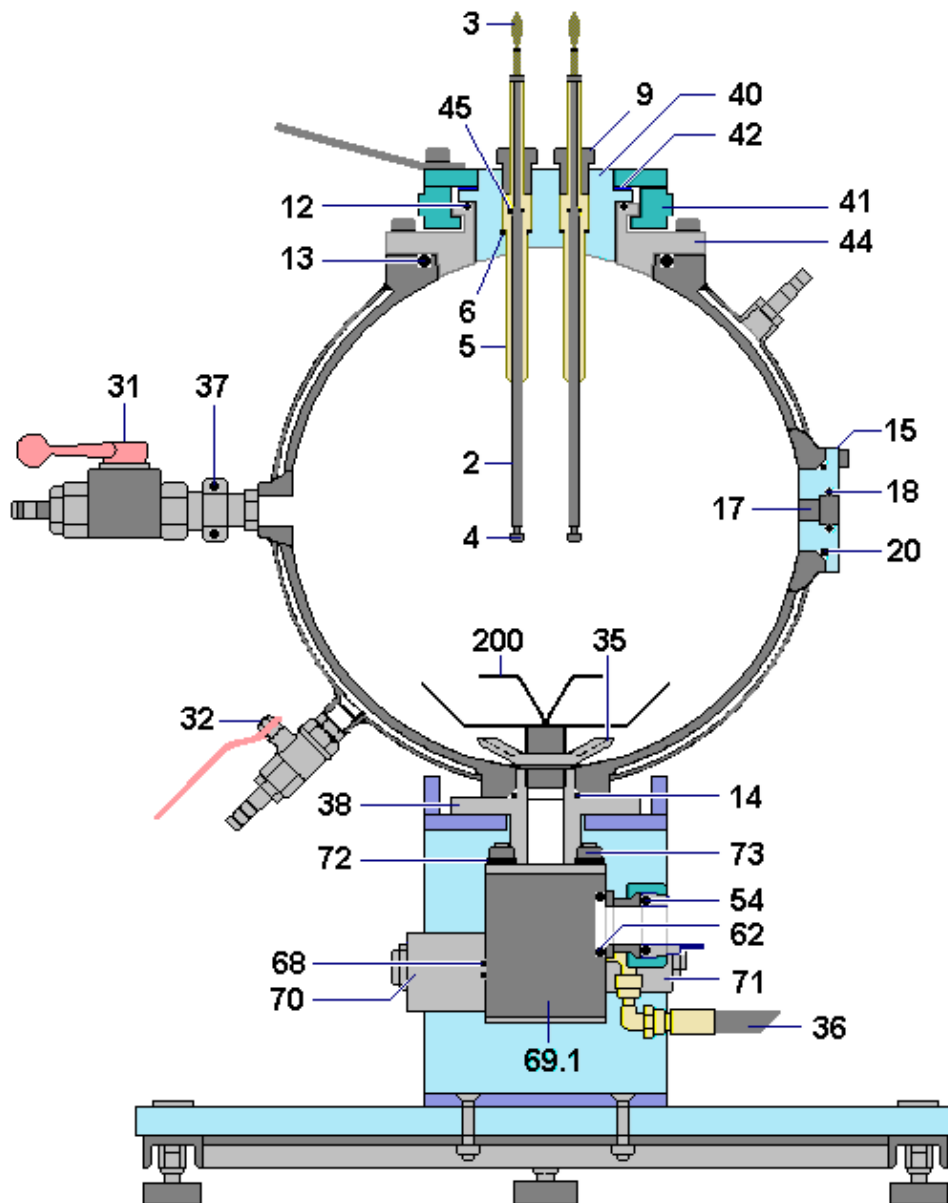






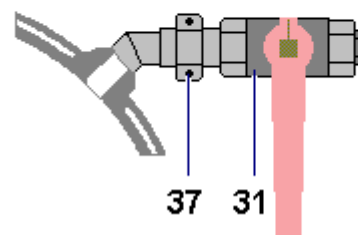
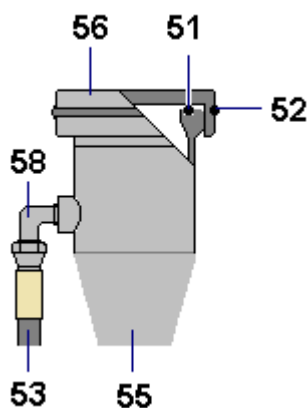
6.4 Spare parts

6.4.1 20-l-Sphere

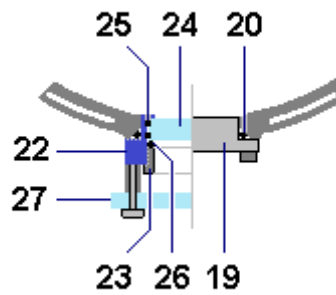


Dust storage container

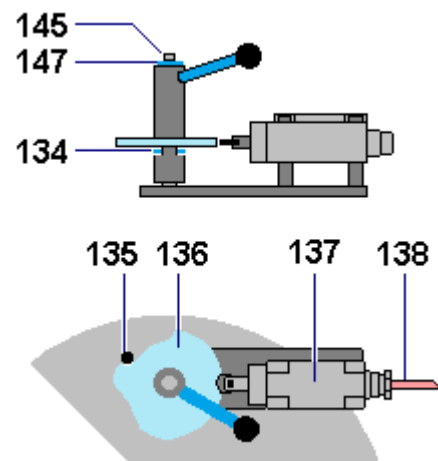
Vacuum



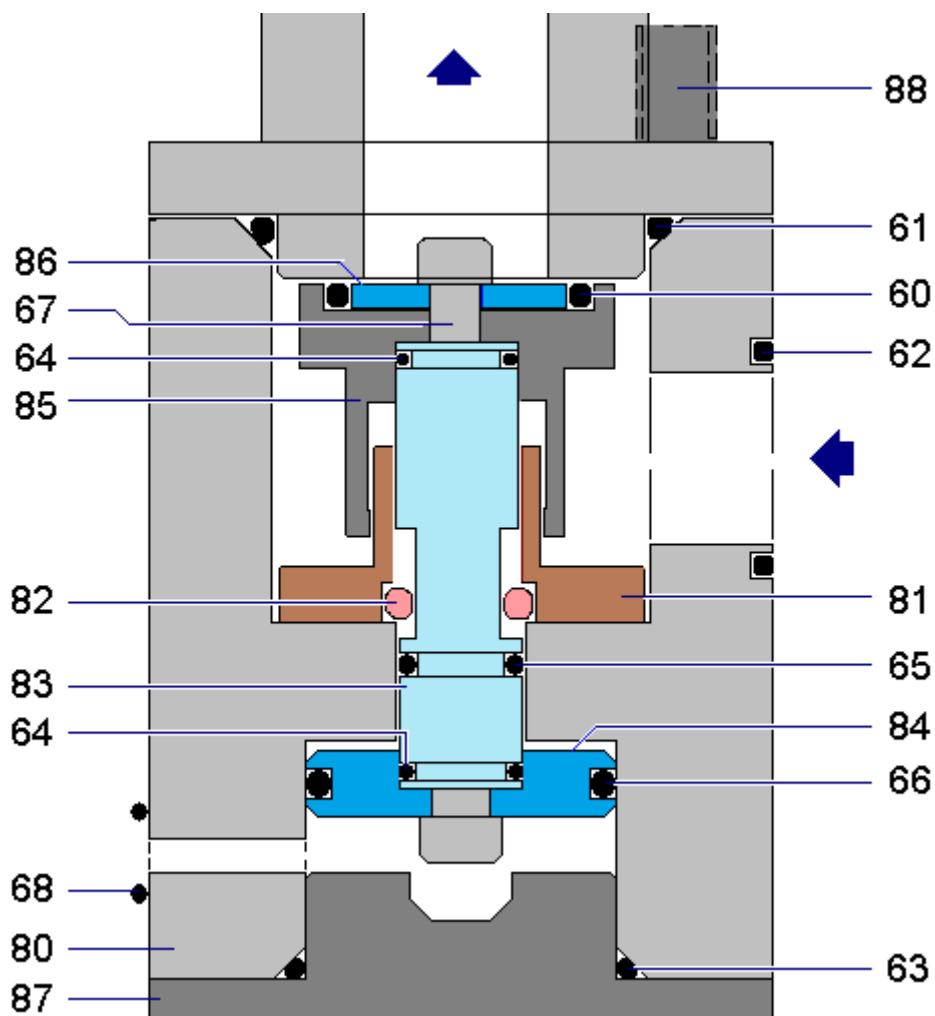
Sight glass / Flange



Safety



6.4.2 Outlet valve



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

SP8000	Recommended set of spare parts	SP8137	Safety switch
SP8001	Electrode assembly	SP8200	Rebound nozzle
SP8002	Rod	SP8051	O-ring 66.27 x 3.53 - 231
SP8003	Contact	SP8052	O-ring 88.27 x 5.33 - 341
SP8004	Clamping screw	SP8053	Pressure line 1/4" - 1/4" 450 mm
SP8005	Insulator	SP8054	O-ring 26.64 x 2.62 - 121
SP8006	O-ring 14.00 x 1.78 - 015	SP8055	Dust storage chamber assembly
SP8007	Electrode tips (100pcs)	SP8057	Screw-in nipple
SP8008	Plug	SP8058	Elbow fitting
SP8009	Pressure seal	SP8059	Connector-half G 3/4"
SP8010	Ignition lead for chem. igniters	SP8060	O-ring 28.17 x 3.53 - 216
SP8012	O-ring 101.19 x 3.53 - 242	SP8061	O-ring 47.22 x 3.53 - 225
SP8013	O-ring 158.12 x 5.33 - 363	SP8062	O-ring 30 x 2
SP8014	O-ring 40 x 3	SP8063	O-ring 40 x 3
SP8016	Measuring flange	SP8064	O-ring 11 x 2.5
SP8017	Sealing screw for flange	SP8065	Quad ring 4111 - 366Y
