Operating Manual

PSG Basic / PSG Plus Probe

Version: November 2016
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1 SAFETY INFORMATION

Please observe the following fundamental safety precautions using device:

- A safe and proper operation requires proper transport and storage, correct installation and set-up and finally careful maintenance only by qualified personal.

- The device is designed and tested in accordance to relevant safety standards and has been shipped ready for safe operation. To maintain this condition and to assure safe operation, read and follow the safety information in this operator's manual. Otherwise any failure can put persons at risk and damage other systems and devices.

- Read these operating instructions carefully before start-up and use of device. The information and warnings given in these operating manual must be heeded!

- The regulations, standards and guidelines founded in this operator's manual are applicable in the Federal Republic of Germany. The relevant national regulations should be followed when the device is used in other countries.

- Protection against contact with high electrical voltages:
  The device must be safely isolated from the mains supply before it is opened. The same applies to any connected external control circuits.

- The protective lead (ground) should be attached to the protective lead connector before any other connection is made.

- If it is apparent that safe operation is no longer possible, the device should be put out of operation and secured against unauthorized use.
  Safe operation is no longer possible:
  - If the device is visibly damaged,
  - If the device no longer operates,
  - After prolonged storage under adverse conditions,
  - After severe transport stresses.

- Only use the device within the permissible temperature ranges.

- Protect the PSG filter unit from direct heat radiation, rain, draughts and heavy soiling. If necessary, protect the filter unit with a protective box.
2 ABOUT OPERATING INSTRUCTIONS

This Operating Instruction contains the information that is required to install, putting into operation, operate and maintain probe tubes (Unheated and Heated) and filter units types (Basic and PSG Plus) safely and as specified.

The Operating Instruction also contains information about the operation of the temperature controller. The complete Operator's Manual of the temperature controller is a constituent of the scope of supply and delivery.

If the information in this operator's manual does not cover a particular situation, PSG Service will be pleased to supply additional information as required.

2.1 SYMBOLS AND TYPFACES IN THESE OPERATING INSTRUCTIONS

Denotes safety instructions which must be followed when handling the device, in order to prevent danger to user.

Denotes information about particular features with regard to the handling of the device and the use of this operating Instructions.

1, 2, 3 … Denotes the reference numbers in the figures.

2.2 QUICK GUIDE FOR THE INSTALLATION

1- Unpacking the supplied equipment (page 5)

2- Installing the probe tube, see sections
   • Installing Probe Tube Type Unheated (page 5)

3- Mounting the filter unit, see sections
   • Mounting the PSG Basic filter unit (page 10)
   • Mounting the PSG Plus filter unit (page 19)

4- Electrical connections
   • Electrical Connections for the PSG Basic and Plus Filter Unit (page 25)

After you have carried out these steps, the probe tube and the filter unit are operative.

Please refer to the planning documents for the installation. Please also refer to the technical data. The wall tube must be installed at the sampling point before the probe is installed!
3 USE

The probes of the type PSG Basic and PSG Plus are used for continuous gas sampling processes. The process gas is cleaned from dust particles with a heated filter in the unit, which is mounted directly on the probe tube. The sample gas is subsequently transferred to the analyser system via sample gas line.

4 UNPACKING

1- Unpack the probe tube, the filter unit and, if applicable, the temperature controller.

2- Make sure that any accompanying accessories do not get lost.

3- Check the contents of the delivery to ensure that is complete by comparing the actual goods with the dispatch note.

Keep the packing material for possible future transport.
If damage has occurred during transport due to improper handling, please submit a damage report to the transport institution within seven days.

5 ASSEMBLY

5.1 INSTALLING PROBE TUBE

Possible combinations of the probe tubes and filters units:

<table>
<thead>
<tr>
<th>Probe Tube Type</th>
<th>Filter Unit Types</th>
<th>Type of Assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unheated</td>
<td>PSG Basic/Plus</td>
<td>Bolted</td>
</tr>
<tr>
<td>Heated</td>
<td>PSG Basic/Plus</td>
<td>Flanged</td>
</tr>
</tbody>
</table>

1- Install the customer-supplied wall tube with assembly flange into the wall of the flue gas duct or chimney according to the planning documents.

2- Use the green seal from accessories pack to seal the space between the probe tube and the wall tube.

3- Insert the pre-assembled gas sampling system in the wall tube.

