2

Overview

Cross-duct sensors CD 6 and cables for non-Ex applications

The standard cross-duct sensor consists of a transmitter unit and a detector unit with the same dimensions. The transmitter unit provides a connector for the fiber-optic cable. The laser light is transmitted through this cable. The receiver unit contains a photodetector and an electronics PCB, and is connected to the detector unit by a sensor cable.

The sensors are mounted onto flanges. The easiest way to avoid condensation and dust deposits on the sensor windows is to use a purging gas, e.g. with instrument air. Purging must be selected depending on the application. The cross-duct sensors can therefore be configured for the respective situation. The application reference table provides recommendations for suitable purging with standard applications.

If a component is to be measured which is also present in measurable quantities in the purging medium - such as oxygen or moisture - it is necessary to use purging gases such as nitrogen, superheated process steam or similar. In such cases it is usually also necessary to purge the sensor heads, since the ambient air must also be displaced here out of the laser beam path. A differentiation is therefore made between purging on the process side and purging on the sensor side.

Note: For measurement of O_2 at gas temperatures above 600 °C, it may also be possible to tolerate air as the purging medium since its influence on the measurement can be compensated.

Applications with oxygen (high-pressure)

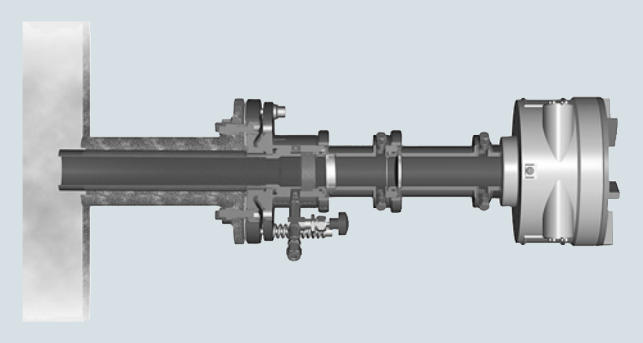
For oxygen measurements with a higher process gas pressure (1 to 5 bar), the sensor CD 6 can be used together with a high-pressure window flange as the process connection. This window flange is also available in the standard sizes DN 65/PN 6, DN 80/PN 16 or ANSI 4"/150 lbs. The optical surface to the process is made of borosilicate glass. High-pressure window flanges can be equipped with window purging, but without purging tubes. Possible purge modes for the window flanges are "A-C" (no purging or moderate purging on the process side). Window flanges are tested for leakage before delivery using overpressure, and show leakage rates of less than 10^{-5} mbar·l/s.

For ordering this application, the MLFB code of the central unit with the application code letter "P" must be selected. The process interface suitable for the sensors can be chosen by selection of the corresponding code in the 6th configurable position of the MLFB number.

The most important sensor purging configurations are presented below:

Purging on the process side with moderate flow

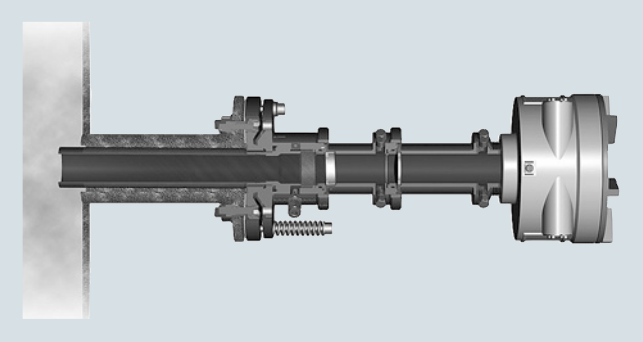
Selected for pure gas applications, emission monitoring, inertia monitoring, for example. The purging gas flow can be adjusted between 0 and approx. 120 l/min at each sensor head using a needle valve (included in delivery).



Moderate purging on the process side

Purging on the process side with increased flow

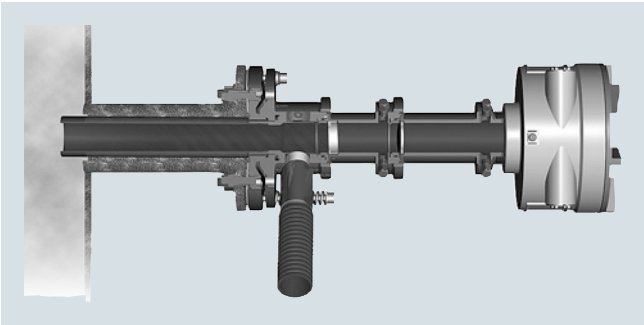
Through omission of needle valve. This type of purging is selected in crude gas applications with higher concentrations of particles and/or condensation as well as in non-purified flue gases in combustion plants. The purging gas flow is typically set between 200 and 500 l/min on each sensor head depending on the input pressure of the purging medium.



