VersaFlow

Technical Information

VersaFlow Coriolis 1000 Mass Flow Sensor Specifications 34-VF-03-03, February 2022

The Superior Solution

The VersaFlow mass flow sensor is the only mass flow sensor with a straight measuring tube that is available in Stainless steel, Hastelloy®, Titanium or Tantalum. VersaFlow reliably measures mass flow, density, volume, temperature, mass or volume concentration and solids content.

Highlights

- Single straight measuring tube
- Secondary pressure containment
- Low pressure loss
- Easily drained and easy to clean
- Choice of four different tube materials
- Excellent zero stability
- Low operating and installation costs
- Rapid signal processing even with varying conditions
- Advanced Entrained Gas Management (EGM)
- Heating jacket option

Figure 1 – VersaFlow Mass Flow Sensor

Industries

- Water and Wastewater
- Mining & Building Materials
- Chemical & Petrochemical
- Iron, Steel & Metal
- Oil & Gas
- Pulp & Paper
- Pharmaceutical

Applications

- Viscous or shear-sensitive products
- Inhomogeneous mixtures
- Products with entrained solids or gas
- Product Loading and unloading
- Slurries
- Highly corrosive fluids

Compact version

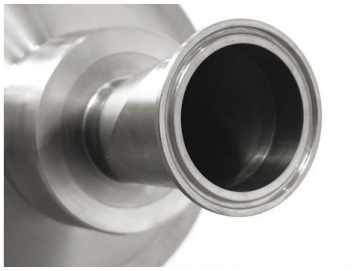
1) Comprehensive diagnostic with Entrained Gas Management (EGM) capabilities.
2) Standard flange and hygienic process connections available.
3) Modular electronics with a range of output options.

1) Remote terminal box.

Features

- Available as compact or remote.
- Single straight tube design guarantees a low pressure drop across the meter.
- Self-Draining and easy to clean.

Connection options



- A range of flanges up to ASME 600 / PN100.
- Supports a wide range of industry standard hygienic connections.
- Adaptable to suit customer's hygienic connections.

Heating jacket and purge port

Figure 2 – Heating jacket and purge port

- Heating jacket option for use with temperature dependent products.
- Prevents solidification of process product.
- Purge port option for protection in the event of measuring tube failure.
- Allows hazardous chemicals to be drained away safely.
- Can also be used for the early detection of measuring tube failure where highly toxic chemicals are being measured.

Converter: Common hardware for all converters makes spares holding simpler

Figure 3

1. TWC 9400 C: Compact or integrally mounted on sensor.
2. TWC 9400 F: Field mount up to 300 m / 1000 ft from sensor3.

Mass Flowmeter Product Family

All meters consist of a sensor and a converter. The converter may be mounted integral to the sensor, or remotely, either with a field mounting kit, a wall-mounted housing, or a rack mounted housing. See specification 34-VF-03-04 for converter details.

Sensor: Sensors for any Applications

1. VersaFlow Coriolis 100: The general-purpose solution for the process industry.
2. VersaFlow Coriolis 1000: The optimum solution for chemical, food & beverage and pharmaceutical industry.
3. VersaFlow Coriolis 200: Large diameter meter suitable for custody transfer measurement.
4. VersaFlow Coriolis 6000: Twin bent tube design with extended pressure and temperature capabilities.

Figure 4

Technical Data

Measuring system

Table 1

Measuring principle	Coriolis mass flow
Application	Mass flow and density measurement of liquids, gases & slurries
Measured variables	Mass, density and temperature
Calculated variables	Volume, concentration, velocity

Size, Tube MOC and Flow Rate

Table 2

Size mm (inches)	**DN06 (1/8") (CM20)**	**DN80 (3") (CM16)**
Material	Stainless Steel	Titanium
Maximum flow rate [kg/h]	1230	560000
Maximum flow rate [lbs/min]	45	20576

Accuracy

Table 3

Accuracy, liquid	±0.1% of actual measured flow rate + zero stability
Accuracy, gas	±0.35% of actual measured flow rate + zero stability
Repeatability	Better than 0.05% plus zero stability (includes the combined effects of repeatability, linearity and hysteresis)
Zero stability-Titanium	±0.004% of maximum flow rate with respective sensor size
Zero stability-Stainless Steel	±0.015% of maximum flow rate with respective sensor size

Reference Conditions

Table 4

Product	Water
Temperature	20°C / 68°F
Operating pressure	1 $bar_{rel.}$ / 14.5 psig

Process Effects on the Sensor zero

Table 5

Temperature - Titanium	0.001% per 1°C / 0.055% per 1°F
Temperature – Stainless Steel	0.004% per 1°C / 0.0022% per 1°F
Pressure – Titanium / Stainless Steel /	0.0011% of the max flow rate per 1 $bar_{rel.}$ / 0.000076% per 1 psig

Density

Table 6

Measuring range	400...2500 kg/m3 / 25...155 lbs/ft^3
Accuracy	±2 kg/m^3 / ±0.13 lbs/ft^3
Accuracy (on-site calibration)	±0.5 kg/m^3 / ±0.033 lbs/ft^3

Temperature

Table 7

	Titanium	**Stainless Steel**
Process Temperature	-40… +150º C/ -40 …+302º F	0… +100º C/32 …+212º F Extended range 0… +130º C/32 …+266º F on Stn. Stl sizes DN25...80, hygienic conn. only
Accuracy	±1°C / ±1.8°F	
Ambient Temperature		
Compact w/Aluminum Housing	-40… +60º C/-40 …+140º F Extended temperature range +65º C/+149º F for some I/O options. For more information contact Honeywell	
Compact w/Stn. Stl. Housing	-40… +55º C/-40 …+130º F	
Remote versions	-40… +65º C/-40 …+149º F	

Protection Category

Table 8

According to EN 60529	IP 67, NEMA 4X

Installation

Table 9

Inlet runs	None required
Outlet runs	None required

Technical Data, Continued

Table 10

Materials	Titanium	Stainless Steel
Measuring Tube/ raised face	Titanium	Stainless Steel
Flanges	Stainless Steel 316/316L (1.4401/1.4404) dual certified	
Outer cylinder - standard	Stainless Steel 304/304L (1.4301/1.4307) dual certified	
Outer cylinder – optional	Stainless Steel 316/316L (1.4401/1.4404) dual certified	
Optional Heating Jacket	Stainless Steel 316L (1.4404)	
Sensor Electronics	Stainless Steel 316L (1.4409)	
Junction Box – remote version	Die cast Aluminum (polyurethane coating Optional Stainless Steel 316L (1.4401)	
Nominal Pressure at 20ºC /68ºF	-1…100 barg/ -14.5 …1450 psig	-1…50 bar g/ -14.5 …725 psig
Outer Cylinder	**Titanium**	**Stainless Steel**
Non-PED/CRN Approved	Typical burst pressure > 100 barg. / 1450 psig	
PED Approved secondary containment		
Titanium (Stainless Steel 304 or 316 outer cylinder)	-1…63 barg / -14.5…910 psig	
Titanium (Stainless Steel 316 outer cylinder)	-1...100 barg. / -14.5...1450 psig	
Stainless Steel (Stainless Steel 304 or 316 outer cylinder)	-1…63 barg / -14.5…910 psig	
CRN Approved secondary containment		
Stainless Steel	-1…63 barg / -14.5…910 psig	

Process Connection

Table 11

Flange	
DIN	DN10, DN15, DN80, DN100 / PN40…100
ASME	½", 3", 4"/ ASME 150…600
JIS	10A, 15A, 100A / 10…20K
Hygienic	
Tri-clover	½",3"
Tri-clamp DIN 32676	DN10, DN80
Tri-clamp ISO 2852	3"
DIN 11864-2 form A	DN10…80

Approvals and Certifications

Table 12

Mechanical	
Electromagnetic compatibility (EMC) acc. to CE	Namur NE 21/5.95 204/108/EC (EMC) 2006/95/EC (Low Voltage Directive)
European Pressure Equipment Directive	PED 97-23 EC (acc. to AD 2000 Regelwerk)
Factory Mutual / CSA	Class I, Div 1 groups B, C, D Class II, Div 1 groups E, F, G Class III, Div 1 hazardous areas Class I, Div 2 groups B, C, D Class II, Div 2 groups F, G Class III, Div 2 hazardous areas
ANSI / CSA (Dual Seal)	12.27.901-2003
IECEx	Available
Custody transfer	OIML R117-1

Table 13

ATEX (acc. 94/9/EC)	
Coriolis 1000/TWC9400C non-Ex i Signal outputs without heating jacket / insulation	
Ex d connection compartment	II 1/2 G Ex d IA IIC T6....T1 Ga/Gb
	II 2 D Ex tb IIIC T165°C Db
Ex e connection compartment	II 1/2 G Ex de ia IIC T6....T1 Ga/Gb
	II 2 D Ex tb IIIC T165°C Db
Coriolis 1000/TWC9400C non Ex i signal outputs with heating jacket / insulation	
Ex d connection compartment	II 1/2 G Ex d ia IIC T6....T1 Ga/Gb
	II 2 D Ex tb IIIC T165°C Db

ATEX (acc. 94/9/EC)	
Ex e connection compartment	II 1/2 G Ex de ia IIC T6....T1 Ga/Gb
	II 2 D Ex tb IIIC T165°C Db
Coriolis 1000/TWC9400C Ex i signal outputs without heating jacket / insulation	
Ex d connection compartment	II 1/2(1) G Ex d ia [ia Ga] IIC T6....T1 Ga/Gb
	II 2(1) D Ex tb [ia Da] IIIC T165°C Db
Ex e connection compartment	II 1/2(1) G Ex de ia [ia Ga] IIC T6....T1 Ga/Gb
	II 2(1) D Ex tb [ia Da] IIIC T165°C Db
Coriolis 1000/TWC9400C Ex i signal outputs with heating jacket / insulation	
Ex d connection compartment	II 1/2(1) G Ex d ia [ia Ga] IIC T6....T1 Ga/Gb
	II 2(1) D Ex tb [ia Da] IIIC T165°C Db
Ex e connection compartment	II 1/2(1) G Ex de ia [ia Ga] IIC T6....T1 Ga/Gb
	II 2(1) D Ex tb [ia Da] IIIC T165°C Db
Coriolis 1000/TWC9400F - with or without jacket / insulation	
	II G Ex ia IIC T6…T1 Ga
	II 1 D Ex ia IIIC T165°C Da
Coriolis 1000/TWC010 without heating/ insulation	II 2 G Ex ib IIC T6…T1
	II 2 D Ex ibD 21 T150 °C
Coriolis 1000/TWC010 with heating/ insulation	II 2 G Ex ib IIC T6…T1
	II 2 D Ex ibD 21 T165 °C

Table 14

ATEX (acc. 94/9/EC) temperature limits (standard)	Ambient temp. Tamb °C	Max. medium temp. Tm °C	Temp. class	Max. surface temp. °C
Coriolis 1000/TWC9400C with aluminium converter housing – with or without heating jacket / insulation	40	40	T6	T55
		70	T5	T85
		90	T4	T105
		150	T3-T1	T165
	50	90	T4	T105
		145	T3-T1	T160
	65	65	T6-T1	T80
Coriolis 1000/TWC9400C – with SS converter housing – with or without heating jacket / insulation	40	40	T6	T55
		70	T5	T85
		90	T4	T105
		130	T3-T1	T145
	50	70	T5	T85
		90	T4-T1	T105
	60	60	T6-T1	T75
Coriolis 1000/TWC9400F with or without heating jacket / insulation	40	40	T6	T55
		70	T5	T85
		90	T4	T105
		150	T3-T1	T165
	50	70	T5	T85
		90	T4	T105
		150	T3-T1	T165
	65	90	T4	T105
		130	T3-T1	T145