4- Screw the assembly flange to the flange of the filter unit.
5.1.1 UNHEATED PROBE TUBE VARIANTS

$L_1$ = length of the probe tube (dimensions in mm)

Special Steel Material No. 1.4571 (max. 450 °C)

Special Steel Material No. 1.4835 (max. 900 °C)
5.2 INSTALLING PSG BASIC

Components:

- Filter unit
- Filter
- Protective Box
- Heating Sleeve
- Isolation
- Terminal
5.2.1 GAS CONNECTION PSG BASIC

A Plug, Test gas connection (G 1/4"

B Test gas connection (G 1/4"

C Back-Purging Gas Connection (G 3/8")
5.2.2 OVER VIEW PSG BASIC PROBE

A Plug, Test gas connection ( G 1/4" )
B Sample gas connection ( G 1/4" )
C Screw type blank cap
   (For compressed air for back-purging the filter 4-6 bar) ( G 3/8" )
1 Terminal Box
2 2x Cable gland M12/16 ( Pt100 and 230V PSG )
3 2x Cable gland M20 ( Pt100 and 230V costumer )
4 1x Cable gland M16 ( Pt100 PSG )
5 1x Cable gland M16 ( 230V PSG )
6 1x Bulkhead fitting 6 mm ( Test gas connection )
7 1x Mounting clamp
8 1x Bulkhead fitting 12 mm ( Instrument air connection )
9 1x Plug M25
5.2.3 MOUNTING THE PSG BASIC FILTER UNIT ON THE WALL TUBE

The following table states the recommended mounting angle of the PSG Plus filter unit:

<table>
<thead>
<tr>
<th>Mounting angle</th>
<th>10°</th>
<th>15°</th>
<th>20°</th>
<th>25°</th>
<th>30°</th>
<th>35°</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x_{\text{min}}$ mm</td>
<td>229</td>
<td>248</td>
<td>268</td>
<td>287</td>
<td>307</td>
<td>324</td>
</tr>
</tbody>
</table>

- Connect the sample gas line to gas port B at the sample gas connection of the filter unit by means of a clamp ring screw fitting (not in the scope of supply and delivery).

  ![Possible leakage!](image)

  When tightening the screw connection, relieve the pressure on the gas port, e.g. by holding back with a suitable spanner. Otherwise there is a danger that the gas port is twisted and becomes leaks or breaks off.

- If probe back-purging is available, connect the compressed air lines to gas port C (One stage back-purging)
- If test gas is to be fed in at the probe, connect the test gas line to gas port B.
- If the PSG Basic filter unit is operated at ambient temperatures below –20 °C, additional heating must be provided.
5.2.4 INSPECTION AND MAINTENANCE

Risk of burns!
The work described in this chapter require special training. Therefore, they may only be performed by qualified and specially trained persons. The metal parts may have by operation at elevated temperatures.

Health hazard!
Dependent on the substances which it comes into contact with during operation, the filter element could be contaminated with toxic or corrosive substances. Always wear suitable protective clothing for cleaning work.

Cleaning interval of the filter:

The service life of filters depends on the operating conditions. If necessary, you can disassemble it so that you can exchange it or eliminate it from contamination and mechanical damages. If the filter stone is obviously damaged, you have to replace it with a new one. This also depends on the operating conditions. The cleaning interval is to be determined by you.
5.2.4.1 COMPONENTS OF THE PSG BASIC FILTER UNIT

1. Flange clamp 3"
2. Filter Unit
3. Probe housing
4. Stainless steel ring
5. Upper filter holder
6. O-ring seal 45mm
7. O-ring seal 59mm
8. O-ring seal 50mm
9. Filter stone
10. O-ring seal 45mm
11. Lower filter holder
5.2.4.2 DISASSEMBLING THE FILTER UNIT

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Loosen the flange clamp (1) with the help of the wing nut and remove it</td>
</tr>
<tr>
<td>2</td>
<td>Pull the ring to remove the complete filter unit (2) using the stainless steel ring (4) from the housing</td>
</tr>
</tbody>
</table>
If the filter unit due to heavy pollution, corrosion, etc. cannot be pulled out, so the dual function of the clamp is used to press the filter element:

- Insert the bottom edge of the clamp (1) into the conical groove
- Screw the clamp (1) to the end

Accordingly, the filter unit (2) is slightly raised and then can be pulled out using the ring (4)
5.2.4.3 FILTER STONE REPLACE