Increased purging on the process side

Purging on the process side with high flow

Through use of air blower or dry process steam. Connectors with hose adapters are included in the delivery. An additional Swagelok adapter must be ordered if a high flow of steam or instrument air purging is required (option A27). This type of purging is selected in crude gas applications with very high concentrations of particles and/or condensation such as in the furnaces of combustion plants. If instrument air is not available, an air blower is also an alternative for purging in applications with lower demands. On the process side, dry steam can be used as the inert purging gas instead of nitrogen (Tmax. 240 °C). The purging gas flow is automatically set between 500 and <1 000 l/min on each sensor head depending on the purging air blower or the steam pressure.



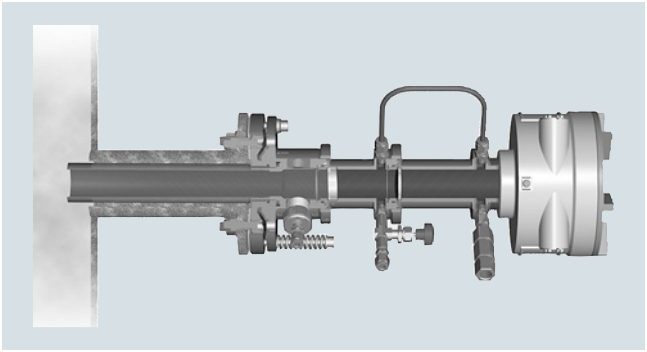
Increased purging on the process side, with hose connection adapter

Purging on sensor side

Can be combined with any purging mode on the process side, and is always selected if the ambient air must never have an influence on the measurement. The volumes within the sensor head are then continuously purged with an O_2-free gas (with H_2O-free gas in the case of moisture measurement).

Note

With purging on the process side, it may be necessary to use non-return valves to ensure no process gas can enter the purging gas line in the event of failure of the purging gas supply. This applies especially in the case of cascaded process and sensor purging where there is otherwise the danger that, for example, corrosive process gases could enter the sensor enclosure.



Sensor configuration with high purging on the process side, with 6 mm joint for use with steam, and with N_2 purging on the sensor side

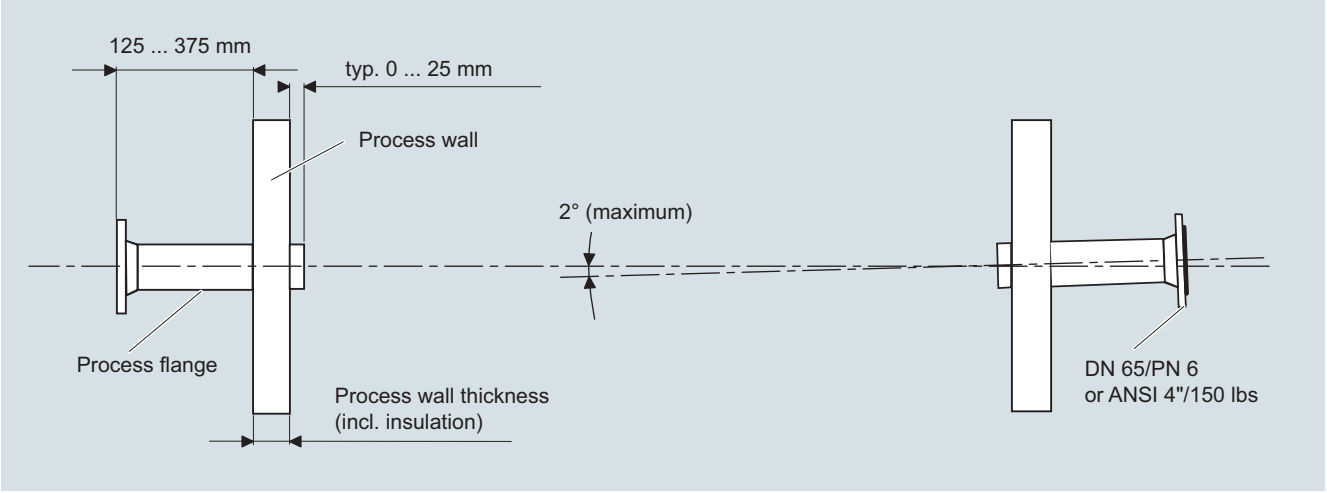
The purging media used on the process side flow through purging gas tubes into the process gas flow. The tubes extend a few centimeters into the process area, and usually receive a flow of process gas from the side. This results in a wedge being generated in the inlet zone of the purging gas. The effective measuring path in the process gas is therefore well-defined as the distance between the ends of the two purging gas inlet tubes.

Cross-duct sensor CD 6: Options and accessories

Sensor alignment kit

Includes a battery-operated visible light source, a centering aid with crosshair, and two hook spanners for opening the optics tube of the sensors.

Please note: the sensor alignment kit is not explosion protected.

