The heated sample lines ready for installation are equipped either with resistance, parallel or self-regulating heating cables, depending on their use of power. Temperature set points of more than 200°C and circuit lengths up to 150 m are available. The process tubes are made of stainless steel, PFA-Teflon or diffusion protected special materials. Thermal insulation by multilayer thermo sheath material, protected through a coating made of PVC or PE, halide free, flame retardant and self-extinguishing.

PSG has a longtime experience with the explosion proof requirements for installation, control and regulation techniques.

PSG manufactures more than 2500 different sample lines, for more information visit:

www.psg-petroservice.de
Installation and start of operation

General

Electrically heated PSG-lines are to be treated as "electrical equipment". They are designed and connected according to the acknowledged rules of technology. These rules also have to be considered during mounting, start up and during operation.

Chemical resistance

In the PSG Project data sheet the customer is required to specify the process medium. Thereupon PSG will determine the material for the process tube, such as PTFE, PFA or stainless steel.

Thermal resistance

The maximum ambient temperature for the lines will be decided by the material of the jacket to be used.

Sheath of PVC: max. Temperature 100°C, fire-resistant according to VDE 0209
Sheath of PA: max. Temperature 110°C, fire-resistant according to UL 94 HB

Corrugated metal hose: max. temperature 100°C; encased by PVC.

The temperature of the medium, which flows through the process tube, has to be not higher than 20% above the max. continuous process temperature given in the project data sheet.

Pressure Ratings

The pressure rating of the process tubes depends on the temperature and the material of the tubes. The following max. pressures apply:

<table>
<thead>
<tr>
<th>Tube Size (in mm (OD))</th>
<th>Temperature at 20°C</th>
<th>Temperature at 200°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 x 1</td>
<td>12 bar</td>
<td>5 bar</td>
</tr>
<tr>
<td>8 x 1</td>
<td>10 bar</td>
<td>3.5 bar</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tube Size (in mm (OD))</th>
<th>Temperature at 20°C</th>
<th>Temperature at 200°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 x 1</td>
<td>390 bar</td>
<td>350 bar</td>
</tr>
<tr>
<td>8 x 1</td>
<td>260 bar</td>
<td>235 bar</td>
</tr>
</tbody>
</table>
**Head-start prefabrication for parallel heating cable 40W/m / 60W/m**

- remove cable insulation until cable is uncovered

- measure resistance between short-circuited conductors and the heating coil made of resistance wire

  - 26 Ohm correspond to 1cm at 40 W/m
  - 19.5 Ohm correspond to 1cm at 60W/m

**Example:**

A measured value of 1500 Ohm correspond with \( \frac{1500 \text{ Ohm}}{26 \text{ Ohm/cm}} = 58 \text{ cm} \) to the next grid (contact point).

- continue removing the cable insulation until about 2 cm remain to the grid

- cut off heating cable so that at least 3cm remain to the grid (contact point) and split the ends

- cut away the heating coil up to the cable insulation

- connect by means of PIDG-crimper the screen and the stripped conductors with the supply cable (3 x 2.5mm²)

- seal the line end with silicone compound and push the end piece on top of it

- seal the end piece and the line by means of the heat shrinking sleeve
Head-end prefabrication for parallel heating cable 40W/m / 60W/m

Cutaway about 20cm from the jacket of the line.

Push back heat insulation and seal line end with silicon compound.

Splice heating cable ends and insulate them from process tube by means of the enclosed shrinking sleeve.

Push the end piece over the process tube.

Seal line end and end piece with heat shrinking sleeve. The heat-shrinking should if possible, be carried out with a hot air blower.
Temperature measurement and automatic control

For measuring the temperatures, sensors are mounted on the outside of the process tube. It has to be fundamentally decided whether temperature control or just limitation.

The ambient temperature where the sensor are located influence the whole control action and accordingly the internal temperature of the sample line. Therefore, for safety reasons, the sensor should be placed where the highest temperature of the line might occurs.