Maximum end loadings

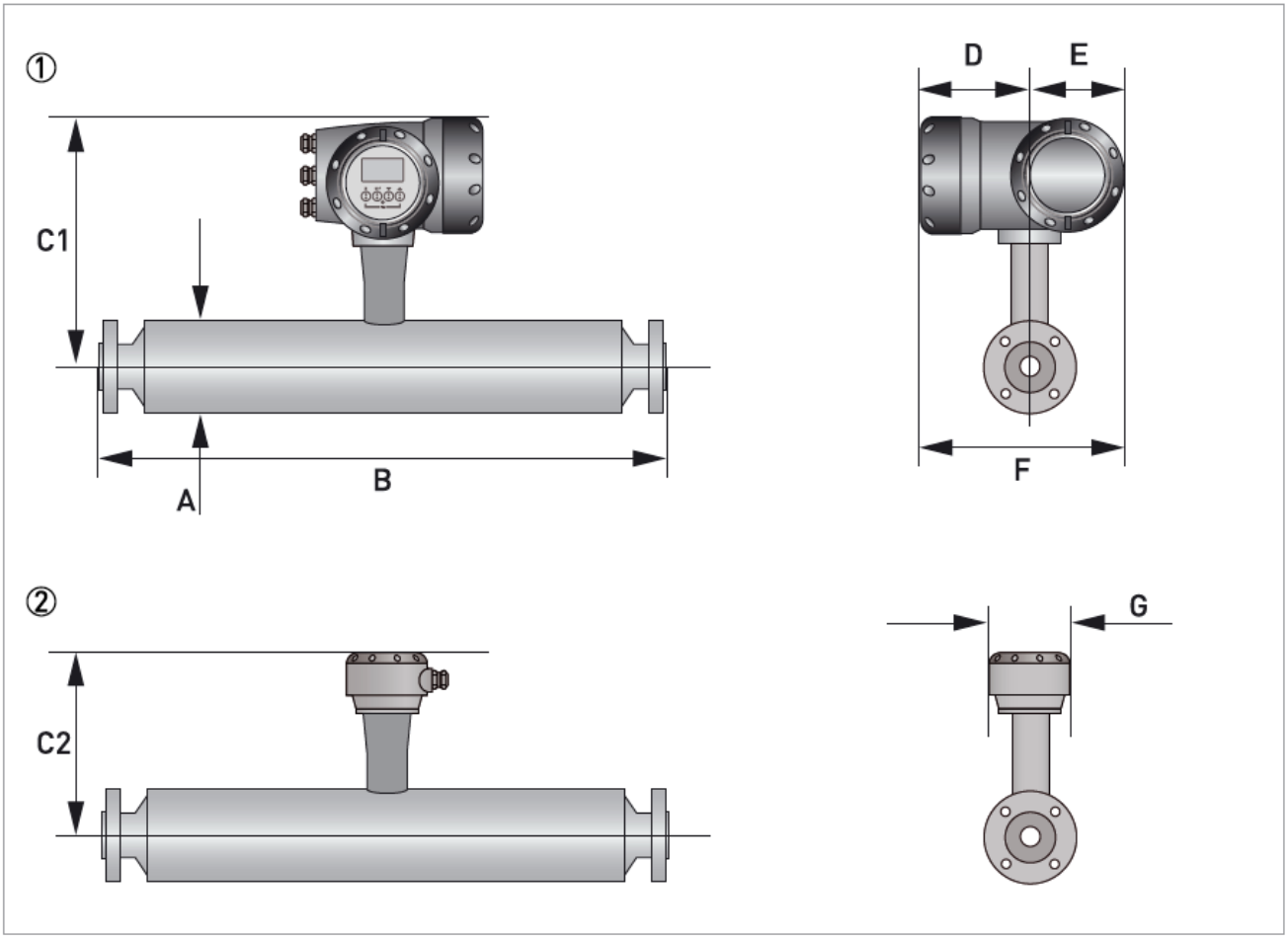
Table 15

Size	06 (CM20)	80 (CM16)
Titanium		
Flanges	-	230kN
Hygienic (welded)	-	30kN
Hygienic (adaptor)	-	9.6kN
Stainless Steel		
Flanges	19kN	-
Hygienic (welded)	1.5kN	-
Hygienic (adaptor)	1.5kN	-

- These axial loads have been calculated based on 316L schedule 40 process pipework and un-radiographed butt weld pipe joints.
- The loads shown are the maximum permitted static load. If the loads are cycling (between tension and compression) these loads should be reduced.

Dimensions and Weights

Flanged Versions



① Compact version
② Remote version

Figure 5 – Flanged Versions

Meter weights for Titanium (T), Stainless Steel (S),

Weight – kg (lbs)
Table 16

	S 06 (CM20)	T 80 (CM16)
Aluminium (compact)	18.5 (40.7)	265 (583)
Stainless Steel (compact)	25.2 (55.4)	271.7 (597.7)
Aluminium (remote)	15.7 (34.5)	262.2 (576.8)
Stainless Steel (remote)	16.5 (36.3)	263 (578.6)

Measuring tube in Titanium (T), Stainless Steel (S) Dimensions – mm (inches)

Table 17

	S 06 (CM20)	**T 80 (CM16)**
A	102 (4)	274 (10.8)
B	See B Dimension Table	
C1 (compact)	311 (12.2)	397 (15.6)
C2 (remote)	231 ±2 (9 ±0.08)	317 ±4 (12.5 ±0.16)
D	137 (5.4)	
E	123.5 (4.9)	
F	260.5 (10.2)	
G	118(4.6)	

B Dimension mm (in) - Titanium (T), Stainless Steel (S),

Table 18

DIN	**S 06 (CM20)**	**T 80 (CM16)**
DN10	420 ±2	-
	(16.5± 0.08)	-
DN15	420 ±2	-
	(16.5± 0.08)	-
DN80	-	1460 ±4
	-	(57.5 ±0.16)
DN100	-	1460 ±4
	-	(57.5 ±0.16)
Tongue/ Groove	**S 06 (CM20)**	**T 80 (CM16)**
DN10	428±2	-
	(16.8± 0.08)	-
DN15	428±2	-
	(16.8± 0.08)	-
DN80	-	1468 ±4
	-	(57.8 ±0.16)
DN100	-	1468 ±4
	-	(57.8 ±0.16)

Table 19

ASME 150/ 300 lb	S 06 (CM20)	T 80 (CM16)
1/2"	420 ±2 (16.5± 0.08)	-
3"	-	1460 ±4 (57.5 ±0.16)
4"	-	1460 ±4 (57.5 ±0.16)
ASME 600 lb	**S 06 (CM20)**	**T 80 (CM16)**
1/2"	428 ±2 (16.8 ±0.08)	-
3"	-	1468 ±4 (57.8 ±0.16)
4"	-	1468 ±4 (57.8 ±0.16)