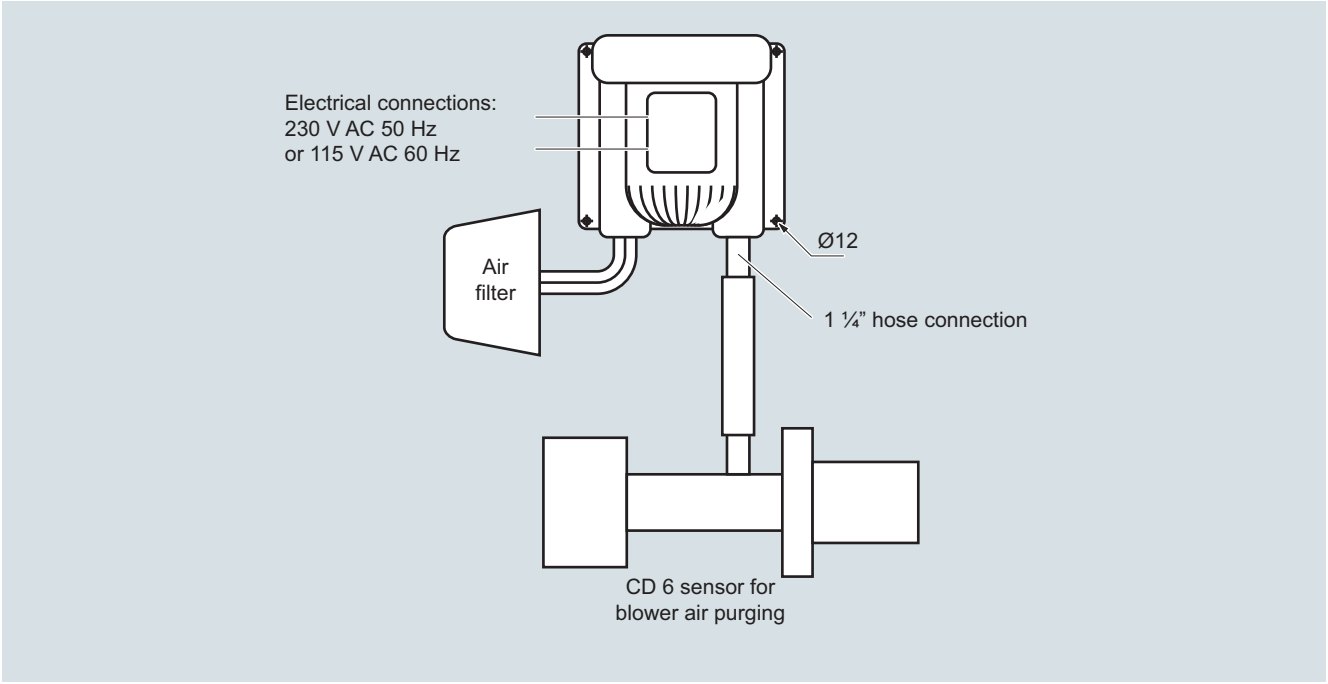


Installation requirements for the cross-duct sensors CD 6, dimensions in mm

Cross-duct sensor CD 6

Purging air blower

Two purging air blowers are required to purge the sensor heads.
Both 230 V AC and 115 V AC versions can be ordered.



Sensor configuration with purging air blower

Flow cell (available on special application)

For implementation of measuring configurations with bypass mode. The cell consists of a stainless steel tube with electropolished internal surfaces to minimize surface effects.
With an effective measuring path of 1 m, the inner volume is only 1.2 l, and fast gas displacement times can therefore be achieved. The flow of sample gas can be from the ends or from the center of the tube, since appropriate 6 mm joints are present here. The flow cell can be ordered in four configurations:

- Unheated, including assembly for wall mounting
- Unheated, including assembly for wall mounting and a 19" housing with an air jet pump with a delivery rate of max. 30 l/min
- As above, but can be heated up to approx. 200 °C
- As above, but can be heated up to approx 200 °C and mounted on a rack with wheels and integrated 19" frame

Optical bandpass filter (only for O_2-CD 6)

Serves to protect the light-sensitive detector in the receiver unit of the sensor from saturation by IR background radiation. Used with measurements in very hot process gases (T > 1 000 °C) or with unavoidable appearances of flames in the measurement path.

