

## Flow Measurement

### SITRANS F X

#### SITRANS FX330

#### Overview



SITRANS FX vortex flowmeters are designed for use in industrial applications and optimally suited to the demands in auxiliary supply systems.

The proven principle of vortex flowmeters is suitable for measurement of liquids, gases and vapors unaffected by conductivity, viscosity, temperature and pressure.

#### Benefits

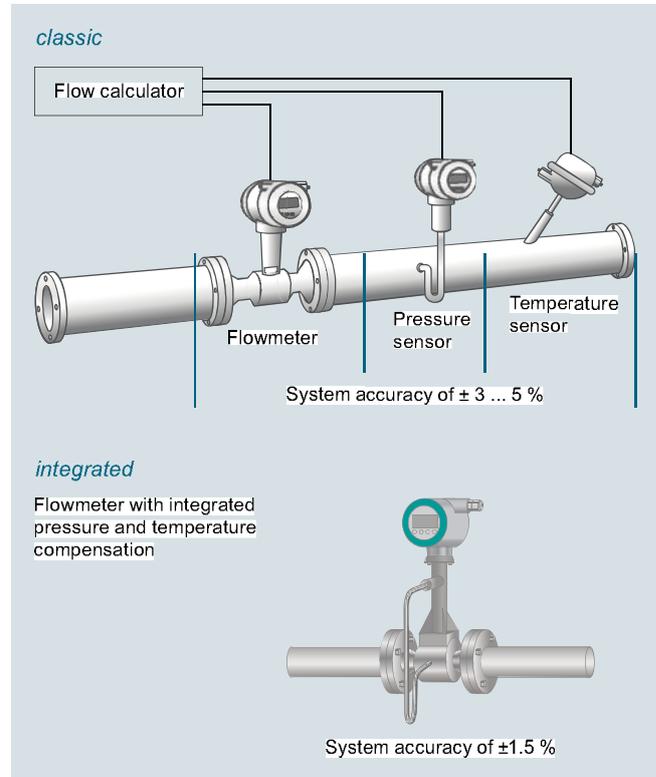
- Integrated pressure and temperature compensation
- Temperature compensation for saturated steam included as standard
- High measuring accuracy
- Maintenance-free sensor
- Non-wearing, fully welded stainless steel construction with high resistance to corrosion, pressure and temperature
- SIL2 certified according to IEC 61508 Edition 2
- Use in hazardous areas
- Integrated reduction of nominal diameter for space-saving and economic installation and large measuring ranges
- Redundant data management: Easy exchange of electronics without loss of calibration and configuration data
- FAD (Free Air Delivery) functionality
- Gross and net heat calculation to support advanced energy management
- Remote version with cable length up to 50 m (164 ft) (in preparation)

Even the basic version of the vortex flowmeter SITRANS FX330 is equipped with temperature compensation for saturated steam applications. With the optional pressure sensor the SITRANS FX330 has integrated density compensation for calculation of corrected volume and mass (online density compensation). The density compensation for calculation of corrected volume and mass is based on the standards of NIST for gases and IAPWS for steam.

#### Higher measuring accuracy with the use of compact measuring systems

With the classic installation of a vortex flowmeter and separate pressure and temperature sensor as well as flow calculator, all errors occurring in the measuring chain must be taken into account when determining system accuracy. This can result in a measuring error between  $\pm 3$  to 5 %.

Using a vortex flowmeter with integrated pressure and temperature compensation such as the SITRANS FX330 allows you not only to lower installation costs but also increase the measuring accuracy of the measuring point. In this case the accuracy is  $\pm 1.5$  % of the measured value.



The SITRANS FX330 in flanged design is available with integrated reduction of nominal diameter for space-saving installations and large measuring spans. About 90% of all vortex flowmeters are ordered one size smaller than the line diameter in order to increase the flow speed and to get a wider measuring range. Here, the line has to be reduced before and widened after the sensor, typically including 20x DN inlet and 5x DN outlet run. With the reduction and widening of nominal diameter included in the sensor, it is no longer necessary. To compensate the non-existent straight inlet run between reduction and the vortex bluff body, these devices are specially calibrated and linearized.

A new feature of the SITRANS FX330 is the advanced signal processing and filtering called AVFD (Advanced Vortex Frequency Detection): Interferences and disturbances in the measuring signal are suppressed, signals outside of the relevant frequency band are filtered out.

Redundant data management prevents loss of calibration and configuration data when changing electronics or display.

By default, all SITRANS FX330 meters are factory-calibrated (traceable to international standards) and pre-set according to customer specifications. The SITRANS FX330 also comes with an installation wizard to ease installation; e.g. in a steam application it will only show related settings.

Developed according to the standard IEC 61508 edition 2, the SITRANS FX330 can be used in safety-related application with classification SIL2 for continuous volume flow measurement.

**Application**

- Measurement of saturated steam and superheated steam
- Steam boiler monitoring
- Heat metering of steam and hot water
- Measurement of consumption of industrial gases
- Measurement of consumption in compressed air systems
- Monitoring of compressor output
- Evaluation of Free Air Delivery (FAD)
- SIP and CIP processes in the food, beverage and pharmaceutical industries
- Measuring of conductive and non-conductive liquids
- Safety-related measurement in SIL applications (SIL2)

**Gross and net heat quantity calculation**

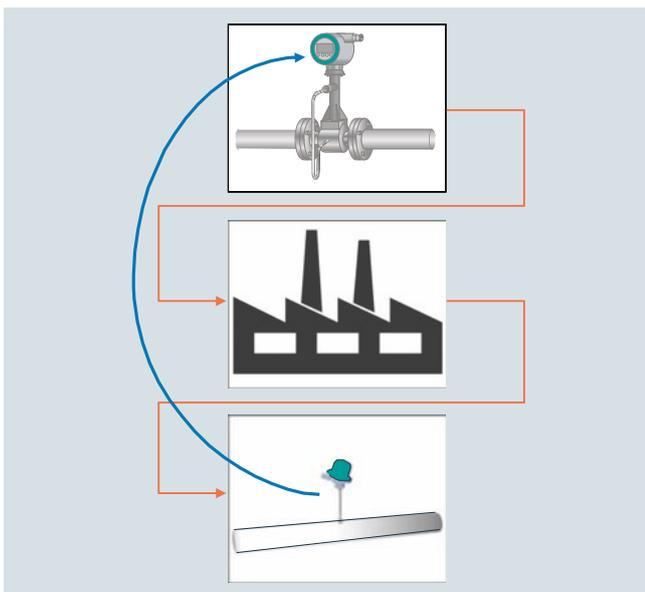
The SITRANS FX330 was designed for applications in auxiliary and supply service lines, such as internal monitoring of energy flows for saturated and superheated steam or hot water. Equipped with temperature sensor as standard, the device can be installed as heat meter in the feed line directly connected with an external temperature sensor in the return line. The gross and net heat calculation can be fed into a DCS to support advanced energy management.

When it comes to energy, the most accurate measurement of consumption is essential. By combining flow, temperature and pressure measurements in one device, SITRANS FX330 provides the basis for a precise mass flow calculation.

In steam applications, the software even determines the enthalpy - the heat content - of the steam. Therefore, SITRANS FX330 is able to calculate the gross heat quantity.

In case net heat quantity consumption of process is asked for, a single temperature sensor can be added to the return line. SITRANS FX330 uses the readings to calculate the amount of heat consumed.

The SITRANS FX330 thereby proves itself to be a reliable partner.

**Design**

SITRANS FX330 Flange	SITRANS FX330 Sandwich
	
Flanged version with integrated temperature compensation as standard for saturated steam and optional pressure compensation for superheated steam, gases and wet gases.	All advantages of the flanged version in a space-saving sandwich design; centering rings guarantee an easy installation without any offset.
Integrated reduction of nominal diameter for space-saving and economic installations plus large measuring ranges.	Integrated reduction of nominal diameter not available
Also in remote design with field housing and connection cable up to 50 m/164 ft (in preparation)	
With shut-off valve allowing	
<ul style="list-style-type: none"> <li>• exchange and calibration of pressure sensor</li> <li>• pressure and leak testing of pipeline without interrupting the process</li> </ul>	

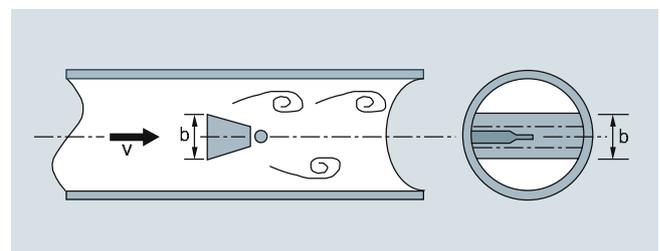
**Function**

Vortex flowmeters are used to measure the flow of gases, vapors and liquids in completely filled pipes. The measuring principle is based on the principle of the Karman vortex street. Inside the measuring sensor vortices are shed from a bluff body and are detected by a sensor located behind. The frequency  $f$  of the vortex shedding is proportional to the flow velocity  $v$ .

The nondimensional Strouhal number  $S$  describes the relationship between vortex frequency  $f$ , width  $b$  of the bluff body and the mean flow velocity  $v$ :

$$f = (S \cdot v) / b$$

The vortex frequency is recorded at the sensor and evaluated at the converter.



Functional principle

# Flow Measurement

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#### Technical data

<b>Range of application</b>	Flow measurement of liquids, gases and vapors	
<b>Mode of operation</b>	Karman vortex street	
Measuring principle	• Volume flow	
Primary measured value	• Mass flow	
	• Corrected volume flow	
	• Density	
	• Temperature	
	• Pressure	
	• Heat energy	
<b>Design</b>		
Transmitter	Cable length up to 50 m (164 ft) (in preparation)	
• Compact and remote version		
Sensor	Flanged version	Sandwich version
• Integrated temperature measurement	•	•
• Reduction of nominal diameter	•	
• Pressure and temperature compensation	•	•
• Isolation valve	•	•
• Dual measuring device	•	
<b>Display</b>	4-line graphical display (backlit) with control keys	
<b>Operation</b>	<ul style="list-style-type: none"> <li>Via local display (languages: German, English, French)</li> <li>Via SIMATIC PDM</li> </ul>	
<b>Accuracy</b>		
Volume flow		
• Liquids	± 0.75 % of measured value	
- $Re \geq 20\,000$	± 2.0 % of measured value	
- $10\,000 < Re < 20\,000$		
• Gases and vapors	± 1.0 % of measured value	
- $Re \geq 20\,000$	± 2.0 % of measured value	
- $10\,000 < Re < 20\,000$		
Mass flow/Corrected volume flow		
• Gases and vapors	± 1.5 % of measured value	
- $Re \geq 20\,000$	± 2.5 % of measured value	
- $10\,000 < Re < 20\,000$		
Mass flow		
• Liquids/water	± 1.5 % of measured value	
- $Re \geq 20\,000$	± 2.5 % of measured value	
- $10\,000 < Re < 20\,000$		
Repeatability (Volume flow)	± 0.1 % of measured value	

#### Operating conditions

Temperature ratings	
• Medium	-40 ... +240 °C (-40 ... +465 °F)
• Ambient	
- Non-Ex	-40 ... +85 °C (-40 ... +185 °F)
- Ex	-40 ... +65 °C (-40 ... +140 °F)
• Storage	-50 ... +85 °C (-58 ... +185 °F)
Pressure ratings	Max. 100 bar (1450 psi), higher pressure rates on request
Max. allowable test pressure	
• With integrated pressure sensor and isolation valve (closed)	1.5 x PN
• With integrated pressure sensor and without isolation valve	2 times the measuring range of pressure sensor
Process medium	
• Density	Taken into consideration when sizing
• Viscosity	< 10 cP
• Reynold's number	> 10000
Recommended flow velocities	
• Liquids	0.3 ... 7 m/s (0.98 ... 23 ft/s)
• Gases and vapors	2.0 ... 80 m/s (6.6 ... 262.5 ft/s)
DN 15:	3.0 ... 45 m/s (9.8 ... 148 ft/s)
DN 25:	2.0 ... 70 m/s (6.6 ... 230 ft/s)
	For detailed information see operating instructions "Intended use"

#### Installation conditions

Inlet run	
• For undisturbed flow profile, after pipe section with reducer, after 1 x 90° pipe bend	≥ 15 x DN
• After 2 x 90° pipe bend	≥ 30 x DN
• After 2 x 90° three-dimensional pipe bend	≥ 40 x DN
• After control valves	≥ 50 x DN
• Before flow conditioner	≥ 2 x DN
• After flow conditioner	≥ 8 x DN
Outlet run	≥ 5 x DN

#### Material

Sensor and process connections	
• Standard	1.4404/316L
• Option	Hastelloy C22 (on request)
Transmitter housing	
• Standard	Aluminum die-cast, two-layer coating (epoxy/polyester)
• Option	Die-cast aluminum with finish for advanced requirements
Pressure sensor gasket	
• Standard	FPM
• Option	FFKM
Sensor gasket (Pick-up)	
• Standard	1.4435/316L
• Option	Hastelloy C276

#### Process connections

DIN EN 1092-1	DN 15 ... DN 300/PN 16 ... PN 100
ANSI B16.5	½" ... 12"/150 ... 600 lb
	For valid combinations of connection size and pressure rating see table "Sensor variants"

<b>Enclosure rating</b>	
Standard	Compact and remote version: IP66/IP67
Option	Remote version: IP66/IP68 for sensor
<b>Power supply</b>	
Non-Ex version	12 ... 36 V DC
Ex version	12 ... 30 V DC
<b>Inputs/Outputs</b>	
Current output	4 ... 20 mA, HART
Binary output	Pulse/Frequency/Status/Limit switch
Current input	4 ... 20 mA, passive
<b>Communication</b>	
HART 7	
<b>Calibration</b>	
Standard calibration	3-point calibration: 3 x 15 %, 3 x 50 %, 3 x 80 %
Special calibration	5-point calibration: 3 x 15 %, 3 x 30 %, 3 x 50 %, 3 x 60 %, 3 x 80 %
<b>Certificates and approvals</b>	
Ex approvals	ATEX, QPS, IECEx
CE declaration of conformity	PED 2014/68/EU EMC 2014/30/EU
Safety integration level (SIL)	SIL2 according to IEC 61508

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Available combinations of sensor and connection size for SITRANS FX330 in flanged design are shown in the table below.

Sensor size	Connection size	EN 1092-1, Form B1/B2, PN 10	EN 1092-1, Form B1/B2, PN 16	EN 1092-1, Form B1/B2, PN 25	EN 1092-1, Form B1/B2, PN 40	EN 1092-1, Form B1/B2, PN 63	EN 1092-1, Form B1/B2, PN 100	ANSI B16.5, Class 150	ANSI B16.5, Class 300	ANSI B16.5, Class 600
<b>SITRANS FX330 Flanged (7ME2610-...)</b>										
DN 15	DN 15	-	-	-	●	-	●	●	●	●
	DN 25	-	-	-	●	-	●	●	●	●
	DN 40	-	-	-	●	-	●	●	●	●
DN 25	DN 25	-	-	-	●	-	●	●	●	●
	DN 40	-	-	-	●	-	●	●	●	●
	DN 50	-	●	-	●	●	●	●	●	●
DN 40	DN 40	-	-	-	●	-	●	●	●	●
	DN 50	-	●	-	●	●	●	●	●	●
	DN 80	-	●	-	●	●	●	●	●	●
DN 50	DN 50	-	●	-	●	●	●	●	●	●
	DN 80	-	●	-	●	●	●	●	●	●
	DN 100	-	●	-	●	●	●	●	●	●
DN 80	DN 80	-	●	-	●	●	●	●	●	●
	DN 100	-	●	-	●	●	●	●	●	●
	DN 150	-	●	-	●	●	●	●	●	●
DN 100	DN 100	-	●	-	●	●	●	●	●	●
	DN 150	-	●	-	●	●	●	●	●	●
	DN 200	●	●	●	●	-	-	●	●	-
DN 150	DN 150	-	●	-	●	●	●	●	●	●
	DN 200	●	●	●	●	-	-	●	●	-
	DN 250	●	●	●	●	-	-	●	●	-
DN 200	DN 200	●	●	●	●	-	-	●	●	-
	DN 250	●	●	●	●	-	-	●	●	-
	DN 300	●	●	●	●	-	-	●	●	-
DN 250	DN 250	●	●	●	●	-	-	●	●	-
	DN 300	●	●	●	●	-	-	●	●	-
DN 300	DN 300	●	●	●	●	-	-	●	●	-

● available

- not available

Selection and Ordering data		Article No.	Ord. code	Selection and Ordering data		Article No.	Ord. code
<b>SITRANS FX330 Flanged</b>				<b>SITRANS FX330 Flanged</b>			
• Not approved for SIL2 safety applications	↗	7ME2610-		• Not approved for SIL2 safety applications		7ME2610-	
• Approved for SIL2 safety applications	↗	7ME2611-		• Approved for SIL2 safety applications		7ME2611-	
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.							
<b>Sensor size</b>	<b>Connection size</b>			<b>Communication</b>			
DN 15 (1/2")	DN 15 (1/2")	1 A		HART		0	
	DN 25 (1")	1 B		PROFIBUS PA (in preparation)		1	
	DN 40 (1 1/2")	1 C		FOUNDATION Fieldbus (in preparation)		2	
DN 25 (1")	DN 25 (1")	2 B		<b>Ex approval</b>			
	DN 40 (1 1/2")	2 C		Without Ex approval		A	
	DN 50 (2")	2 D		ATEX II2 G Ex ia		B	
DN 40 (1 1/2")	DN 40 (1 1/2")	2 K		ATEX II2 G Ex d		C	
	DN 50 (2")	2 L		ATEX II3 G Ex nA		D	
	DN 80 (3")	2 M		ATEX II2 D Ex tb		E	
DN 50 (2")	DN 50 (2")	2 R		QPS IS Class I Div.1		F	
	DN 80 (3")	2 S		QPS XP Class I Div.1		G	
	DN 100 (4")	2 T		QPS NI Class I Div. 2		H	
DN 80 (3")	DN 80 (3")	3 L		QPS DIP Class I, III Div. 1		J	
	DN 100 (4")	3 M		IECEX II2 G Ex ia		K	
	DN 150 (6")	3 R		IECEX II2 G Ex d		L	
DN 100 (4")	DN 100 (4")	3 S		IECEX II3 G Ex nA		M	
	DN 150 (6")	3 T		IECEX II2 D Ex tb		N	
	DN 200 (8")	3 Q		<b>Pressure sensor and gasket material</b>			
DN 150 (6")	DN 150 (6")	4 M		Without pressure sensor		A	
	DN 200 (8")	4 P		With pressure sensor and gasket material			
	DN 250 (10")	4 Q		FPM (Viton), Range:			
DN 200 (8")	DN 200 (8")	4 T		1 bar (14.5 psi)		B	
	DN 250 (10")	4 U		2 bar (29 psi)		C	
	DN 300 (12")	4 V		4 bar (58 psi)		D	
DN 250 (10")	DN 250 (10")	4 W		6 bar (87 psi)		E	
	DN 300 (12")	4 Y		10 bar (145 psi)		F	
DN 300 (12")	DN 300 (12")	5 E		16 bar (232 psi)		G	
				25 bar (363 psi)		H	
				40 bar (580 psi)		J	
				60 bar (870 psi)		K	
				100 bar (1450 psi)		L	
				With pressure sensor and gasket material			
				FFKM (Kalrez), Range:			
				1 bar (14.5 psi)		M	
				2 bar (29 psi)		N	
				4 bar (58 psi)		P	
				6 bar (87 psi)		Q	
				10 bar (145 psi)		R	
				16 bar (232 psi)		S	
				25 bar (363 psi)		T	
				40 bar (580 psi)		U	
				60 bar (870 psi)		V	
				100 bar (1450 psi)		W	
				<b>Software version</b>			
				Standard - Uncompensated for gases, steam and liquids including temperature compensation for saturated steam		0	
				Standard + Heat meter for saturated steam and water		1	
				Density compensation for steam + Heat meter for saturated and superheated steam		2	
				Density compensation for gases, wet gases and mixed gases + FAD		3	
<b>Process connection and pressure rate</b>							
<b>EN 1092-1 Form B1</b>							
PN 10	DN 200 ... 300	A					
PN 16	DN 50 ... 300	B					
PN 25	DN 200 ... 300	C					
PN 40	DN 15 ... 300	D					
PN 63	DN 50 ... 150	E					
PN 100	DN 15 ... 150	F					
<b>ANSI B16.5 RF</b>							
Class 150	1/2 ... 12"	J					
Class 300	1/2 ... 12"	K					
Class 600	1/2 ... 6"	L					
<b>System design</b>							
Compact version	No cable		0				
Remote version (in preparation)	Cable length with Order code L..		1				
<b>Transmitter housing</b>							
Aluminum			0				
Aluminum, silicon free			1				
Dual version, aluminum			6				
Dual version, aluminum, silicon free			7				

## Flow Measurement

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##### Selection and Ordering data

Order code

##### Additional information

Please add "-Z" to Article No. and specify as minimum Order code Y40, Y41, Y42 and Y45 and plain text.