Hygienic Versions Titanium (T) and Stainless Steel (S)

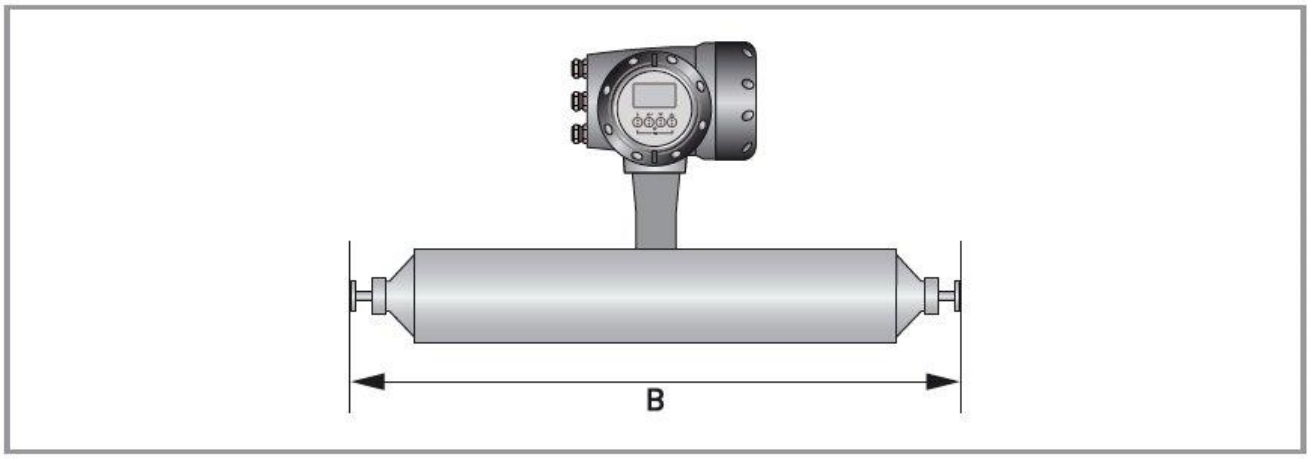


Figure 6 – Hygienic Versions Titanium (T) and Stainless Steel (S)

Hygienic Connections: All Welded Versions

Dimension B [mm ±2]
Table 20

	06 (CM20)	80 (CM16)
Tri-clover		
½"	480	-
3"	-	1522

Dimension B [mm ±2]
Table 21

	06 (CM20)	80 (CM16)
Tri-clamp DIN 32676		
DN10	484	-
DN80	-	1584

Hygienic connections: all welded versions

Dimension B [mm ±2]
Table 22

	06 (CM20)	80 (CM16)
Tri-clamp ISO 2852		
3"	-	1522

Dimension B [mm ±2]
Table 23

	06 (CM20)	80 (CM16)
DIN 11864-2 form A		
DN80	-	1538

Dimension B [inches ±0.08]
Table 24

	06 (CM20)	80 (CM16)
Tri-clover		
½"	18.9	-
3"	-	59.9

Dimension B [inches ±0.08]
Table 25

	06 (CM20)	80 (CM16)
Tri-clamp DIN 32676		
DN10	19	-
DN80	-	62.4

Dimension B [inches ±0.08]
Table 26

	06 (CM20)	80 (CM16)
Tri-clamp ISO 2852		
3"	-	59.9

Dimension B [inches ±0.08]
Table 27

	06 (CM20)	80 (CM16)
DIN 11864-2 form A		
DN80	-	60.5

Heating Jacket Version

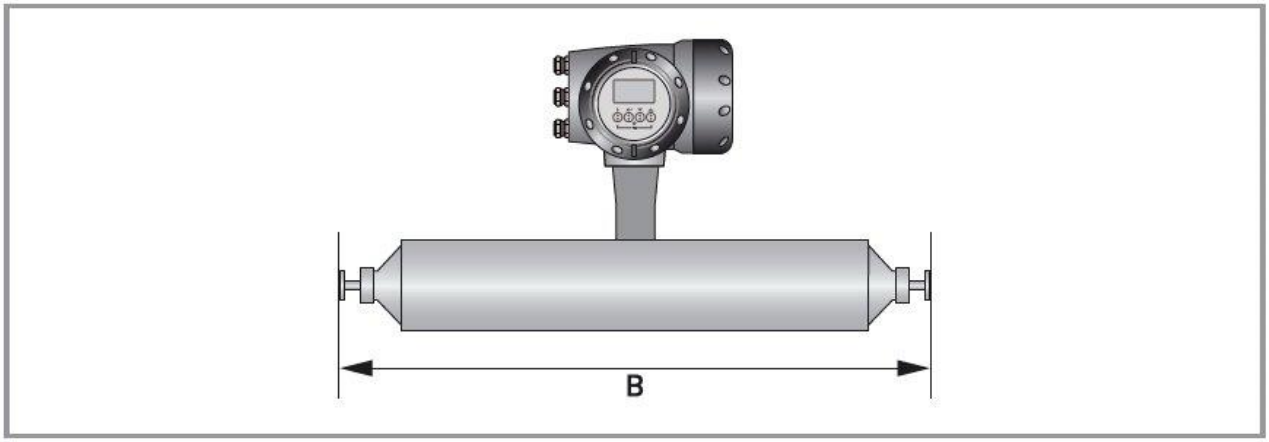


Figure 7 – Heating Jacket Version

Dimensions – mm (inches)
Table 28

	80 (CM16)
Heating connection size	25mm (ERMETO) (1” (NPTF)
A	305 ± 1 (12±0.04)
Titanium	
B	385±1 (15.2±0.04)
C	26±1(1.0±0.04)
Stainless Steel & Hastelloy	
B	200 ±2 (7.9 ±0.08)
C	26± 1 (1.0 ±0.04)