Technical specifications

Cross-duct sensor CD 6

General information	
Design	Transmitter and detector units, connected by a sensor cable
Materials	Stainless steel (1.4305/303), aluminum
Installation	Vertical or parallel to the gas flow
Laser protection class	Class 1, safe to the eye
Explosion protection	II 1 G Ex ia op to IIC T4 Ga II 1 D Ex ia op to IIIC T135 °C Da
	A defined leak rate can only be guaranteed when using high-pressure window flanges. Otherwise, it may be necessary for the owner to carry out an evaluation in accordance with ATEX DEMKO 06 ATEX 139648X; IECEx UL 13.0029X
Design, enclosure	
Degree of protection	IP65
Dimensions	Diameter: 163, L: 450 mm
Purging gas tube in mm	400 (370 net) x 44 x 40 800 (770 net) x 54 x 40 1 200 (1 170 net) x 54 x 40
Weight	2 x approx. 11 kg
Mounting	DN 65/PN 6, DN 80/PN 16 or ANSI 4"/150 lbs

Please note:
- For purging tubes with a length of 800 and 1 200 mm, the wall thickness must not exceed 200 mm with DN 65/PN 6 connections. To carry out measurements with thicker walls, please contact Siemens.
- The optimum adjustment of the flanges can change with high differences in temperature between the process and environment depending on the type of assembly.

Electrical characteristics	
Power supply	24 V DC, supply from central unit via hybrid cable
Power consumption	< 2 W with non-Ex configuration, max. 0.6 W with Ex configuration
Climatic conditions	
Sensor temperature	
Non-Ex	-20 ... +70 °C in operation
	-30 ... +70 °C during transport and storage
Ex	-20 ... +60 °C in operation
	-30 ... +70 °C during transport and storage
Humidity	< 95 % RH, above dew point
Pressure	800 ... 1 100 hPa
Temperature range on the sensor side of the process interface (connection plate)	-20 ... +70 °C
Measuring conditions	
Measurement path	0.3 ... 12 m (other path lengths on request)
Dust load	The influence of dust is very complex and depends on the path length and particle size. The optical attenuation increases exponentially at longer path lengths. Smaller particles also have a very large influence on the optical attenuation. With high dust load, long path length and small particle size, the technical support at Siemens should be consulted.

Accessories

Purging	
Nitrogen is permissible as the purging gas for the sensor side. Nitrogen, steam, air and gases which are not subject to the pressure equipment directive Cat. 2 are permissible as purging gases for the process side.	
Purging with instrument air, N_2	
• Max. overpressure in the sensor	< 500 hPa
• Quality	
- Instrument air	According to ISO 8573-1:2010 [2:3:3]
	Note: It is sufficient if the pressure condensation point is min. 10 K below the minimum ambient temperature.
- Nitrogen	Purity better than 99.7 %. For oxygen measurements, an O_2 content < 0.01% in the purging gas. Optical path length ≥ 1 m, min. 5% oxygen in the process gas.
• Maximum flow rate (process purging)	500 l/min
• Dew point	Benchmark: < -10 °C, condensation on the optics must be avoided
Blower purging	
• Maximum counter pressure	40 hPa
• Maximum flow rate	850 l/min
• Power consumption	370 W
• Degree of protection (fan)	IP54, cover required to protect against rain
Steam purging	
• Steam conditioning	Overheated
• Maximum temperature	240 °C
• Minimum pressure	> 4 000 hPa
• Maximum pressure	16 000 hPa, refers to a volume flow of approx. 1 100 l/min

Cross-duct sensor CD 6

Hybrid and sensor cables

General information	
Configuration hybrid cable	Two optical fibers and two twisted copper wires in one cable for 24 V DC. Single-mode optical fiber fabricated at both ends with E2000 angle connectors. Multimode optical fiber configured at both ends with SMA connectors. Cable is flame-retardant, very good resistance to oil, gasoline, acids and alkalis, outer sheath UV-resistant
Cable sheath	Oil-resistant polyurethane
Dimensions	• An external power supply must be additionally ordered for > 500 m • For installation in hazardous zones, non-intrinsically-safe cables have to be spatially separated from intrinsically-safe lines
• Diameter	< 8.5 mm
• Length	• Use in non-hazardous and Ex Zone 2: Up to 700 m • Use in Ex Zone 0 and Zone 1: Up to 250 m
Weight	75 kg/km
Maximum tensile force	200 N
Maximum lateral pressure	1 000 N/cm
Impact resistance	200 N/cm
Maximum tensile strength	500 N
Minimum bending radius	12 cm
Climatic conditions	
Ambient temperature	-40 ... +70 °C during transport, storage and operation -5 ... +50 °C during cable installation
Humidity	< 95% rel. humidity, above dew point (in operation and storage)