Sensors for safety temperature limiters must always be placed where the ambient temperature is the highest. As a rule the limiter will be set on the max. permitted temperature. Afterwards the control sensor may be set according to customer's requirements.

Installation

All lines, except those with self controlling, must not be installed in conduit or closed cable trays because then an overheating of the line might occur.

We recommend the cables to be layed on "C"-profile and mounted by means of clamps. The distance between lines, except those with self controlling, should be kept at least 25mm.

The laying of heated sample lines outdoors may lead to heat losses due to wind. Therefore they should be protected as much as possible.

In ducts the lines have to be layed freely, i.e. without any insulation.

Installation hints for lines with a PVC jacket:

- Smallest bending radius: 8 x outer diameter
- Min. temperature for laying: app. -9°C
- Horizontal distance between fixations: every 1,20 m
- Vertical distance between fixations: every 2,50m

Installation hints for lines with a PA jacket:

- Smallest bending radius: 6 x outer diameter
- Min. temperature for laying: app. 0°C
- Horizontal distance between fixations: every 1,00 m
- Vertical distance between fixations: every 2,50m
The installation should be carried out, so that there will be no movement or stress exerted directly at the connecting point. Flanges, fittings and valves must not be used as pulling or suspension points. For the vertical laying the minimum distance between fixations have to be observed or else the mounting of a wire for stress is recommended.

Line coils have to be uncoiled carefully, so that no torsion stress is exerted, since the lines are not designed for these forces. They have to be mounted in such a manner that the centre line of the tube and the direction of movement will lie in the same plane.

When fittings and connections are screwed on, a counteracting spanner has to be used. Only clamps, tightening straps or similar holding devices, which do not considerably impair the insulation layer, are allowed. Pressure points should not be deeper than 10% of the jacket diameter.

The line should not be laid across sharp edges and through cut-outs. For very robust applications we recommend a corrugated metal hose for the jacket.

Please also observe the installation and laying instructions on the following pages.

The mounting instructions enclosed in the mounting kits from PSG must be observed. Check if hose, sensor, temperature control, line sections and fuse are well suited to each other. Mixing up sensors and overloading controllers may lead to damage line. Please observe that self-controlling heating elements may have a fivefold starting current, depending on the ambient temperature. Always use fuses with a "C"-characteristic.

When in doubt ask your PSG serviceman.

The heating-up of the sample line may take up to 1 hour, depending on the ambient temperature. Please consider this when you let your process medium flow through the lines for the first time. Only mounting kits approved by us should be used for the finishing end, if necessary, for the alteration of lengths.
Do not lay heated sample line in conduit.

Do not form any siphons during the installation, especially not near the sampling point.

Do not lay heated sample lines bundled together in cable rays, especially not when these are covered.

Lay heated lines on "C"-profiles by means of cable clamps.
Distance: 25mm (about 1 inch)
Fixation:
- horizontal lines every 0.8m
- vertical lines every 2.5 m
Bending radius: 200 - 400 mm
Min. Temperature for laying: -9.5°C
If heating tubes are laid in a duct or trench, the heat will accumulate.

Remedy: The tubes must not touch each other. Moreover, sufficient ventilation has to be provided. Distance between tubes 25 mm

If, for example, powdery substances, glue or other heat insulating material is poured on to heating tubes, over-heating in these places will occur.

Remedy: Clean tubes persistently and eliminate the reason for the trouble.

Heat accumulation also occurs when insulating material is wrapped around the heating tube, which leads to local over-heating. If the area around the sensor is covered, then the remaining parts of the tube will cool down.

Wall ducts must not be filled with foam or insulated. Use bulkhead plates with glands (PG).

Bundling or laying the tubes so that they come into contact with each other, leads to overheating in the contact area.

Remedy: A space of 25mm between the tubes

Do not squeeze the heat insulation with the clamps so much, that the braid is pressed on to the heating conductor. Failure to observe this may lead to damage of the protecting braid and the tube.
Notes: