

TubeBundle *Xtruded* – Heated

PerfectZero – Heated Sample Gas Line for Emission Monitoring

Application

TBX-H PerfectZero is a controlled heated sample gas line for continuous extractive gas analysis. It transports wet sample gas from the sampling point to the sample conditioning system or directly to the analyzer system.

The measurement challenge at high temperatures

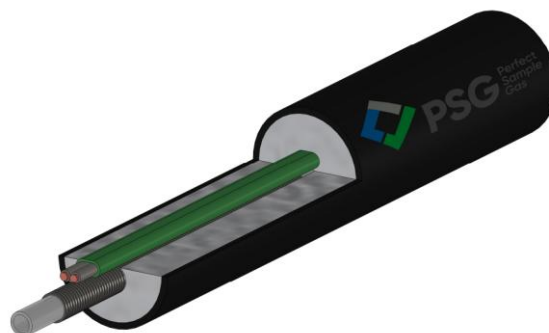
The sample gas must remain above the water and acid dew point along the entire transport path. At high continuous temperatures, CO emissions can at the same time be released from heater and insulation materials. Without a barrier, CO can diffuse through the PTFE wall into the sample gas stream and affect particularly low CO measuring ranges.

The PerfectZero solution

A flexible metallic diffusion barrier surrounds the PTFE or PFA sample gas tube and fully shields it from the heater and insulation materials.

The heated line keeps the sample gas above the dew point at holding temperatures up to 200 °C and at the same time protects the CO reading against line-induced ingress.

Result: No CO ingress from the heated sample gas line.



- ✓ Reliable CO measurement at high holding temperatures
- ✓ Safe sample gas transport above the dew point
- ✓ Lower energy demand than conventional flex lines (approx. 20-30%)
- ✓ Flexible installation even at tight bending radii
- ✓ Short lead times thanks to standard configurations ex stock
- ✓ Can be shortened and terminated at the factory or on site
- ✓ Replaceable PTFE or PFA sample gas tube
- ✓ Additional lines for calibration gas, media or power can be integrated

Design Features

The TBX-H platform combines the robust design of an extruded line with the flexibility of a traditional corrugated line.

Metallic diffusion barrier

A flexible stainless steel corrugated tube separates the sample gas tube from heating cable and insulation.

Replaceable sample gas tube

PTFE or PFA tubes offer high chemical resistance and low surface interaction.

Extruded outer jacket

PVC or TPU versions protect the line against moisture, weather and mechanical stress.

Parallel heating cable

The CPD heating cable enables long heating circuits and can be cut to the required line length.

Modular line design

Additional media, calibration gas, sensor and power lines can be integrated into the insulation.

Flexible termination

The line is supplied ready for connection or terminated with the PSG termination kit in the workshop or on site.

Applications

Continuous emission monitoring

For CEMS and process measurements with high holding temperatures and low CO measuring ranges, for example in combustion plants, power plants, cement plants and chemical facilities.

Process and raw gas analysis

For measurements of CO, NO_x, O₂, SO₂, NH₃ and further components in sulfur-containing or wet gases, where condensation and sample gas losses must be avoided.

Key Technical Data

- ✓ Holding temperature up to 200 °C at 60 W/m
- ✓ Heating circuit length up to 185 m, depending on heating cable and supply voltage
- ✓ Bending radius 4–5 × outer diameter with PVC Flex or TPU Flex
- ✓ Production length up to 450 m in one piece
- ✓ Degree of protection IP65
- ✓ Energy demand approx. 25–30 % below conventional flex lines