Selection and ordering data		Article No.	Cannot be combined
LDS 6 in-situ gas analyzer Pair of sensors (cross-duct sensor)		↗ **7MB6122-** ■■■■■ - ■■■■	
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.			
Explosion protection[1]			
Without		0	
II 1 G Ex ia op is IIC T4 Ga, II 1 D Ex ia op is IIIC T135 °C Da		1	
Sensor type	**Measured component**		
Standard cross-duct sensor	O_2	A	
	All gases except O_2	W	
Purging, process side	**Sensor side**		
Without purging	Without purging	A	
	Air or N_2, 1 to 2 l/min; incl. needle valve, 6 mm Swagelok	B	
Instrument air or N_2 Reduced flow: 0 ... 120 l/min incl. needle valve, 6 mm Swagelok	Without purging	C	
	Air or N_2, 1 to 2 l/min; incl. needle valve, 6 mm Swagelok	D	
Air or N_2 Increased flow: 200 ... 500 l/min incl. 6 mm Swagelok	Without purging	E	
	Air or N_2, 1 to 2 l/min; incl. needle valve, 6 mm Swagelok	F	
Air, fan or steam; high flow: > 500 l/min incl. 1¼" hose adapter	Without purging	G	G
	Air or N_2, 1 to 2 l/min; incl. needle valve, 6 mm Swagelok	H	H
Purging tubes, material			
No purging tubes		0	
Stainless steel, EN 1.4432/316L		1	1
Purging tubes, length			
No purging tubes		0	
400 mm		1	
800 mm		2	
1 200 mm		3	
75 mm, e.g. for engine test rigs		4	
Process connection			
Stainless steel flange (1.4404/316L), connection dimension DN 65/PN 6, MAWP (PS) at 20 °C: 0.05 MPa		0	0 → C12, C13
Stainless steel flange (1.4404/316L), connection dimension ANSI 4"/150 lbs, MAWP (PS) at 20 °C: 7.25 psi		1	1 → C12, C13
Stainless steel flange (1.4404/316L), connection dimension DN 65/PN 6, MAWP (PS) at 20 °C: 0.05 MPa, incl. enclosed welding flanges, e.g. for engine test rigs		2	2 → C12, C13
Pressure-resistant window flange (1.4404/316L, borosilicate glass), connection dimension DN 65/PN 6, MAWP (PS) at 20 °C: 0.6 MPa		3	3 3 3
Pressure-resistant window flange (1.4404/316L, borosilicate glass), connection dimension DN 80/PN 16, MAWP (PS) at 20 °C: 1.6 MPa		4	4 4 4
Pressure-resistant window flange (1.4404/316L, borosilicate glass), connection dimension ANSI 4"/150 lbs, MAWP (PS) at 20 °C: 232 psi		5	5 5 5
Hybrid cable			
No hybrid cable		X	
Standard length			
• 5 m		A	
• 10 m		B	
• 25 m		E	
• 40 m		G	
• 50 m		H	
Customized length (specified in complete meters)		Z	

[1] Complete and consistent implementation of the safety concept by the plant operator must be ensured during the commissioning and operation of the in-situ laser spectrometer LDS6 or the sensor CD 6 in hazardous atmospheres.

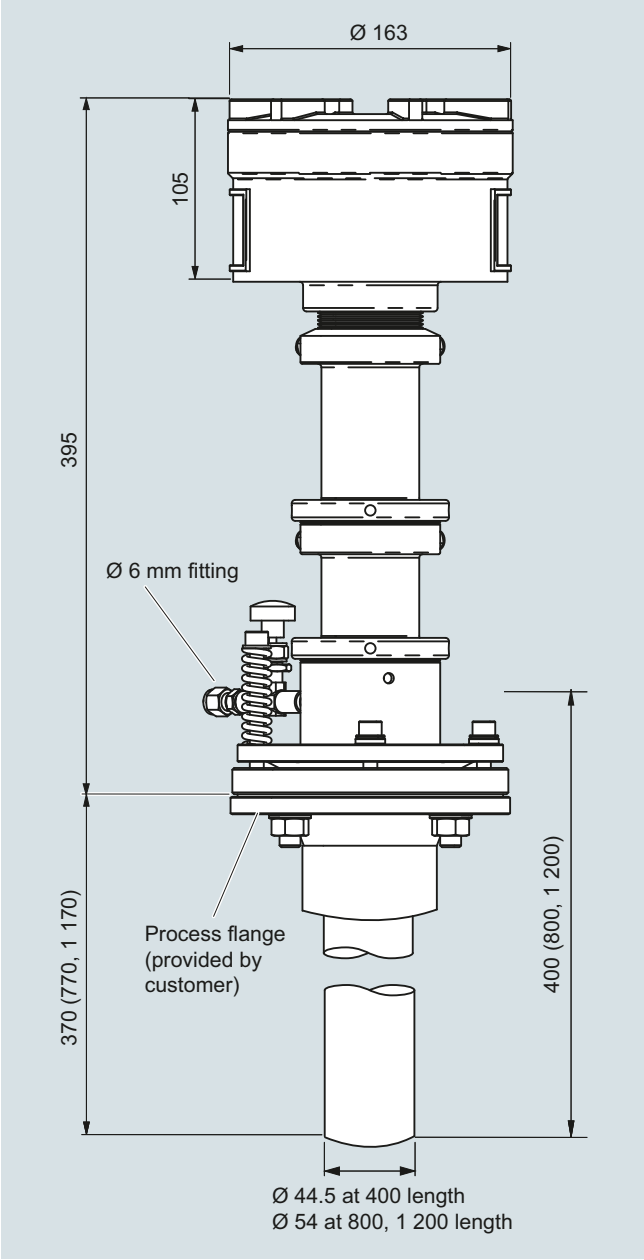
Cross-duct sensor CD 6

Selection and ordering data	Article No.	
LDS 6 in-situ gas analyzer Pair of sensors (cross-duct sensor)	**7MB6122-** ■■■■■ - ■■■■	Cannot be combined
Sensor connecting cable		
No sensor connecting cable	**X**	
Standard length		
• 5 m	**A**	
• 10 m	**B**	
• 25 m	**E**	
Customer-specific length (specified in complete meters)	**Z**	
Language (supplied documentation)		
German	**0**	
English	**1**	
French	**2**	
Spanish	**3**	
Italian	**4**	

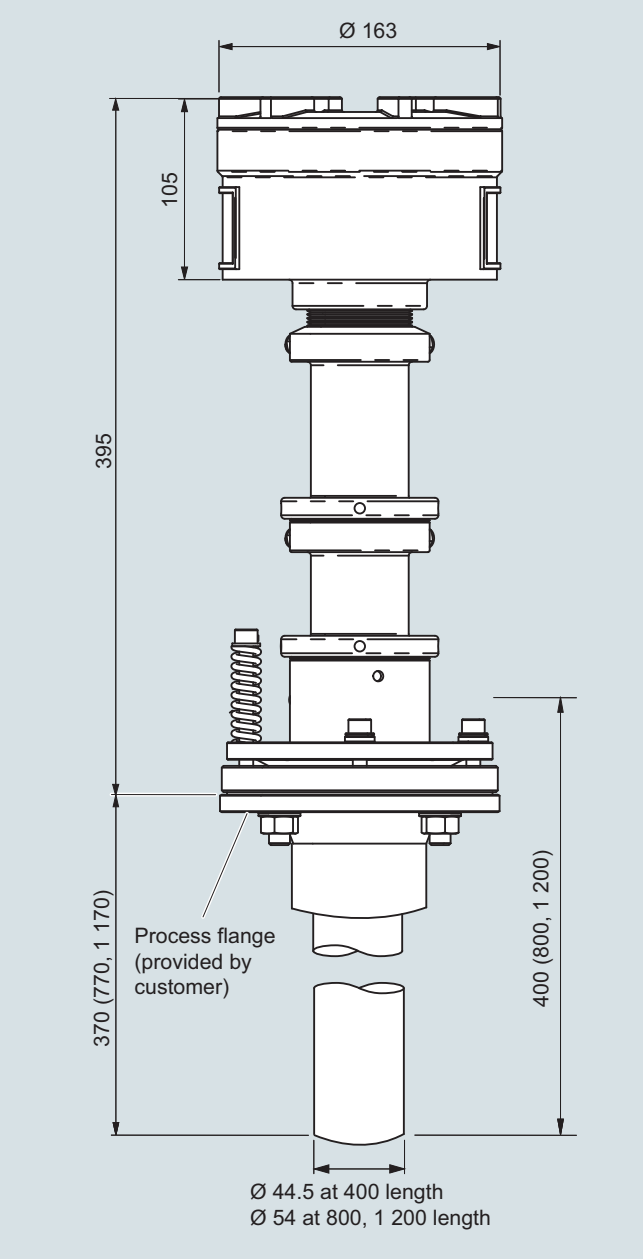
Additional versions	Order code
Add "-**Z**" to Article No. and specify order codes.	
6 mm Swagelok adapter for purging with steam, purging modes G and H	**A27**
Acceptance test certificate 3.1 (leak test) in accordance with EN 10204 (only in combination with flameproof window flanges)	**C12**
Acceptance test certificate 3.1 (material certificate) in accordance with EN 10204 (only in combination with flameproof window flanges)	**C13**
Hybrid cable, customized length	**P1Y**
Sensor cable, customized length	**Q1Y**
TAG label, customized inscription	**Y30**

Additional units	Article No.
CD 6, purging air blower 230 V / 50 Hz	**A5E00829151**
CD 6, purging air blower 115 V / 60 Hz	**A5E00829150**
CD 6, sensor alignment kit	**A5E00253142**
LDS 6, optical bandpass filter for reducing infrarot background radiation (flame filter), only for O_2	**A5E00534668**

Dimensional drawings

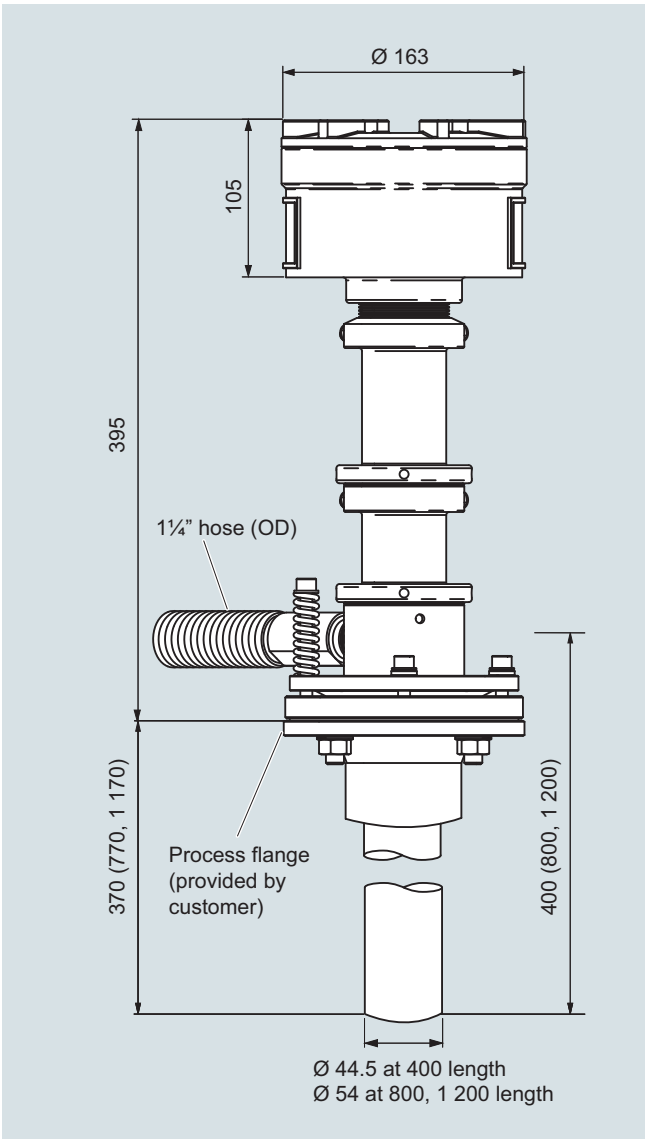


Cross-duct sensor CD 6, moderate purging (instrument air), version according to Order No. 7MB6122-**C1*-0***, dimensions in mm

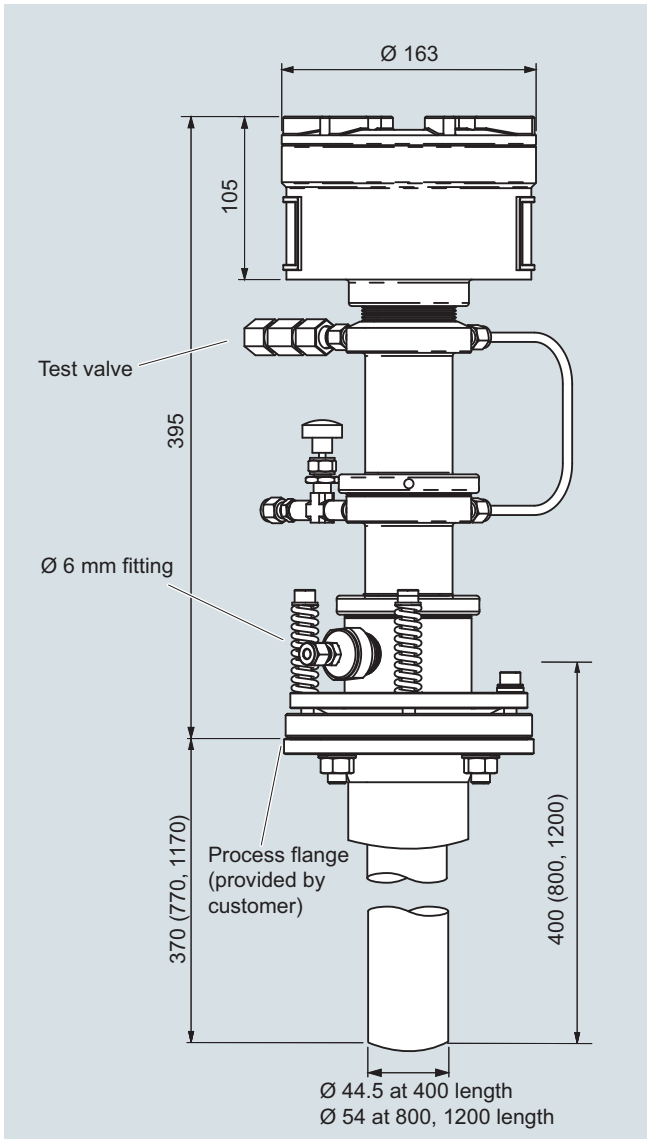


Cross-duct sensor CD 6, increased purging (instrument air), version according to Order No. 7MB6122-**E1*-0***, dimensions in mm