Purge Port Option

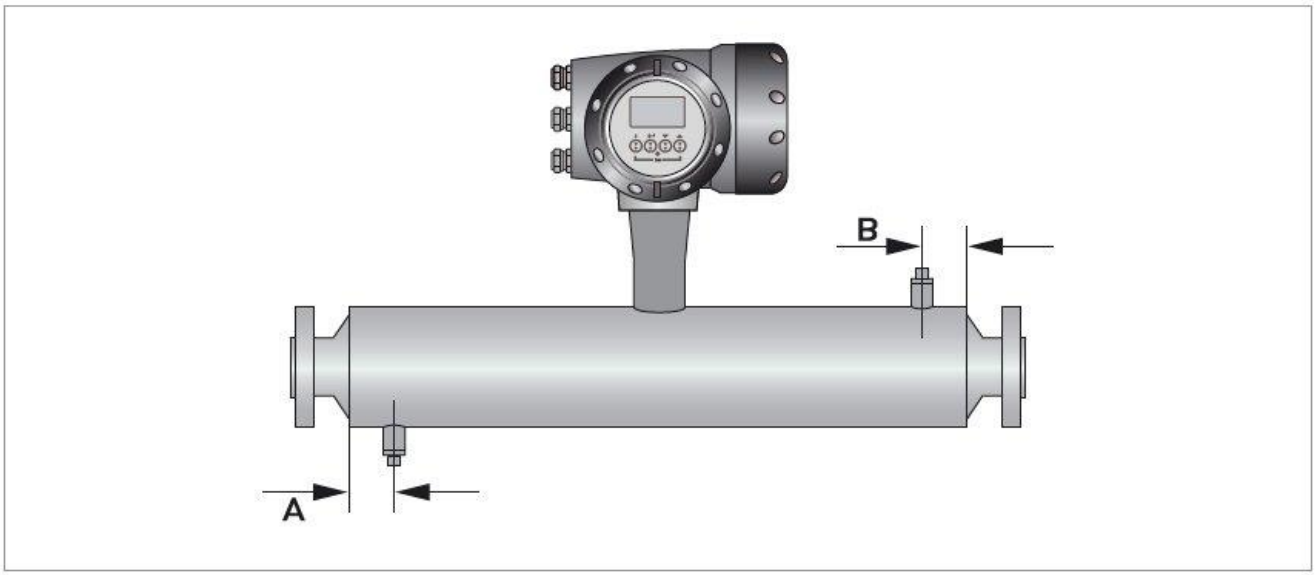


Figure 8 – Purge Port Option

Dimensions – mm (inches)
Table 29

	06 (CM20)	80 (CM16)
Titanium & Stainless Steel		
A	65 (2.6)	65 (2.6)
B	30 (1.2)	65 (2.6)

Measuring Accuracy

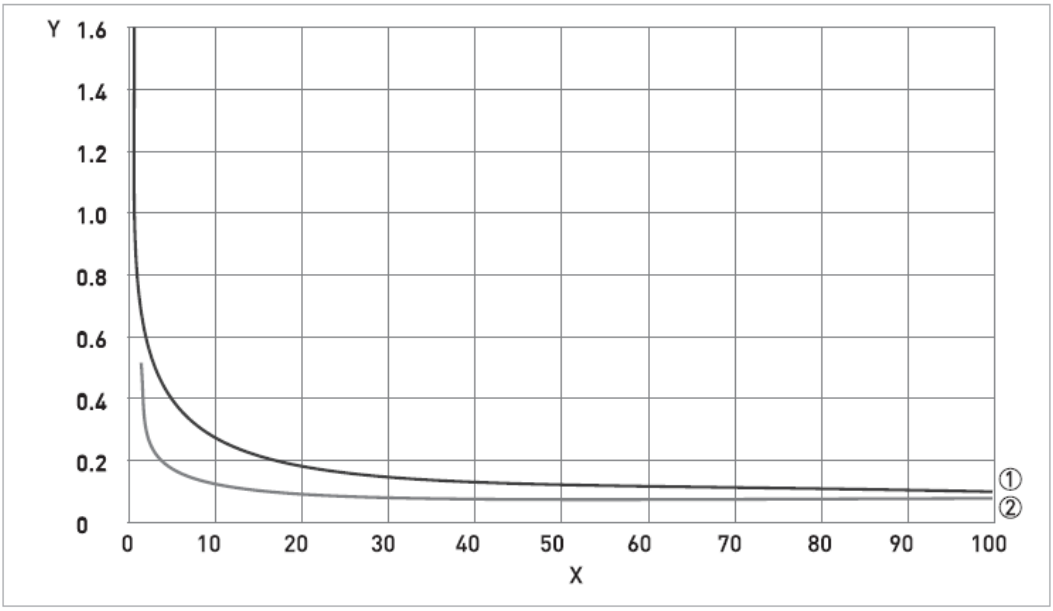


Figure 9 – Measuring Accuracy

X flow rate [%]
Y measuring error [%]

(1) Stainless Steel
(2) Titanium

Measuring error

The measuring error is obtained from the combined effects of accuracy and zero stability.

Reference conditions

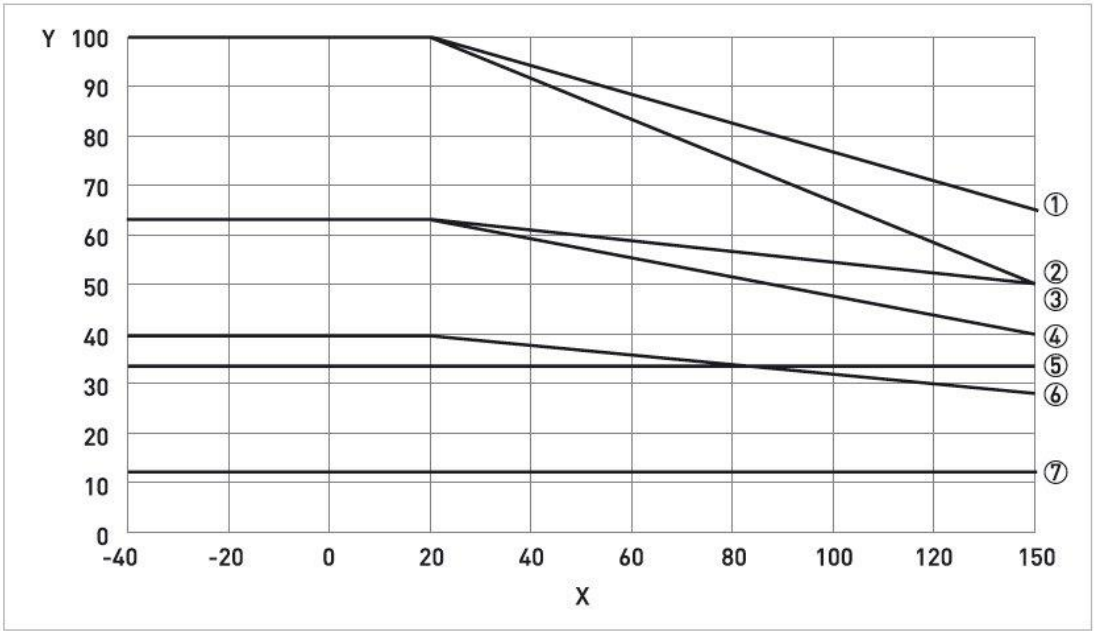
Product: Water
Temperature: +20°C / +68°F
Operating pressure: 1 barg / 14.5 psig