Technical Data

General	
Description	controlled heated sample gas line
Max. Holding temperature	200 °C (60 W/m) 180 °C (45 W/m) <i>180 °C at 45 W/m only achievable at higher ambient temperatures or with additional insulation.</i>
Outer jacket extruded	Standard PVC, Standard PVC Flex Optional TPU, Optional TPU Flex <i>TPU for higher temperature / increased robustness</i>
Insulation	Thermal fleece or Glass fibre fleece
Insulation thickness	10–16 mm depending on application
Heating cable	CPD parallel heater - 45 W/m - 60 W/m
Number of heated sample paths	1 or 2 PTFE / PFA tubes per line
Diffusion barrier	Stainless steel corrugated tube
Sample gas / media tube - material	PTFE or PFA
Sample gas / media tube - size	Metric and imperial PSG Standard 4 – 1 media tube 6x1 mm PTFE, replaceable PSG Standard 5 – 1 media tube 8x1 mm PTFE, replaceable <i>Further configurations - see Order Code section</i> <i>Standard variants are available ex stock.</i>
Overall outer diameter	42–60 mm depending on configuration
End termination	PTFE end cap non-ATEX PTFE end cap ATEX PSG
Lead time	Standard – without termination – 2 weeks after order receipt Standard – with termination – 3 weeks after order receipt <i>(depending on capacity utilization, longer lead times may apply)</i> Specials – without termination – 4–6 weeks after order receipt <i>(depending on capacity utilization, longer lead times may apply)</i> Specials – with termination – 6–8 weeks after order receipt <i>(depending on capacity utilization, longer lead times may apply)</i>
Delivery type / delivery form	up to approx. 70 m as a coil in a carton, above this on a wooden drum
Maximum production length	450 m
Technical Data	
Electrical supply	120 / 230 / 400 / 480 VAC, depending on heating cable and version; protection on supply side
Ambient temperature (operation)	-20 ... +70 °C (other temperature ranges on request)
Installation / Bending radius	8–10 × outer diameter standard PVC / TPU 4–5 × outer diameter PVC / TPU Flex
Weight	approx. 750 g/m
Max. operating pressure PTFE tube	DN4/6: ~4.0 bara @ 180 °C DN6/8: ~3.5 bara @ 180 °C
Overall outer diameter	42–60 mm depending on configuration
Degree of protection	IP65
Heating circuit length	
CPD Basic, 45 W/m	230 V – 75 m
CPD Basic, 60 W/m	120 V – 45 m 230 V – 75 m
CPD Extra, 60 W/m	120 V – 62 m 230 V – 120 m 400 V – 154 m 480 V – 185 m
Options and Accessories	
Additional: cable in the line	see Order Code section
Additional: calibration / media tube in outer insulation	see Order Code section
Additional: temperature sensor	see Order Code section
Additional: temperature controller	see Order Code section
Additional: customer-specific printing and color	On request

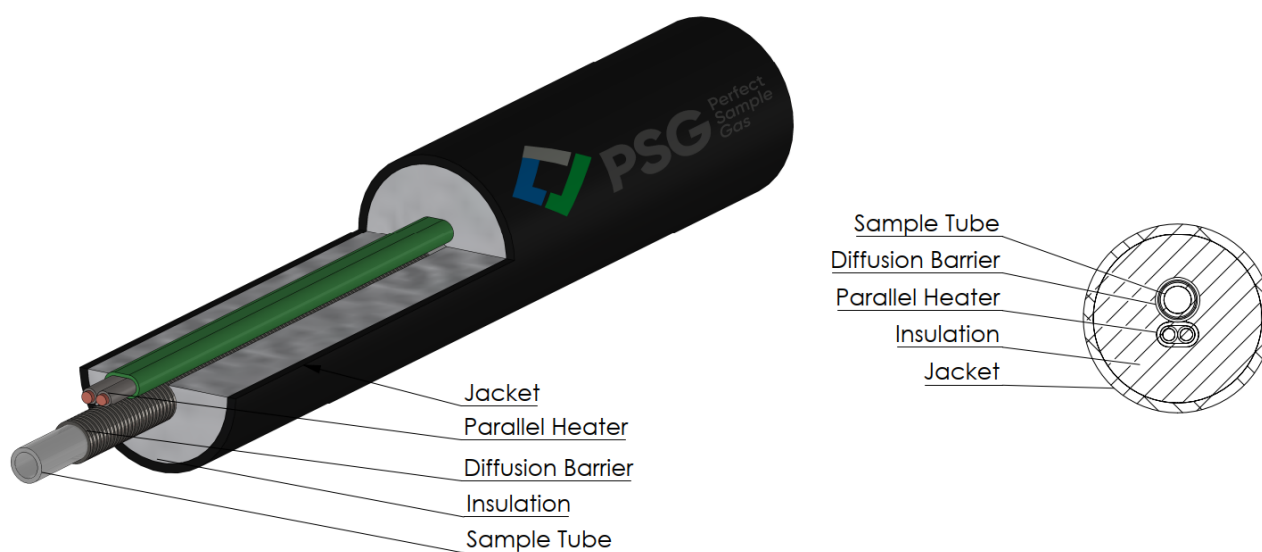
PSG Standards (Stocked Configurations)

Common basis: 230 V · 60 W/m · 10 mm Thermal fleece · Auxiliary tube 6×1 mm PTFE

Series	TBX-H			TBX-H PerfectZero	
Configuration	Standard 1	Standard 2	Standard 3	Standard 4	Standard 5
Sample gas path	6×1 + 8×1 mm PTFE	6×1 + 8×1 mm PTFE	6×1 + 8×1 mm PTFE	6×1 mm PTFE + PerfectZero barrier	8×1 mm PTFE + PerfectZero barrier
Heating cable	CPD Basic	CPD Extra	CPD ATEX Extra	CPD Basic	CPD Basic
Outer jacket	PVC	PVC	Ex² PVC	PVC Flex	PVC Flex
Holding temperature	200 °C	200 °C	180 °C	200 °C	200 °C

Further standard and special configurations: see Order Code.