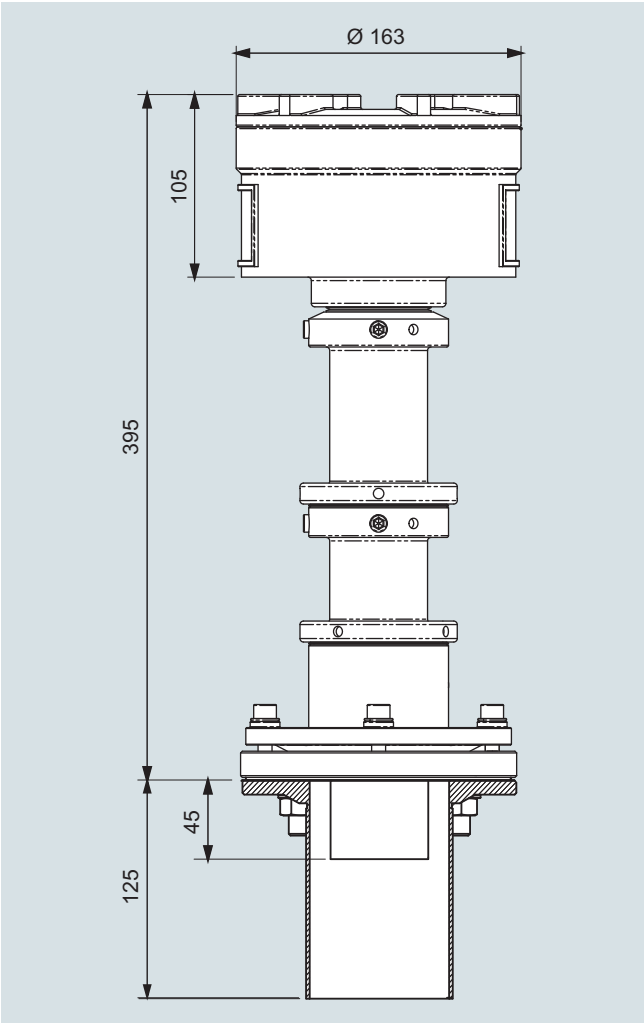
Cross-duct sensor CD 6



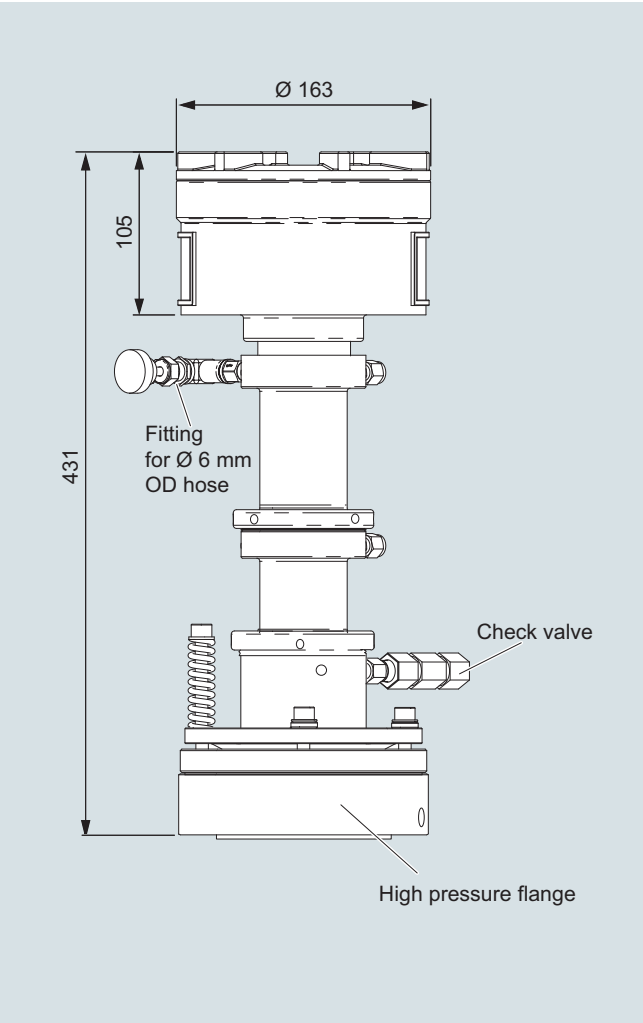
Cross-duct sensor CD 6, blower purging, version according to Order No. 7MB6122-**G1*-0***, dimensions in mm



Cross-duct sensor CD 6, sensor and process side purging, version according to Order No. 7MB6122-**H1*-0***-Z A27, dimensions in mm



Cross-duct sensor CD 6, purged version according to Order No. 7MB6122-*WC14-2***, dimensions in mm



CD 6 high-pressure sensor for oxygen, dimensions in mm