SP8018	O-ring 15.54 x 2,62 - 114	SP8066	Quad ring 4219 - 366Y
SP8019	Solid flange	SP8067	Hex socket screw M6 x 16
SP8020	O-ring 55.25 x 2.62 139	SP8068	O-ring 10.82 x 1.78 - 013
SP8021	Sight glass assembly	SP8069.1	Outlet valve assembly
SP8022	Sight glass support	SP8070	Solenoid valve type 123
SP8023	Threaded bushing	SP8071	Solenoid valve type 122
SP8024	Sight glass	SP8072	Washer
SP8025	O-ring 44.12 x 2.62 - 132	SP8073	Hex nut M10
SP8026	Seal	SP8074	Hex socket screw M6 x 53
SP8027	Protective plate assembly	SP8075	Hex socket screw M6 x 48
SP8031	Ball valve (vent / vacuum)	SP8076	Adjustable fitting
SP8031.1	Repair seal set for ball valve	SP8077	Elbow fitting
SP8036	Pressure line 1/8" - 1/4" 190 mm	SP8081	Guide (Pos.81)
SP8037	O-ring 21.95 x 1.78 - 020	SP8082	Round wedge (Pos.82)
SP8037.1	Coupling with threaded nipple	SP8083	Plunger (Pos.83)
SP8038	Lower flange	SP8085	Plate (Pos.85)
SP8040	Filler block	SP8086	Disc (Pos.86)
SP8041	Sealing ring	SP8094	O-ring 44.04 x 3.53 - 224
SP8042	Guide ring	SP8808	Silicone rubber Type 1043
SP8044	Upper flange	SP8809	Cleaning spray Type 1001A
SP8045	O-ring 4.47 x 1.78 - 008		