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unscrew the lower filter holder (11) with help from the web</td>
</tr>
<tr>
<td>2</td>
<td>Remove the filter stone</td>
</tr>
<tr>
<td>3</td>
<td>Replace O-ring seals (6,10)</td>
</tr>
<tr>
<td>4</td>
<td>Insert the new filter stone (or clean the old one)</td>
</tr>
<tr>
<td>5</td>
<td>Screw the lower filter holder (11)</td>
</tr>
</tbody>
</table>

5.2.4.4 INSTALL FILTER UNIT

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Replace upper O-ring seals (7,8)</td>
</tr>
<tr>
<td>2</td>
<td>Insert the filter unit (2) into the housing (3)</td>
</tr>
<tr>
<td>3</td>
<td>Insert the flange clamp (1) and tighten by hand</td>
</tr>
</tbody>
</table>
5.3 INSTALLING PSG PLUS

Components:

- Filter Unit
- Filter
- Protective Box
- Heating Sleeve
- Isolation
- Terminal Box
5.3.1 GAS CONNECTION PSG PLUS

A Sample Gas Connection (G 1/4")
B Test Gas Connection (G 1/4")
C Back-Purging Connection (Probe Tube ) (G 3/8“)
D Back-Purging Connection (Filter ) (G 3/8“)
5.3.2 OVERVIEW PSG PLUS PROBE

1. Tube, VA 1.4571, 6x1 mm
2. Tube, CU, 12x1 mm
3. Terminal box -X1 IP66
4. 2 x M12x1.5 cable connectors
5. 3 x M20x1.5 cable connectors
6. 2 x M20x1.5 cable connectors
7. Tube, CU, 12x1 mm

A. Test gas connection with check valve, bulkhead union 6 mm
B. Back-purging of filter (max. 6 bar), bulkhead union 12 mm
C. Back-purging of filter surface and probe tube (max. 6 bar), bulkhead fitting 12 mm
D. Sample gas connection, male fitting 6 mm
5.3.3 MOUNTING THE PSG PLUS ON THE WALL TUBE

The following table states the recommended mounting angle of the PSG Plus filter unit:

<table>
<thead>
<tr>
<th>Mounting angle</th>
<th>10°</th>
<th>15°</th>
<th>20°</th>
<th>25°</th>
<th>30°</th>
<th>35°</th>
</tr>
</thead>
<tbody>
<tr>
<td>x_{min} mm</td>
<td>229</td>
<td>248</td>
<td>268</td>
<td>287</td>
<td>307</td>
<td>324</td>
</tr>
</tbody>
</table>

- Connect the sample gas line to gas port B at the sample gas connection of the filter unit by means of a clamp ring screw fitting (not in the scope of supply and delivery).

  \[ \text{Possible leakage!} \]

  When tightening the screw connection, relieve the pressure on the gas port, e.g. by holding back with a suitable spanner. Otherwise there is a danger that the gas port is twisted and becomes leaks or breaks off.

- If probe back-purging is available, connect the compressed air lines to gas port C and D (Two stage back-purging)
- If test gas is to be fed in at the probe, connect the test gas line to gas port B.
- If the PSG Plus filter unit is operated at ambient temperatures below \(-20\) °C, additional heating must be provided.
5.3.4 INSPECTION AND MAINTENANCE

Risk of burns!
The work described in this chapter require special training. Therefore, they may only be performed by qualified and specially trained persons. The metal parts may have by operation at elevated temperatures.

Health hazard!
Dependent on the substances which it comes into contact with during operation, the filter element could be contaminated with toxic or corrosive substances. Always wear suitable protective clothing for cleaning work.

Cleaning interval of the filter:
The service life of filters depends on the operating conditions. If necessary, you can disassemble it so that you can exchange it or eliminate it from contamination and mechanical damages. If the filter stone is obviously damaged, you have to replace it with a new one. This also depends on the operating conditions. The cleaning interval is to be determined by you.
5.3.4.1 COMPONENTS OF THE PSG PLUS FILTER UNIT

1. T-handle
2. Bridge
3. Detaching disk
4. Locking screw
5. Upper filter holder
6. Flange
7. O-ring seals
8. Filter stone
9. Bridge holding device
10. Casing
11. Lower filter holder
5.3.4.2 DISAMBELING THE PSG PLUS FILTER UNIT

Step | Action
--- | ---
1 | Turn the T-handle 1 of the filter removal device 1–3 in a counter-clockwise direction. This pulls the filter element 8 out of the casing 10 via the detaching disk 3.