Technical Drawings



Structure of the TBX-PerfectZero line · Subject to change

Order Code

The part number consists of the fixed prefix **TBX-Z1-XXXX-XXX-XXXXXXXX-XXXXXXXX-XXXX** (product line TB-Xtruded PerfectZero) and the code positions 1–20.

Pos 1 · Process tube 1			
11	6×1 mm PTFE – diffusion-tight barrier	12	6×1 mm PFA – diffusion-tight barrier
21	8×1 mm PTFE – diffusion-tight barrier	22	8×1 mm PFA – diffusion-tight barrier
51	¼×0.035" PTFE – diffusion-tight barrier	91	¼×0.062" PTFE – diffusion-tight barrier
92	¼×0.062" PFA – diffusion-tight barrier	ZZ	Special tube

Pos 2 · Process tube 2			
00	none	11	6×1 mm PTFE – diffusion-tight barrier
12	6×1 mm PFA – diffusion-tight barrier	21	8×1 mm PTFE – diffusion-tight barrier
22	8×1 mm PFA – diffusion-tight barrier	51	¼×0.035" PTFE – diffusion-tight barrier
91	¼×0.062" PTFE – diffusion-tight barrier	92	¼×0.062" PFA – diffusion-tight barrier
ZZ	Special tube		

Pos 3 · Heating cable			
000	no heating cable	EP1	ELP/PFA 60 BOT · 60 W/m · 230 V · max. 180 °C
PB1	CPD Basic · 60 W/m · 230 V · max. 200 °C	PB2	CPD Basic · 60 W/m · 120 V · max. 200 °C
PE1	CPD Extra · 60 W/m · 230 V · max. 200 °C	PE2	CPD Extra · 60 W/m · 400 V · max. 200 °C
PE3	CPD Extra · 60 W/m · 120 V · max. 200 °C	PE4	CPD Extra · 60 W/m · 480 V · max. 200 °C
PM1	CPD EMI · 45 W/m · 230 V · max. 180 °C	PM2	CPD EMI · 45 W/m · 120 V · max. 180 °C
PP1	CPD Plus · 40 W/m · 230 V · max. 200 °C	PP3	CPD Plus · 60 W/m · 230 V · max. 200 °C
PX1	CPD ATEX · 60 W/m · 230 V · max. 180 °C	PX2	CPD ATEX Extra · 60 W/m · 230 V · max. 180 °C
PX3	CPD ATEX · 60 W/m · 120 V · max. 180 °C	PX4	CPD ATEX Extra · 60 W/m · 120 V · max. 180 °C
ZZZ	Special heating cable		

Pos 4 · Auxiliary tube 1 in the insulation			
00	none	11	6×1 mm PTFE
12	6×1 mm PFA	21	8×1 mm PTFE
22	8×1 mm PFA	31	10×1 mm PTFE
32	10×1 mm PFA	41	12×1 mm PTFE
42	12×1 mm PFA	51	¼×0.035" PTFE
61	3/8×0.062" PTFE	62	3/8×0.062" PFA
71	1/2×0.062" PTFE	81	12×2 mm PTFE
91	¼×0.062" PTFE	92	¼×0.062" PFA
ZZ	Special tube		

Pos 5–7 · Auxiliary tubes 2–4 in the insulation	
—	Codes identical to auxiliary tube 1 (Pos 4)

Pos 8 · Auxiliary cable 1 in the insulation			
0	no auxiliary cable	1	3× 2.5 mm²
2	PT100 cable 4× 0.75 mm²	3	5× 2.5 mm²
4	Thermocouple cable Type K (2× 0.22 mm²)	5	Data cable 2× AWG 18, twisted/shielded
6	3× AWG 14 (black / white / green)	7	Thermocouple cable Type J (2× 0.22 mm²)
Z	Special cable		

Pos 9–16 · Auxiliary cables 2–9 in the insulation

—	Codes identical to auxiliary cable 1 (Pos 8)
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Pos 17 · Insulation

0	no insulation (processing fee only)	1	Thermal fleece 10 mm
2	Thermal fleece 14 mm	3	Thermal fleece 16 mm
4	Thermal fleece customer-specific thickness	5	Glass fibre fleece 10 mm
6	Glass fibre fleece 14 mm	7	Glass fibre fleece 16 mm
8	Glass fibre fleece customer-specific thickness		

Pos 18 · Extruded Flex

1	Standard extruded jacket (smooth)	2	extruded flexible line
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Pos 19 · Outer jacket

0	no outer jacket	1	PVC
2	Ex² PVC + PE	3	TPU
4	Ex² TPU + PE	5	ATEX4 PVC antistatic
Z	Special outer jacket		

Pos 20 · Documentation

D	Standard digital	X	ATEX in 1 paper copy
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