##### Application data

Medium: Specify medium (Liquid, gas, steam or customer-specific)	<b>Y40</b>
Temperature: Specify operating temperature with unit	<b>Y41</b>
Pressure: Specify operating pressure with unit	<b>Y42</b>
Density (only for customer-specified medium): Specify density with unit	<b>Y43</b>
Viscosity (only for customer-specified medium): Specify viscosity with unit	<b>Y44</b>
Flow rate: Specify max. flow rate with units	<b>Y45</b>
Pulse output setting: Specify pulse value (1 pulse/unit)	<b>Y47</b>

##### Operating instruction

Description	Article No.
English	<b>A5E2100423</b>

All literature is available to download for free, in a range of languages, at [www.siemens.com/processinstrumentation/documentation](http://www.siemens.com/processinstrumentation/documentation)

##### Selection and Ordering data

Order code

##### Further designs

Please add "-Z" to Article No. and specify Order code.

##### Cable connection

Without cable glands	<b>A01</b>
M20x1.5 cable glands made of plastic, grey	
• 3 pcs.	<b>A02</b>
• 2 pcs.	<b>A12</b>
• 1 pc.	<b>A22</b>
M20x1.5 cable glands made of plastic, blue	
• 3 pcs.	<b>A03</b>
• 2 pcs.	<b>A13</b>
• 1 pc.	<b>A23</b>
M20x1.5 cable glands made of brass, Ex-d/t approved	
• 3 pcs.	<b>A04</b>
• 2 pcs.	<b>A14</b>
• 1 pc.	<b>A24</b>
M20x1.5 cable glands made of brass, Ex-nA approved	
• 3 pcs.	<b>A05</b>
• 2 pcs.	<b>A15</b>
• 1 pc.	<b>A25</b>
M20x1.5 cable glands in stainless steel, Ex-d/t approved	
• 3 pcs.	<b>A06</b>
• 2 pcs.	<b>A16</b>
• 1 pc.	<b>A26</b>
1/2" NPT conduit connection in plastic (cable glands not included)	
• 3 pcs.	<b>A07</b>
• 2 pcs.	<b>A17</b>
• 1 pc.	<b>A27</b>

##### Selection and Ordering data

Order code

##### Isolation valve

With isolation valve **B10**

##### Certificates

Certificate of compliance according to EN 10204-2.1	<b>C10</b>
Pressure test + Inspection certificate according to EN 10204-3.1	<b>C11</b>
Material certification of pressure bearing metal parts according to EN 10204-3.1	<b>C12</b>
Material in accordance with NACE MR0175/ISO 15156	<b>C13</b>
PMI of pressure bearing metal parts + Inspection certificate according to EN 10204-3.1	<b>C14</b>
Material certificate of pressure bearing metal parts according to EN 10204-3.1 + PMI	<b>C15</b>
Dye penetration test of wetted welds	<b>C16</b>
X-ray test of wetted welds	<b>C17</b>

##### Calibration

5-point calibration with certificate **D11**

##### Cleaning

Free of oil and grease (wetted parts)	<b>K46</b>
Free of oil and grease (wetted parts) + Inspection certificate according to EN 10204-3.1	<b>K48</b>

##### Cable length for remote version (in preparation)

5 m (16 ft)	<b>L01</b>
10 m (32 ft)	<b>L02</b>
15 m (49 ft)	<b>L03</b>
20 m (65 ft)	<b>L04</b>
25 m (82 ft)	<b>L05</b>
30 m (98 ft)	<b>L06</b>
35 m (114 ft)	<b>L07</b>
40 m (131 ft)	<b>L08</b>
45 m (147 ft)	<b>L09</b>
50 m (164 ft)	<b>L10</b>

##### Tag name plate

TAG name plate in stainless steel 40 x 20mm (Add plain text)	<b>Y17</b>
TAG name plate in stainless steel tag 120 x 46 mm (Add plain text)	<b>Y18</b>