2 | Turn bridge 2, until it can be pulled off the bridge holding device 9 through the elongated holes.
3 Pull out the filter element 8 with bridge 2 and detaching disk 3.

4 Turn the detaching disk 3, until it can be pulled off the hexagon screws 5 through the elongated holes.
## 5.3.4.3 FILTER STONE REPLACE

To carry out this work, you require:

A new filter stone (with new O-rings from the accessory set)

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unscrew lower filter holder(11) with help from the web</td>
</tr>
<tr>
<td>2</td>
<td>Take out the filter stone.</td>
</tr>
<tr>
<td>3</td>
<td>Insert a new filter stone.</td>
</tr>
<tr>
<td>4</td>
<td>Replace the O-ring seals 7 if required</td>
</tr>
</tbody>
</table>
6 ELECTRIC CONNECTION

Sample gas outlet

Pt100

Probe heating

Protection box

Junction box

Supply for probe heating:
230V/AC or 115V/AC,
50..60Hz, 250W

Connection for temperature sensor Pt100

Connection for sample gas outlet

X1

5 PE 4 3 PE 2 N 1 L

Spare
7 TECHNICAL DATA

7.1 TECHNICAL DATA FOR THE PSG PLUS PROBE

<table>
<thead>
<tr>
<th>Sampling conditions</th>
<th>Type Unheated</th>
<th>Type Heated (heated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating pressure Pabs</td>
<td>50...500kPa (0.5...5.0 bar)</td>
<td>2000 kPa (2 bar)</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Stainless steel material no. 1.4571: max. 450˚C</td>
<td>Max. 200˚C</td>
</tr>
<tr>
<td></td>
<td>Stainless steel material no. 1.4571(coated): max. 180˚C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stainless steel material no. 1.4835: max. 900˚C</td>
<td></td>
</tr>
<tr>
<td>Heating temperature</td>
<td>--</td>
<td>Max. 200˚C, regulated</td>
</tr>
<tr>
<td>Flow rate</td>
<td>Max. 300l/h</td>
<td>Max. 250l/h</td>
</tr>
<tr>
<td>Velocity of flow</td>
<td>Max. 12 m/s</td>
<td>Max. 12 m/s (&gt;1,000mm:max7 m/s)</td>
</tr>
<tr>
<td>Pressure drop</td>
<td>Approx. 10hPa (mbar) At 30....90l/h flow</td>
<td>Approx. 10hPa (mbar) At 30....90l/h flow</td>
</tr>
</tbody>
</table>

Permissible operating parameters for the Filter

<table>
<thead>
<tr>
<th>Process Gas Sampling Conditions</th>
<th>Pressure</th>
<th>Temperature</th>
<th>Flow Rate</th>
<th>Pressure drop</th>
<th>Dust content</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$p_{abs} = 50...600$ kPa(0.5 ... 6bar)</td>
<td>max. 200˚C(coated 180˚C)</td>
<td>30...500 l/h, based on 100 kPa(1bar) and 0˚C</td>
<td>approx. 0.6 hPa at 100 l/h</td>
<td>max 3g/m³ (application recommendation)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Max Unheated g/m³ with probe tube type</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Unheated with purging facility¹</td>
</tr>
<tr>
<td>Filter Properties</td>
<td>Filter fineness</td>
<td>0.3 μm</td>
<td>Seal Integrity</td>
<td>$10^{-4}$ hPa l/s</td>
<td></td>
</tr>
<tr>
<td>Protection Box</td>
<td>Ambient Temperature</td>
<td>-20˚C ... +45˚C</td>
<td>Degree of Protection of the case</td>
<td>IP54</td>
<td></td>
</tr>
</tbody>
</table>
7.2 TECHNICAL DATA FOR THE PSG BASIC PROBE

- Heated probe for continuous gas sampling of low and medium contaminated gases
- Quick and easy installation and mounting
- Extreme compact design allows installation with small space
- Special filter layout: outstanding filter surface allows low maintenance operation
- For filter exchange no tools are required
- Compact weather protection box enables installation and operation outside in rough conditions
- Connection for test- and calibration gas port as default
- Operation as continuous emission monitoring
- Single-stage backwashing