Guidelines for Maximum Operating Pressure

Notes

- Ensure that the meter is used within its operating limits
- All hygienic process connections have a maximum operating rating of 10 barg at 150°C /145 psig at 302°F

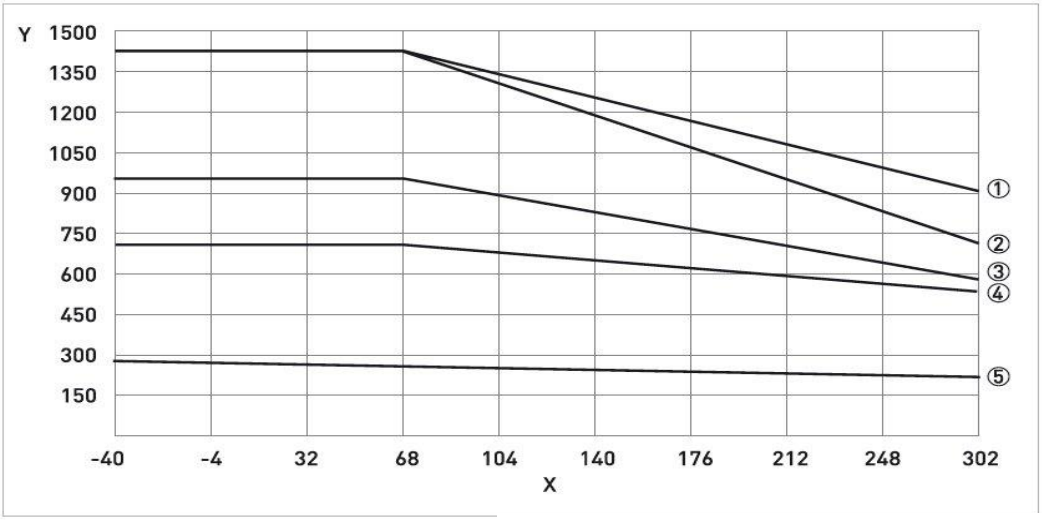
Pressure / temperature de-rating for Titanium Gr 9 meters (all meter sizes, with flanged connections as per EN 1092-1 and JIS B 2220)



X temperature [°C]
Y pressure [barg]

(1) Standard tube and outer cylinder 316L (100 barg PED option) with PN100 flanges (sizes DN10/ DN15.)
(2) Standard tube and outer cylinder 316L (100 barg PED option) with PN100 flanges (sizes DN80/DN100)
(3) DIN 2637 PN63 flanges
(4) Outer cylinder 304 (63 barg PED / CRN option)
(5) JIS 20K flanges
(6) DIN 2635 PN40 flanges
(7) JIS 10K flanges

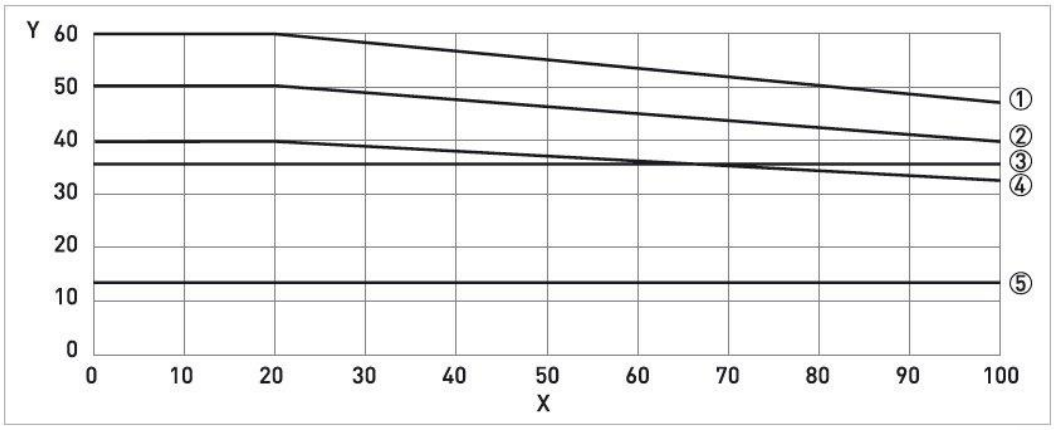
Pressure / temperature de-rating for Titanium Gr 9 meters
(all meter sizes with flanged connections as per ASME B16.5)



X temperature [°F]
Y pressure [psig]

(1) Standard tube and outer cylinder 316L (100 barg PED option) with ASME 600 lbs flanges (sizes DN10/DN15)
(2) Standard tube and outer cylinder 316L (100 barg PED option) with ASME 600 lbs flanges (sizes DN80/DN100)
(3) Outer cylinder 304 (63 barg PED / CRN option)
(4) ASME 300 lbs
(5) ASME 150 lbs

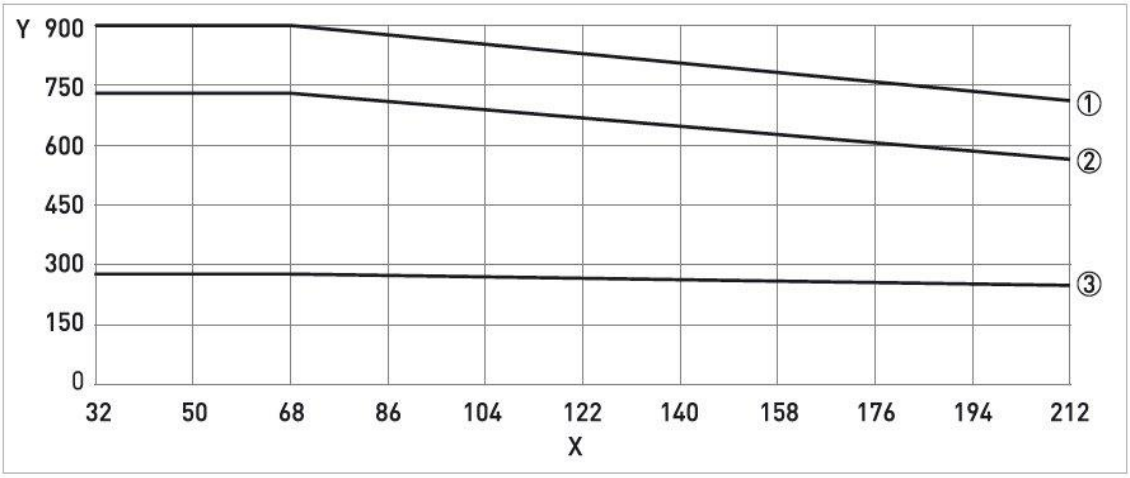
Pressure / temperature de-rating for Stainless Steel
(all meter sizes with flanged connections as per EN 1092-1 and JIS B 2220)



X temperature [°C]
Y pressure [barg]

(1) SS meters with outer cylinder 304 (all sizes) (63 barg PED / CRN option)
(2) De-rating for SS measuring tubes and outer cylinder de-rating for Tantalum meters (all sizes)
(3) JIS 20K flanges
(4) DIN 2635 PN40 flanges
(5) JIS 10K flanges

Pressure / temperature de-rating for Stainless Steel meters(all meters with flanged connections as per ASME B16.5)



X temperature [°F]
Y pressure [psig]

(1) Outer cylinder de-rating for SS meters (all sizes) (63 barg PED / CRN option)
(2) SS measuring tubes (all sizes).
ASME 300 lbs flanges.
(3) ASME 150 lbs

Flanges

- DIN flange ratings are based on EN 1092-1 2001 table 18, 1% proof stress material group 14EO
- ASME flange ratings are based on ASME B16.5 2003 table 2 material group 2.2
- JIS flange ratings are based on JIS 2220: 2012 table 11 division 1 material group 022a

Notes

- The maximum operating pressure will be either the flange rating or the measuring tube rating, WHICHEVER IS THE LOWER!
- The manufacturer recommends that the seals are replaced at regular intervals. This will maintain the hygienic integrity of the connection.

Installation

Intended use

This Coriolis mass flowmeter is designed for direct measurement of mass flow rate, density and temperature of the product. It also enables indirect measurement of parameters like total mass, volume flow and concentration of dissolved substances.

Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator,

The manufacturer is not liable for any damage resulting from the improper use or use for other than the intended purpose.

General Installation principles

There are no special installation requirements, but the following points should be noted:

Support the weight of the meter especially the larger meter sizes and hygienic connections. The meter can be supported on the sensor body.

No straight runs are required.

Take care to avoid cavitation while using reducers and other fittings at flanges.

Avoid extreme pipe size reductions.

Meters are no affected by crosstalk and can be mounted in series or in parallel.

Avoid mounting the meter at the highest point in the pipeline where air/gas can collect.