<table>
<thead>
<tr>
<th>Process Gas Sampling Conditions</th>
<th>Pressure</th>
<th>$p_{\text{abs}} = 50\ldots 600 \text{ kPa}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>max. 200 °C</td>
<td></td>
</tr>
<tr>
<td>Flow</td>
<td>30…500 l/h, based on 100 kPa and 0 °C</td>
<td></td>
</tr>
<tr>
<td>Pressure drop</td>
<td>approx. 0,6 hPa at 100 l/h</td>
<td></td>
</tr>
<tr>
<td>Dust content</td>
<td>max. 3 g/m³</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Connections</th>
<th>Sample gas</th>
<th>G1/4&quot; inner thread according DIN ISO 228/1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test gas</td>
<td>G1/4&quot; inner thread according DIN ISO 228/1</td>
<td></td>
</tr>
<tr>
<td>Back washing</td>
<td>G3/8&quot; inner thread according DIN ISO 228/1</td>
<td></td>
</tr>
<tr>
<td>Probe tube</td>
<td>G3/4&quot; inner thread according DIN ISO 228/1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Heating</th>
<th>Type</th>
<th>Heating jacket and insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>200 °C</td>
<td></td>
</tr>
<tr>
<td>Temperature alert</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>115V AC or 230V AC, 50...60 Hz, 250 VA</td>
<td></td>
</tr>
<tr>
<td>Temperature sensor</td>
<td>Pt100</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Filter Properties</th>
<th>Filter</th>
<th>Surface Filter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filter fineness</td>
<td>0,3 µm</td>
<td></td>
</tr>
<tr>
<td>Density</td>
<td>$10^{-4} \text{ hPa l/s}$</td>
<td></td>
</tr>
<tr>
<td>Dead volume</td>
<td>ca. 280 ml</td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td>50/20 x 135 mm</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Protection Box</th>
<th>Dimensions</th>
<th>330 x 205 x 270 mm (L x W x H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material / Protection type</td>
<td>stainless steel M.-No.: 1.4301 / IP54</td>
<td></td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-20°C … +45°C</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>ca.14 kg incl. filter (total)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mounting</th>
<th>Flange</th>
<th>DN 65, PN 6, 4 whole, form B DIN 2527</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attachment</td>
<td>flange or screw on the special pipe</td>
<td></td>
</tr>
<tr>
<td>Installation angle</td>
<td>10°-35° inclination to horizontal position</td>
<td></td>
</tr>
</tbody>
</table>

| Gas Bearing Parts              | Case, Flange, Gas connection | Stainless steel M.-No.: 1.4571 |
|--------------------------------| Seal                   | Viton FKM |
8 PUTTING OUT OF SERVICE AND PACKING

Danger of burns!
The work described in this chapter requires specialist knowledge. As a result, it may only be carried out by persons who are qualified and specially trained. The metal parts may have high temperatures as a result of operation.

Electric shock!
You must disconnect the voltage for the current circuit, in which the electrical equipment is integrated, when putting the device out of service. Otherwise there is a danger of electric shock.

Health hazard!
Dependent on the substances which it comes into contact with during operation, the filter element could be contaminated with toxic or corrosive substances. Always wear suitable protective clothing for cleaning work.

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Clean the filter (see Chapter &quot;Inspection and Maintenance&quot; (page 75)).</td>
</tr>
<tr>
<td>2</td>
<td>Disconnect the power supply to the gas sampling system.</td>
</tr>
<tr>
<td>3</td>
<td>Remove the gas sampling system from the assembly flange of the bushing tube and hermetically seal the assembly flange with a blind flange.</td>
</tr>
<tr>
<td>4</td>
<td>Hermetically seal the connections of the gas sampling system.</td>
</tr>
</tbody>
</table>

8.1 DISPOSAL

Depending on the service conditions, the filter stone could be contaminated with dangerous substances. Depending on the contamination, the filter stone must be disposed of according to good professional practice and in accordance with the currently applicable statutory regulations.
## 8.2 PACKING FOR RETURN

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>If the original packing material is no longer available, wrap the device in bubble foil or corrugated cardboard. When shipping overseas, also heat-seal the device air-tight in 0.2 mm thick polyethylene, including a desiccant (e.g. silica gel). The amount of desiccant used should be adequate for the package volume and the probable shipping time (at least 3 months).</td>
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<tr>
<td>2</td>
<td>Pack the device in an adequately large box lined with shock absorbent material (e.g. foam material). The thickness of the cushioning material should be adequate for the weight of the device and the mode of shipping. The box should also be lined with a double layer of bitumen paper for overseas shipping.</td>
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<tr>
<td>3</td>
<td>Mark the box &quot;Fragile! Handle with care!&quot;</td>
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</tbody>
</table>