Mounting positions

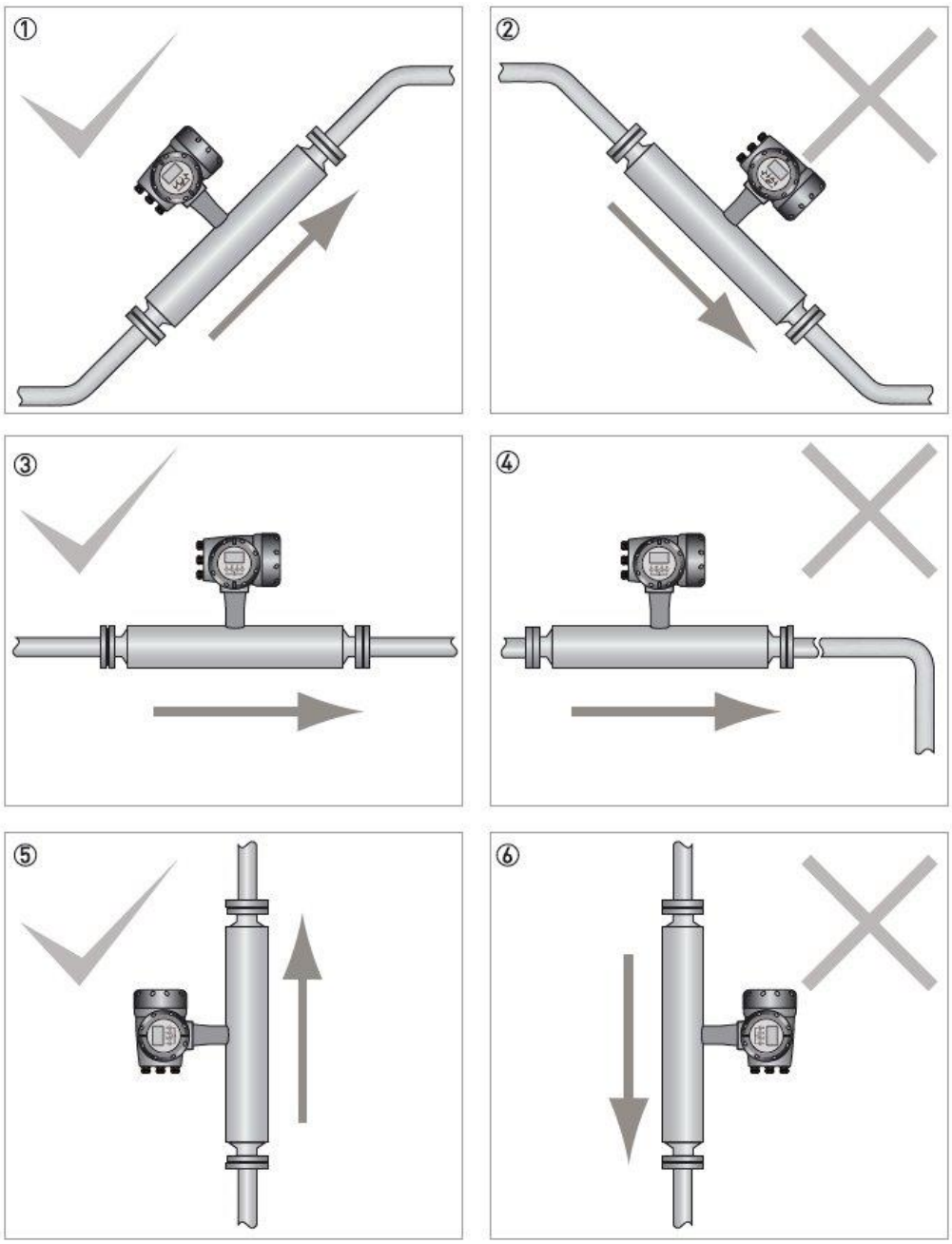


Figure 10

(1) Recommended flow direction is from bottom to top for meter mounted at an angle.

(2) Avoid mounting the meter with the flow running top to bottom as it can cause siphoning. In such a scenario, install an orifice plate or a control valve downstream of the meter to maintain backpressure.

(3) Horizontal mounting with flow left to right.

(4) Long vertical runs after the meter should be avoided as it can cause cavitation. Install an orifice plate or a control valve downstream to maintain backpressure.

(5) Recommended flow direction is from bottom to top for vertical installation.

(6) Avoid mounting the meter vertically with flow running downhill. This can cause siphoning. Install an orifice plate or a control valve downstream of the meter to maintain backpressure.

Zero Calibration

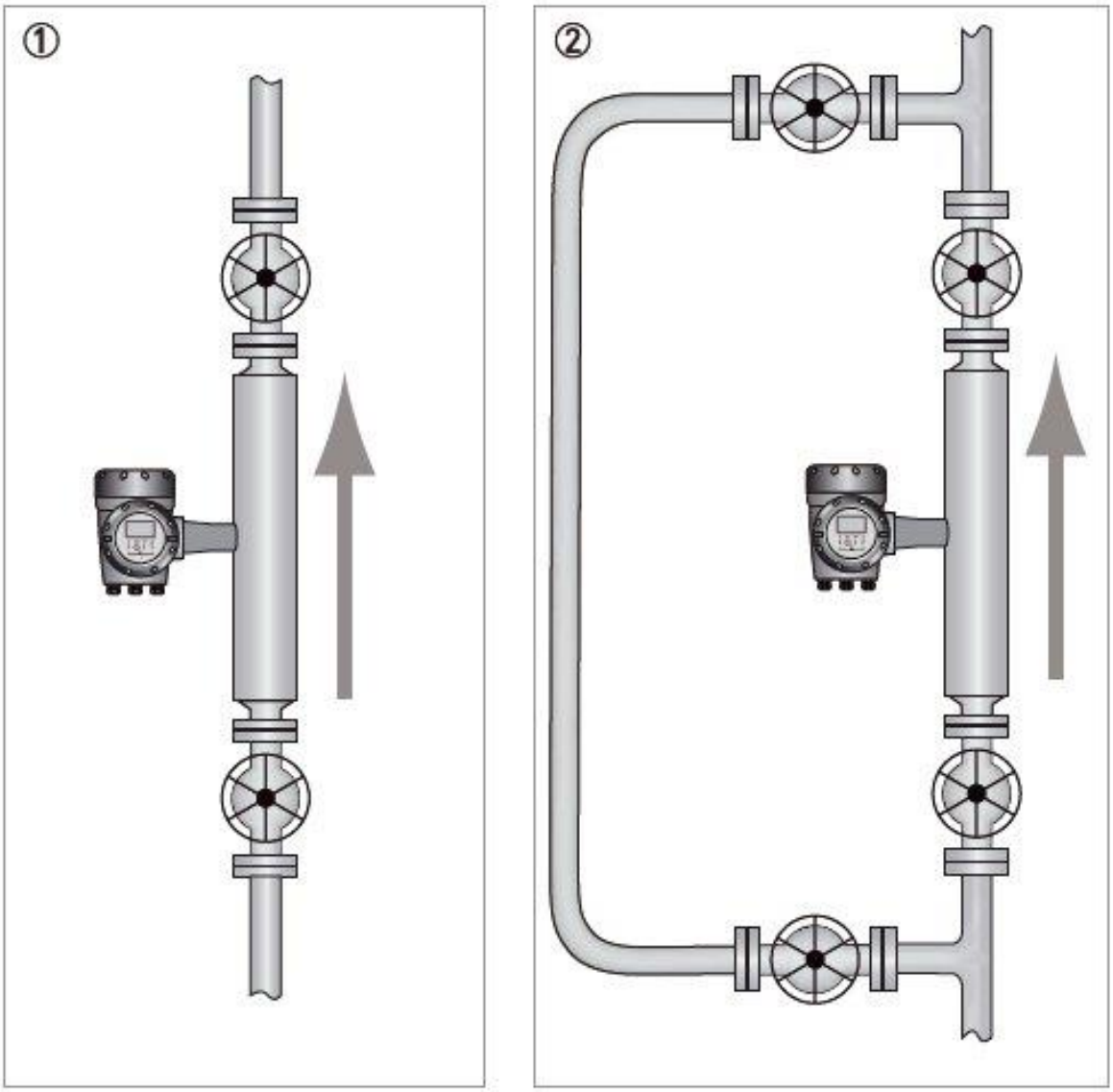


Figure 11

(1) Where the meter has been installed vertically, install shut-off valves either side of the meter to assist with zero calibration.

(2) If the process cannot be stopped, install a bypass section for zero calibration.

Sales and Service

For application assistance, current specifications, pricing, or name of the nearest Authorized Distributor, contact one of the offices below.

ASIA PACIFIC

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(TAC) **hfs-tac-support@honeywell.com**

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